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URBAN REGIONS AS ENGINES OF ECONOMIC GROWTH

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What can policy achieve?

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Contents

MAIN FINDINGS

Summary

- **In new regional economic policies, national and regional agendas are aligned and reinforce each other.** The agendas are based on a joint strategy that combines policy areas; policies aimed at strengthening the economic structure also encompass plans of action for human capital, the residential environment, the physical environment and infrastructures.

- **Government authorities can make a difference to regional economic growth.** In economically successful regions, government authorities play an active role by facilitating growth processes and investing in them. The role of regional authorities to formulate a joint strategy (all involved are of like mind) and to develop alliances between public and private parties and with national and provincial authorities. This is done by streamlining generic policies towards regional tasks. In successful regions, policies focus on factors that are critical for growth and innovation, and on creating places that are attractive to live and work in. This usually involves establishing a coherent mix of policy areas, for example by coordinating programmes for clusters, entrepreneurship, the labour market, knowledge, accessibility and the physical and residential environments.

- **There is no such thing as a uniform path to economic success.** Regional economic developments vary widely and are context-specific. Moreover, economic growth is path-dependent; historical structures and past events determine the course of subsequent developments. The challenge is to find a suitable policy mix around a common goal that is in line with the economic structure and dynamism of the region. The core concept is innovation and diversification, building on existing structures. Regional economic policies therefore combine present-day strengths, but also focus on the transformation to new activities and technologies.

- **There are, however, robust factors that stimulate economic growth, or, conversely, obstruct it.** It proves beneficial to focus policies on a number of robust factors that are positively or negatively linked to growth in both employment and productivity. The quantitative analyses in this study show that economic growth is stimulated by factors such as *human capital* (a very qualified labour force), attractive *conditions for living and working* with an interesting range of facilities (quality of education, and numerous cultural amenities and restaurants), and good *accessibility* in both physical and digital terms. Growth is hampered by a *high cost of living*, *polluted air* and *noise pollution*.

- **Growth is often sector-specific.** What works fine for one sector does not necessarily work for another. For example, *clustering and specialisation* in technology and materials are important for growth in industrial companies, whereas the growth in knowledge-intensive services is mainly linked to the quality of *human capital*.

- **Growth is often context-specific.** In regions with *high population density*, the impact of *knowledge* and *culture* on economic growth is particularly strong. Density brings agglomeration benefits and is in itself robustly linked to growth, but in combination with *knowledge* and *culture*, its effect is reinforced. The impact of density is also more marked in cities with good *international connectivity*.

- **It is a matter of having a policy mix aimed at a total innovation system.** The qualitative analyses in this study reveal that in economically successful cities, government authorities have made express efforts to anticipate, facilitate and invest. In these places, there has been a shift in recent decades from policies with a physical orientation, focusing on spatial planning and infrastructure, to policies aimed at establishing an overall innovation system. Programmes for entrepreneurship, clusters, knowledge and innovation have become important elements of a policy mix whose specific details are worked out according to the regional context. Thanks to this policy mix, regional authorities have contributed to ensuring that *economic renewal* could take place in a bottom-up process in a timely fashion. They achieved this by creating critical mass around the new and promising economic activities that were emerging in the region. But, they also stimulated innovation in sectors that had a strong presence in the region and were in danger of entering a phase of decline.

- **Backing challengers is a priority in policy.** Policies are not aimed at 'picking winners', an approach that involves opting for certain sectors. Nor are they aimed at 'backing losers', in efforts to maintain sectors that are performing badly. They are best characterised as 'backing challengers'; they stimulate both innovation within the existing structure and the challengers of the established order. By making this concrete in the form of a policy mix, promising new activities, which are in line with the economic activities, technologies, themes or challenges in the region, are able to prosper.

- **Policies make choices.** While urban planning aimed at creating attractive cities with a high quality of life can be beneficial to entire populations and all businesses, its actual interpretation is often specific to a region or city. Policies in successful cities focus strongly on certain economic objectives or target groups. In practice, this can involve, for example, creating attractive residential conditions and facilities for knowledge workers, or creating working conditions for specific new economic activities that are in line with the knowledge and innovation policy. Key issues here are the desired economic structure and geographic location in relation to other cities.

- **Institutions are strong and follow trends.** In economically successful regions, the institutions are structured under public-private, multi-level (national, regional and local) and cross-sectoral cooperation. Institutions are proactive and able to adapt, allowing modification by government authorities to suit changing circumstances, anticipation on future problems and the search for new opportunities.

- **Growth can be based on unplanned events.** Many growth processes are therefore path-dependent. In the initial phase, when it is not clear whether growth will actually take place, steering the process is a far more uncertain exercise than facilitating and promoting innovation from existing growth paths.

- **Both the national and the regional level.** National governments can also play an important role in regional economic developments. National policies have effects at the regional level and, if they are customised, they could effectively fit in with regional contexts and regional policy initiatives. In addition, there are several matters that can be dealt with more readily by national authorities than by regional authorities. Examples include safeguarding national or supra-regional interests, operating above the level of the regional lobby, and providing a knowledge and monitoring system to analyse and assess economic developments.

These findings follow from quantitative and qualitative research into the question of which policies are effective when aiming to support the potential for urban and regional growth. They provide policymakers with insight into issues that are important for economic growth and into how policy efforts can contribute to economic growth. This report presents a menu, so to speak, of policy options.

Urban regions as engines of economic growth

Introduction

In recent years, the importance of urban regions for economic development has been strongly emphasised, both in science and in policies. Cities or urban regions are also referred to as *engines of economic growth*. Due to the increasing importance of cities for the economy, government policies are also becoming the object of scrutiny. What can policies do to support the economic growth of cities? Or, put differently, what policies work? That is the central question of this study.

We found that at least eight factors are important for regional economic growth:

1. *Clusters* (of collaborating, related businesses);
2. *Entrepreneurship* (new businesses, rapidly growing businesses such as scale-ups, and new activities by existing businesses);
3. *Human capital* (a very qualified, educated and skilled workforce);
4. *Knowledge infrastructure* (the quality of public and private research and educational institutions);
5. *Physical infrastructure* (accessibility and connectivity by road, rail, air and water);
6. *Financing* (especially that of efforts to reinforce the economic structure and of risky innovations, involving venture capital);
7. *Residential amenities* (that contribute to an attractive environment for living, working and interaction);
8. *Governance* (the quality of the administration and the effectiveness of the way its different levels work together).

In Figure 1, these factors are represented as cogwheels in the engine of economic growth. They encourage such growth of cities, and cities in turn boost growth at the national level. Around these cogs is a variety of national, more generic factors that also influence the economic growth of regions. The eight factors in Figure 1 differ from region to region and there are also several interconnections between them. The economic engine functions optimally when all wheels rotate and accelerate each other. The core is made up of the mechanisms of *matching*, *sharing* and *learning* and innovation. These mechanisms ensure growth in productivity and employment in urban regions.

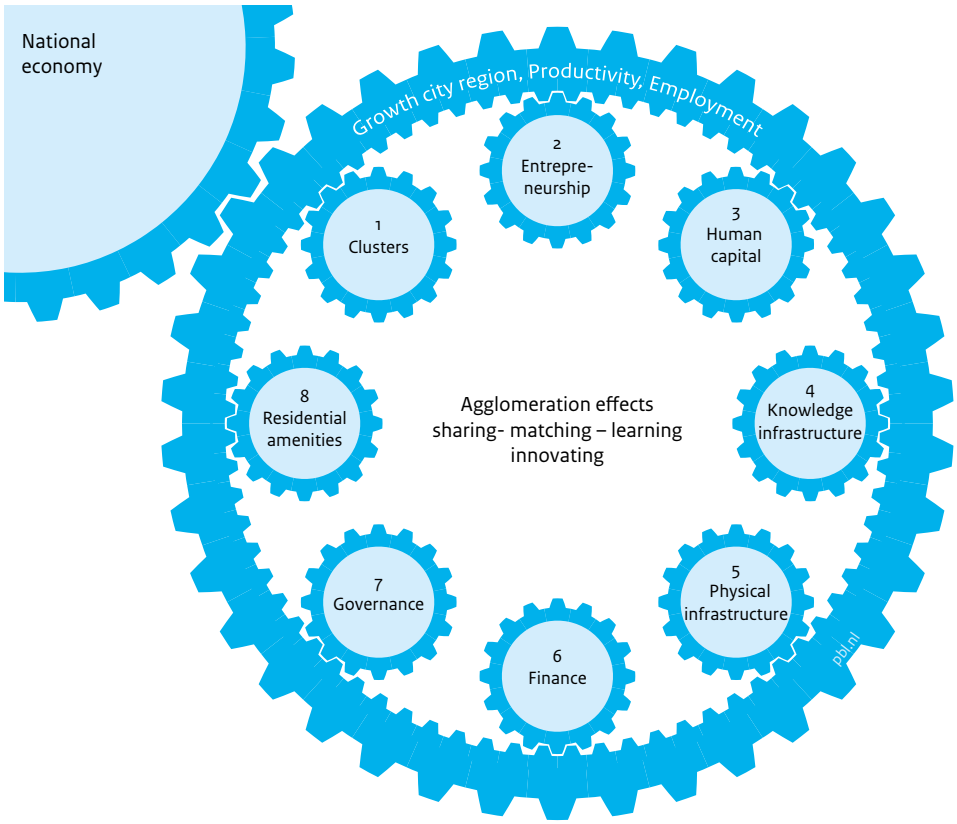
Growth processes are often path-dependent, which means that new economic growth arises from pre-existing structures. At the beginning of a growth process, unplanned events, and sometimes also chance happenings, can play a role. A large company's choice of location is an example of this. Around large companies, clusters sometimes develop that would not have arisen in the absence of such a trigger.

Moreover, regional growth is partly determined by changes in external demand, both national and international (Thissen et al., 2017). We take this into account as much as possible in our analyses. Therefore, we focus on regional factors that play a role in economic growth, in addition to national and international factors. Institutional and macroeconomic reforms and the elimination of trade barriers are other questions that are often dealt with at administrative levels beyond that of the region.

Looking for the regional factors that are robustly connected with growth

To empirically determine the relationship between the factors described above and regional growth, we performed regression analyses using around 70 variables that stand for the characteristics of nearly 800 regions in 27 countries in Europe. With the analyses, we explain employment growth and productivity growth over a period of more than 20 years. The aim of the regression analyses is to identify robust factors (variables); factors whose relationship with economic growth of the region is statistically significant, under *all* possible conditions with variables being included and then left out again. To determine these robust factors, we carried out simulations of regression analyses. Given that the variables in the regressions were entered in different combinations for each run, a simulation consists of almost 600,000 different model estimates. We summarised the results in heat maps that show how often a variable is significant and what sign it has, i.e. whether its effect is positive or negative for growth. Chapter 3 includes the heat maps for employment growth and productivity growth in regions,

Figure 1
The engine of regional economic growth



Source: PBL

showing the overall results and the results for several economic sectors. Figure 2 presents the overall results only.

What can we deduce from the heat maps?

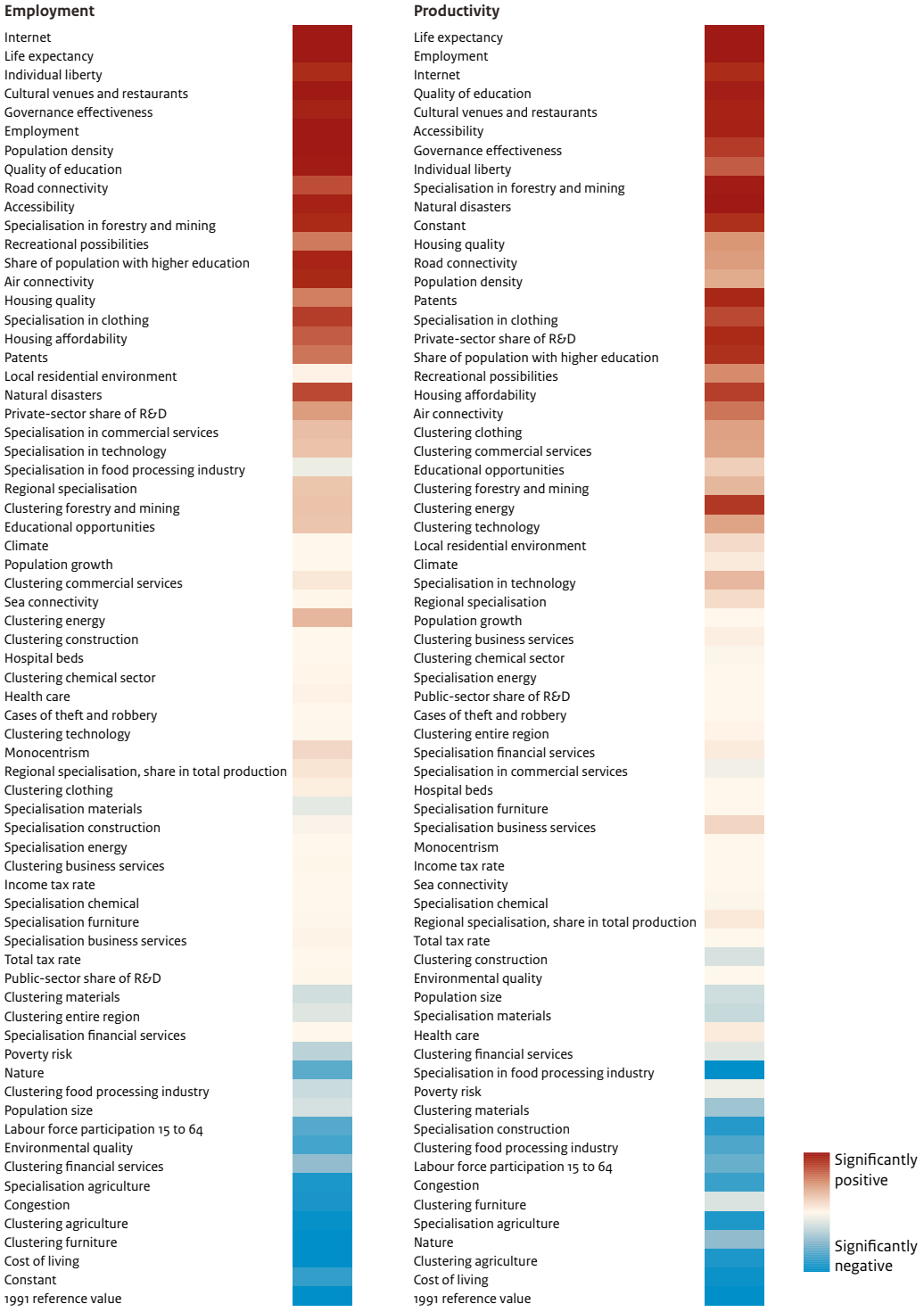
- Employment growth mainly has to do with agglomeration benefits arising from *population density*, *good accessibility*, a highly qualified workforce (a concentration of *people with a high level of education*), high quality *education* and a wide range of *cultural amenities*. *Traffic jams*, *air pollution*, *noise pollution* and *expensive locations* are negatively related to employment growth.
- The characteristics that correlate with productivity growth are mainly related to the characteristics of the labour force, especially that of a highly developed *human capital* base.
- Only a *limited number of factors* are robust for regional economic growth. It is important to identify the policy areas that correspond to these factors since they may have a relationship with economic growth of regions.
- The *context* is also relevant, as certain regional characteristics condition the impact of others on growth. The clearest examples are knowledge and culture, which are both particularly effective in densely populated regions. The valorisation of knowledge and the quality of the cultural amenities therefore bring about growth, especially in cities with high population densities.
- Sectors benefit from specific characteristics of the business climate. The growth in industrial companies, for example, is related to the *specialisation and clustering of technological activities* and *the materials sector* in the region. This means that industrial companies can benefit from a location close to many other businesses in the sector or with which they cooperate in the production chain. When it comes to location, these factors are more important for industrial companies than service activities.

Policy achievements in successful regions

In successful regions, government authorities have been very active in facilitating and directing economic processes, and in making targeted investments in the economy. However, these policy efforts cannot be

Figure 2

Heat map results regression analyses employment and productivity growth



Source: PBL

considered outside the context of historical events in the region. In regions with strong economic growth, success can often be traced back to several important initial or base conditions that brought about growth, or developed growth potential, at a later stage. Those conditions were usually not planned or created by government authorities. They can include, for example, the choices made by large leading businesses or institutions to establish themselves in a certain region, as Philips did in Eindhoven and Siemens in Munich. The designation of Milton Keynes as a *New Town* by the British government also had historical significance. In Madrid and Dublin, large-scale national institutional reforms played a role, with the benefits being felt particularly in the cities' metropolitan regions. What was significant in Amsterdam was the region's historical economic specialisations in trade, logistics, financial and business services, and creative services.

After these initial phases, regions develop in a path-dependent way (i.e. previous events determine the course of later developments). This is how an economic structure builds up along the lines of an evolutionary process. Evolutionary, because regional economic growth is often gradual and change often arises from the pre-existing economic structure. Regions are the natural environments for selection. In this growth process, an important ingredient is innovation (attracting new sectors and renewal within sectors), for example in relation to existing economic activities.

Government authorities have a prominent role to play in these evolutionary growth processes. In successful regions, policy efforts are expressly attuned to the potential of the economic structure of a region and to the challenges arising from it. Sometimes the case is urgent because of economic stagnation and decline. Amsterdam, for example, saw a period characterised by major redundancies and an exodus of residents. Due partly to earlier policies aimed at other nearby growth centres, the city had dropped back as an economic and cultural focal point. Sometimes such cases of decline are sector-specific, as those affecting the high-tech sector in Munich and Eindhoven. But, often, policies are coupled to existing endogenous and self-reinforcing developments towards continual innovation in the region, such as the shift from hardware to software (and thereby from industry to services) in Dublin. In strongly growing regions, government authorities facilitate the process *in a timely fashion* by creating a basis for innovation. This is not done by choosing sectors from above (picking winners), but rather by taking a bottom-up approach to facilitate a growth strategy in concert with higher administrative levels, the business world and knowledge institutions. In addition, government authorities sometimes focus on stimulating certain transitions, for example by centring their attention on social challenges. These challenges too are made region-specific on the basis of demands and opportunities that arise in the economic structure. They include sophisticated innovations in the field of cleantech in Munich, or pilot projects for collaboration with knowledge institutes and the business world to find solutions for the energy-intensive structure of suburban settlements in Milton Keynes.

These general findings emerge from the historical analysis of policies in Munich, Eindhoven, Milton Keynes, Madrid, Dublin and Amsterdam– in six economically successful cities. In these case studies, we explored the causal mechanisms of economic growth, rather than the causal effects. It is also possible to inspect the mechanisms that operate in other regions as long as the study is adapted to those specific contexts.

Region-specific policy mix

The case studies show that in successful regions, policies typically cover several policy areas. Government authorities work with a coherent *policy mix* that is enacted over a longer period of time. Policies are therefore not treated independently from each other within individual domains, such as the economy, social affairs and physical interventions. The policy mix concerns the combination of factors and the interaction between them in the conceptual model of the economic growth engine (Chapter 2). There are, for example, strong links between the policies for clusters, the labour market, education and entrepreneurship within a consistent whole, or system. In many occasions, policies for the physical domain are streamlined in consequence.

The policy mix is specified in agreement with the regional potential or challenges arising from the economic structure. Traditionally, a distinction can be made between generic and specific policies. Generic policies, such as those for high-quality education or proper accessibility, focus on all actors in the region. Specific policies are prioritised towards certain target groups, thematic areas or economic activities. The case studies show that in the successful regions priorities are set expressly, and that generic policy instruments have many specific characteristics. To give an example, investments in knowledge and educational institutions are dedicated specifically to spearhead activities. In regions enjoying economic growth, policies that are inherently quite generic, such as spatial planning (everyone benefits from such policies), appear to include specific characteristics. Investments in facilities and residential and working environments have been found to specifically target the needs or potential needs of a certain type of worker (e.g. knowledge workers) or economic activity.

Examples of priorities are the choice for *high tech and innovation* in Eindhoven and Munich, both of which have a base made up of several types of activities and technologies. Milton Keynes and Amsterdam worked

decidedly towards obtaining *attractive facilities and residential environments* in order to attract highly qualified human capital. In Dublin, the focus was on attracting *foreign capital and businesses*, mainly with an eye on achieving a transformation to top-of-the-line activities (electrical, pharmaceutical and chemical industries, software development) within its current economic structure. In Madrid, an autonomous agglomeration process took place, with an emphasis on *physical projects* involving urban rehabilitation and expansion and, in a later stage, mega development projects.

With regard to the various priorities and accents in these regional policy mixes, it is possible to distinguish two overarching objectives that the policies actively focus on. First of all, timely and ongoing facilitation of economic renewal. Secondly, the creation of places that are attractive to live and work in.

Economic renewal

Regional authorities have contributed to making economic renewal possible in a timely fashion and to enabling regions to literally reinvent themselves. This was achieved by creating critical mass around the new and promising economic activities that were emerging in the region and stimulating innovation in sectors that had a strong presence in the region and were in danger of entering a phase of decline.

Examples of the first strategy are Munich's investments in knowledge institutions (Fraunhofer-Gesellschaft, Max Planck Society), education (universities, including the University of Applied Sciences) and venture capital (Bayern Kapital) aimed at specific new technologies. In the Dublin region, *foreign direct investments* (FDI) were linked to specific training programmes (software, technicians) and to domestic business clusters (Linkages Programme). In Eindhoven, the relocation of the Philips headquarters was turned into an opportunity to establish a campus and redevelop the city. Milton Keynes launched its Smart City initiative, in which the high CO_2 emissions resulting from great car dependency and high energy consumption were taken as a challenge; specialised university programmes and a start-up and test centre were linked to data management activities and the city's tradition of spatial planning.

Examples of the second strategy, stimulating innovation, include the Future Bavaria Initiative in Munich and the Brainport Development Initiative in Eindhoven, both involving large-scale investments in the renewal of existing clusters. In these cases, the moves were the result of a sense of urgency shared by the government, the business world and knowledge institutions. In Munich, this sense of urgency was triggered by an impending downward spiral in the defence, electrical and machine building industries; in Eindhoven, it arose from within the electronics industry. In Dublin, timely investments were made in the knowledge infrastructure around software development to support the necessary diversification from hardware manufacturing to the provision of software services.

Attractive cities

Regions have focused especially on investing in attractive places to live and work in. As mentioned above, these policies too are specified in detail and in concordance with other areas in the policy mix.

Examples include extensive renovations of old city centres and the associated cultural amenities in Amsterdam (in the mid 1980s), Munich (after the Second World War) and Madrid (after Franco's death in 1975). Values related to nature were a factor of attraction in Munich (compact, urban and green) and Milton Keynes (the forest city). Other regions related their policy initiatives to specific working environments for high-tech knowledge activities; in Munich, former military sites–'areas for the new economy'–were linked to the Future Bavaria Initiative, and Eindhoven linked its Strijp S district–the creative centre of the city–to the Brainport Strategy. In Dublin, the inflow of foreign investments was linked to the redevelopment of the Docklands Area. Milton Keynes successfully attracted human capital through its suburban residential environments equipped with urban facilities. In Amsterdam, the structural 'De Stad Centraal' plan formed a turning point; this policy focused on top-end, urban residential and working environments, such as the 'IJ-oevers' redevelopment project, which were aimed at young, highly educated people.

Strong institutions...

The examined regions do not only have different priorities, but they also characterise themselves through their own strong, multi-level *governance structure*.

In Munich, investments in the innovation system contributed to the emergence of the *Munich Mix*–characterised by a close interconnectedness between different sectors, and large and small companies–and *institutional thickness*, with strong links between public and private parties. In addition, the federal state of Bavaria exerted strict control, ensuring coordination between the region of Munich and the city itself. This is a clear case of full multi-level governance between actors (large and small, the market and the government), between sectors (cross-sectoral) and between administrative levels. In Eindhoven there were links between the actors in the 'triple helix'–companies, knowledge institutes and government authorities–and between the geographical scales of the city, the metropolitan region, the province and the national government. In addition, the open innovation model was successful and intensively clustered around the High Tech Campus and other locations in the

city (Strijp S, TU/e). In Milton Keynes, the Development Partnership played an important role in the cooperation with local, regional, public and private partnerships. The institution also has many land rights and works together with the Park Trust and Milton Keynes City Centre Management to oversee the preservation of the urban and nature-related core qualities. In Dublin, the Industrial Development Agency (IDA) has a long track record (starting in 1958) of attracting foreign direct investments. Enterprise Ireland is responsible for links with the regional labour market, knowledge infrastructure and entrepreneurship. The Madrid region is characterised by the fact that the borders of the region follow the criteria of the Daily Urban System, which means that the administrative decision-making power is finely attuned to the region as a functional whole. Another advantage here is that a great deal of the decision-making power lies at the level of the region.

… that follow trends (proactively and by being able to adapt)

The case studies show that it is important that institutions follow trends, both proactively and by making adaptations (also see WRR, 2013). Adaptation refers to the ability of the authorities to continually readjust their institutions to changing environments, so that innovations can occur in time. Proactive, here, refers to authorities anticipating future problems and looking for future opportunities. Consequently, this orientation focuses on the long term (WRR, 2013: 128). Being proactive also means learning from mistakes. All in all, following trends involves outlining perspectives and, once a path has been taken, being flexible and willing to adapt.

Examples include the institutional adjustments that were made in Eindhoven and Munich, when certain sectors came under pressure because of changing market conditions; and the role of the supporting institutions in Dublin, during the shift towards top-end activities and the efforts to consolidate them. The Milton Keynes Development Corporation shaped its policies to respond to the deteriorating economic situation, an increase in home ownership, an increase in private vehicle use and the trend towards suburban growth. These efforts took advantage of lessons learnt during the development of previous New Towns. As for Amsterdam, in the early 1980s, the Andriessen Commission stressed the importance of investing in the metropolitan residential and working environments and in making the city attractive as an economic and cultural centre; its economic strengths had to be exploited.

In actual practice, it is also found that the capacity to anticipate and learn sometimes develops too slowly. In Ireland, for example, the approach to foreign investments took a rather long time to shift from ‘spreading policies’, which allocated resources over underdeveloped rural areas, to dedicated policies aimed at urban regions and at securing the presence of top-end foreign companies in the regional economy. The decentralisation process took place at a very slow rate. The governance systems in England and Ireland have always been highly centralised.

The Madrid region, on the other hand, enjoyed a great deal of autonomy after the Franco era, but for a long time also neglected the city of Madrid. The top-down policies of the national governments of the United Kingdom and Ireland, and the regional authorities in Madrid hampered the participation of stakeholders and the starting up of innovative, bottom-up initiatives that match local dynamics. In Madrid and Dublin, the absence of control mechanisms from other levels of government also caused lobbies and other interests to become entangled.

In both regions, a property bubble arose because government, banking, property developers and the construction sector were too closely intertwined. With banks readily giving mortgages, the drawing up of mega development projects and the increase in domestic spending, a bubble was created that burst in 2008. Particularly in Ireland, the national government proved to be quite hard-headed; it had kept on pursuing the same pro-cyclical investment policy (‘When I have it, I spend it’) between the two oil crises of the late 1970s and the early 1980s, also leading to negative consequences for the economy in that period. In Spain and Ireland, public debt soared immediately after the financial crisis.

Madrid had invested mainly in bricks and mortar and far too little in knowledge. In 2007, the OECD already issued warnings that sustainable economic development could be disrupted by the large number of temporary labour contracts, the modest investments in labour, poor labour productivity and the low level of innovation. This was also reflected in the mass unemployment that arose during the financial crisis among highly educated young adults and the share of the workforce that depended on consumer services and the construction sector.

Amsterdam struggled to find the most appropriate formal partnerships, and the corresponding geographical scale. Informal partnerships were an important basis for the process there, while attempts at formal cooperation imposed from above proved to be less practicable. Eventually, the informal structures went on to provide adequate support for cooperation.

A regional strategy, along with its regional policy mix, can also enter a phase of consolidation, comparable to and coinciding with that of economic sectors. Continual adaptation is required, but there is no blueprint for future success. The strategy followed in Munich raises the question of what shape its future technology policy will take. With the new cluster initiative, the region is shifting

towards more mature industries, in which almost every sector participates. Based on dialogue and the mobilisation of private resources, the initiative deals with projects that operate on a smaller scale than the technology stimulation programmes of the past. This change is motivated by the shortage of financial resources and the high cost of large-scale programmes.

The relationship between robust factors and the six successful regions

In the economically successful regions, explicit policies were adopted on factors that the quantitative analyses have shown to be robust. One of the most important conclusions of this study is that there exists a strong relationship between the robust factors affecting economic growth (identified in the quantitative analyses) and the policy efforts that have been launched (analysed in the qualitative case studies). Each of the studied regions does have its own particularities. The ways policies focus on the factors are context-specific; policies and measures within a single domain (i.e. corresponding to a certain factor) differ from region to region. This has to do with the concrete implementation of the policies and also with the structure of economic sectors and the size of the regions, which are all centred around cities but vary considerably in surface area.

Table 1 summarises the relationships between the eight cogwheels and the ways policies were implemented in the six regions. It is of course not possible to reflect all the nuances of the individual cases in the table. For example, the dynamics of policies over time is not visible. This means it is simply a brief overview of the policy priorities that were found to be predominant over a period spanning several decades. Their weights are sorted into the following categories: top priority, very important, important and less important. Another point is that the initial situations differed from one region to another. In some cases, for example, many policy efforts were needed because a certain factor had been seriously neglected in the region. But, there are also examples of regions preforming well with regard to a certain factor, meaning that policy priorities in that field were not required. The table shows that the regions in this study emphasised several policy areas, often in the form of a coherent policy mix.

The individual regions are displayed in the columns in Table 1. Some caution is required when comparing the information in the columns. Moreover, the intensity of the policy does not fully correspond to the breadth of the deployed resources, which varied from region to region. Differences in size among regions should also be considered. For example, Milton Keynes grew strongly, but was a relatively small region a few decades ago. This means that growth was, in relative terms, very high.

Table 1 shows that, in the Munich region, all eight cogwheels in the growth engine were prioritised and were very important in policy efforts. Priority was given to strengthening and further developing clusters (economic structure), the quality of human capital, the knowledge infrastructure, and the necessary financing–altogether forming a coherent innovation system. The strong policies that were developed also addressed the governance of the innovation system, which strongly contributed to ensuring that all actors involved in the Munich region became like-minded and pursued a joint strategy. The policies were complemented by an intense focus on entrepreneurship. Other important policy areas were physical infrastructure (accessibility) and the quality of the physical and local residential environments.

In Brainport Eindhoven, the emphasis was mainly on clusters, knowledge infrastructure and governance of innovation–a triple helix structure in which government, businesses and knowledge institutions work in close collaboration. The case study also reveals that entrepreneurship, financing (venture capital) and the quality of the physical and local residential environments, despite being considered important, received less intense policy attention.

In the Milton Keynes region, priority was given mainly to the physical and local residential environments and to the facilities that contribute to creating an attractive location to live and work in. Policies in the physical domain and governance in development projects and public-private partnerships were very important in this regard. The region focused far less on entrepreneurship and specific clusters but did embrace the smart-city idea as a concept with links to economic activities. Human capital was important but was attracted mainly through the physical and local residential environments. In the field of knowledge infrastructure, the region enjoys many advantages because of its location close to the leading universities and knowledge clusters in Oxford, Cambridge and London. Policymakers were very much aware of this unique location, and of the required physical infrastructures to ensure proper connections with these core areas.

In the Dublin region, high priority was placed on attracting foreign investments and, in the field of human capital, on giving Irish workers the skills they needed to match the demand of foreign businesses. The aim was to ensure these businesses became an intrinsic part of the regional structure. However, priority was also given to the further development of the clusters that needed new and different forms of knowledge, making policies aimed at the required knowledge infrastructure and cluster

Table 1

Policy priorities in the six economically successful regions

Policies aimed at:	Munich	Eindhoven	Milton Keynes	Dublin	Madrid	Amsterdam
1. Clusters						
2. Entrepreneurship						
3. Human capital						
4. Knowledge infrastructure						
5. Physical infrastructure						
6. Financing						
7. Residential amenities						
8. Governance						

	Top policy priority
	Very important in policies
	Important in policies
	Less important in policies

development highly important. Although especially relevant, entrepreneurship and the quality of the physical and local residential environments were given less policy priority in Dublin. Governance was important, but efforts were mainly related to the interaction between national policies and the region.

The Madrid region assigned top priority to physical infrastructures and major projects that correspond to the development of a large agglomeration. The quality of the physical and local residential environments was also important. Since the city of Madrid dominates the region and living and working are concentrated there in the region, other policies, such as those for cluster development, were less prominent. Large, leading companies would be establishing themselves in the city anyway, partly because several authorities, including the national government, had interests in clusters such as those belonging to the telecom and energy sectors.

In Amsterdam, policy priority was given to the quality of the physical and local residential environments. Initially to make the city an attractive place to live in, and later to facilitate growth towards a creative knowledge economy. Policies in the physical domain were important, and strongly related to the sectors (clusters) of logistics and financial and business services. Examples are the development of the Zuidas business district and the upgrades of Amsterdam Airport Schiphol. The other policy areas were also important, but somewhat less dominant.

Behind this table lies an abundance of concrete interpretations of policies within the fields of the factors listed. The policy efforts dedicated to these factors are context-specific. The discussion of the individual case studies offers more insight into the policies, but at this point, we will limit ourselves to a few examples, focusing on context-specific interpretation of robust factors in the regression analyses.

In Munich, the cluster policy was focused on innovation, both within the clusters themselves and on the crossovers between technologies and sectors, deployed over a relatively broad area. The cluster policy in Eindhoven was aimed at the transformation from 'company town' to open innovation system, with important issues being the organisation of the system and the required physical locations. In Dublin, specific Linkages Programmes aimed to embed businesses in the regional structures and institutions, but here too policies went for a limited number of clusters, such as the electrical industry, software development and pharmaceuticals. The objective with regard to human capital (education policies) was to 'deliver' technicians and workers trained in ICT. In Munich too, new faculties and institutes for vocational training had to the strengthen the human capital base. The case descriptions also show that the knowledge infrastructure and the related policies differ between regions. In Munich, for example, *institutional thickness* refers to the fact the region has a very high density of public and private knowledge infrastructure. Eindhoven has less public-knowledge infrastructure; on the other hand, it has leading R&D-intensive companies that work together with knowledge institutions. In Munich and Amsterdam, international connectivity, particularly by air, was important. Accessibility is important in all six cases, including Dublin and Madrid, which serves as a hub for South America. Differences also exist in the domain of financing for areas such as start-up systems with specific risk financing (in Munich and, in a later stage, in Amsterdam). Dublin focused on foreign investments and businesses, and on institutional reform of the tax system.

In the management of the physical environment and the local residential environment, a wide palette of measures also emerges. Milton Keynes focused on the urban characteristics of suburban settlements, the freedom to build and leisure facilities. Munich opted for the combination of history in its old centre, the *Altstadt*, polycentric developments around the centre and good connections with nature areas outside the city. In Amsterdam, policies involved offering metropolitan residential functions and, at the same time, finding a balance between the segments of the housing market; public rental housing versus expensive, privately owned housing. Finally, we see that governance may concern efforts to coordinate strategies and investments (in Eindhoven and Munich), or deal with public-private land development (in Milton Keynes). Multi-level implementation of governance measures has to do with the relationship between local and national or other higher authorities, as was the case in Munich, and more recently in Eindhoven and especially in Dublin and Madrid.

Discussion

In recent decades, economic science has developed new insights and currents of thought that have served to expose several mechanisms and factors behind economic growth. Endogenous growth theory has revealed the importance of human capital and innovation, new economic geography deals with agglomeration and distance, and institutional theory highlights the critical role of the institutions (Barca et al., 2012). These mechanisms are found to do particularly well in urban regions.

The match between policies and new economic dynamics

McCann and Rodriguez-Pose (2011), Barca et al. (2012) and Garretsen et al. (2013) note that, while science highly anticipated new developments, this occurred to a far lesser degree in policy-making. According to the authors, many policies still follow traditional, often macroeconomic frameworks, with hardly any consideration for the region or recent determinants of growth (combined in a location-specific approach). Not until more recently have these trends emerged in policy strategies. The most prominent example is probably the European Union's smart specialisation policy, discussed in Chapter 2. Smart specialisation mainly involves stimulating new economic activities (entrepreneurial discovery) and transformative activities. There is no long tradition of policies aimed at regional economic growth, particularly not of such policies developed at the national level. In contrast, the historical policy analyses of the six urban regions examined here show that regional policymakers strongly anticipated the main mechanisms of growth that play a role in their territory, and consequently they entered into specific agreements with their national government. Regional policymakers are in closer contact with the mechanisms behind economic growth, but often lack the national resources to carry out economic policies. For example, policies on labour market, education and innovation are often dictated by national interests.

This means there is a mismatch. Regions play an increasingly important role in generating national economic growth, in a world that is becoming more and more globalised (Garretsen et al., 2013). However, national governments carry out relatively few place-based policies (e.g. see the situation in the Netherlands as described in OECD (2014b, 2017)).

This study shows that many mechanisms behind growth play a role at the level of urban regions and that they function efficiently in precisely that regional context. To ensure that policies conform to the concrete situation, regions should be given the opportunity to realise their economic potential. This can be done partly by means of the municipal and provincial resources that regions have at their disposal, and partly by ensuring national policies match the reality of the region. If only because policies that are place-neutral often make themselves felt at the level of the region but prove ineffective because they are not in concordance with the regional context and regional policy initiatives.

To implement effective policies, 'what works?' is therefore the crucial question. Followed by the question of who knows what to do and when. It is precisely this question that refers to the interconnectedness of local and national knowledge, consisting of local (municipal, provincial) knowledge and custom-made national policies. In this regard, Sen (2009, in Barca et al., 2012: 147) commented that 'a place-based approach builds on local values and the 'sense of community', while it also requires openness to values from outside'. This involves policy strategies covering several levels of government, national and regional.

It is important to stress that location-specific policies mainly have to do with bottom-up developments and geographically linked mechanisms of growth, which then enable businesses and people to secure competitive positions nationally and internationally. To quote McCann, 'It's not about localism'.[1]

The essence of a new regional economic policy

Regional and national policies should connect in a more coherent way. We are making the argument for a possible new regional economic policy line. It means there will often be a policy mix in which investments and institutions in the fields of the labour market, entrepreneurship, innovation, knowledge and education are adapted to the

economic structure and potential of the region. Delivering tailor-made solutions, not following a blueprint.

We conclude this section with a few considerations and suggestions for the implementation of this new regional economic policy.

In the first place, it is important to develop an agenda for cooperation between the national government and the regions. This agenda should not only set regional priorities from within the national government, but also streamline the set of national instruments into a joint strategy for growth. Initially, the parties in the regions are to formulate this strategy. However, national experts (within sectors and from the field of technology) also need to be involved, for example in regional panels.

The goal may be economic growth, but the joint growth strategy should focus mainly on the factors behind that growth (see the metaphor of the growth engine) and the relationships between the policy areas corresponding to those factors. Economic growth arises from the adoption of a policy mix. In an integrated strategy, an investment in one policy area cannot be seen in isolation from investments in others. Cluster policies, for example, cannot be seen dissociated from the knowledge infrastructure and physical infrastructure required for cluster development. Policies aimed at developing the quality of the labour force in the region cannot be disconnected from the economic structure and the quality of the physical and the local residential environments.

A joint strategy is also subject to continual monitoring and regular evaluation. In addition, the strategy, once operationalised in projects and programmes, should be allowed the possibility to adapt to changing circumstances. This is also referred to as a *learning system*. The evaluation of the City Deals drawn up in the Netherlands offers good tools and recommendations that go with such a learning system (Hamers et al., 2017).

A new regional economic policy should be accompanied by a new knowledge infrastructure that provides evidence-based policy with input in the form of information that is relevant for active government authorities and for institutions that adapt to economic trends. What is required is accurate and timely information that serves several purposes besides monitoring regional and technological developments, as well as information that can be used as a reference for policy adaptation and decisions on deploying additional resources (Feldman and Lowe, 2017). This knowledge infrastructure should also be able to perform continual assessments. A practical example is the What Works Centre for Local Economic Growth in England. Knowledge centres could be set up in other locations along the lines of this model.

Regional deals

The formulation of strategies within a 'learning system between national government and the region' fits in with the practice that can also be labelled *regional deals*. Regional deals can be the result of an agreement between several regional authorities, and between regional authorities and the national government. The specifics of the regional deals can be based on successful elements that have been identified in successful cities. An example from the United Kingdom is the agreement between the central government and the regions, which was elaborated into the Local Growth Deals.[2] One of the advantages of these deals is that they fit in with the factors that we characterised in the metaphor of the growth engine, which reads 'money will go towards providing support for local businesses to train young people, create thousands of new jobs, build thousands of new homes and start hundreds of infrastructure projects; including transport improvements and superfast broadband networks'.[3] In the United Kingdom, Growth deals are a unique feature in the history of economic policies, as they combine investments in housing markets, infrastructure, knowledge and education in a single fund. The drawing up of the Brainport Action Agenda (Brainport Eindhoven, 2017) is another good example of a region working together with the national government on its investment agenda. In Munich, cooperation between the region and other authorities is not referred to as a deal or an agenda for action, but there is a close relationship between the federal authorities, the individual federal states and the regional authorities. This relationship is outlined in Perspective Munich and is based on a joint innovation strategy that has been pursued for more than 20 years. Unlike many other locations, Munich does not have any formal administrative structures or institutions at the level of the urban region or the agglomeration. Instead, the metropolitan strategy is coordinated both from above (the federal state of Bavaria) and from below (the municipality). The governments of the federal states in Germany are prominent actors in economic development and budget management for education, research & development, culture and the media. This is also referred to as an *active state approach*.4 The last example is the situation in Spain, where the latest growth agenda includes initiatives for reform (Programa Nacional de Reformas de España 2015). This reform agenda was born out of sheer necessity due to the economic crisis that started in 2007 (the most serious crisis of the last 50 years). Here, the national government and the Madrid region focus mainly on measures to combat (youth) unemployment, government deficits, poverty and inequality.

Report structure

This report is divided into four chapters. Chapter 1 presents the motivation for the study and its set-up. Chapter 2 deals with the literature on the urban and regional economy and introduces the conceptual framework of the city as the engine of the economy. This engine consists of several cogwheels that can bring about growth individually and in interaction with each other. In Chapter 3, we translate the cogwheels (factors) into variables, which we can apply in econometric models. We also estimate which of these variables are significant and that are often found to have a bearing on economic growth, measured in terms of employment and productivity (added value per inhabitant). We then present six case studies in Chapter 4, exploring the mechanisms underlying growth and the policy efforts adopted to enhance growth. The discussion makes use of the insights gained in the preceding chapters. We assess the cases from the conceptual framework (Chapter 2) and verify whether any policy efforts were made that targeted the robust factors operating in the region.

What works for regional economic growth?

Policymakers are faced with the question of which policies perform well in supporting the potential for urban and regional growth. In other words, what are the policies that play an important role in the economic development of urban regions? This broad question is the focal point of this research. The question is rather difficult to answer. It involves isolating the impact of a policy and making a comparison with a situation not regulated by that policy, while controlling for autonomous developments (OECD 2004). An approach that is often used is performing a detailed assessment of policy measures or policy investments, for example by means of an impact analysis or a cost-benefit analysis. Properly conducted assessments provide insight into the effects of policy. In a regional economic context, this means the effects of a very specific measure in a certain region, over a certain period of time.[5] The conclusion may be that something in that context (probably) works for growth. To answer the broader question of what things really work, a large number of these evaluations should be used as the basis for a generalisation, taking into account the specific contexts. In short, a kind of meta-analysis of evaluation studies. It is problematic that many evaluation studies do not meet the criterion of enabling proper isolation of policy effects (according to Max Nathan of the What Works Centre in his presentation for the PBL Autumn School held in October 2016). This also makes it difficult to draw more generic conclusions about such evaluation studies.

Structure of the research

With this research, we take a first step towards answering the question of what policies play an important role in the economic development of urban regions, or what things work for regional economic growth. The study consists of three related parts. We started with the literature survey, presented here in Chapter 2, and described the factors that are highlighted in publications as crucial for regional economic growth. The survey results made it possible to realise a conceptualisation of the urban region as the engine of economic growth.

We then operationalised the factors identified in the literature as much as possible into measurable variables (or indicators; see Annex 1 for a complete list) and performed regression analyses to determine their relationship with economic growth (Chapter 3). In these regression analyses by simulation, nearly 70 regional indicators in almost 800 European regions were examined for their impact on regional economic growth over a period of more than 20 years. Starting from the general literature on growth, this revealed which factors are significantly related to growth, and which are not. Moreover, the exercise also served to verify whether the variables are robust, i.e. determine whether the effect of a variable is felt, regardless of the presence of other variables in the regressions. We also gained insight into those factors that are sometimes related to growth and sometimes not, taking into consideration the importance of the specific context for their impact.

Finally, we carried out the case studies that are detailed in Chapter 4. We chose six regions that have undergone exceptionally strong growth. Each case study includes a historical analysis (what have policies achieved?) to explore the mechanisms behind growth and the role of policies in further detail. This approach produces solid insights into the mechanisms that lead to growth because we avoid our observations from fading out of sight as they are worked into averaged-out figures. The cases studies are based on the same theoretical-conceptual starting point as the quantitative analyses and are therefore related to each other. We examined which policies were adopted with regard to the robust factors we identified in the quantitative analyses, and whether context-specific variables are crucial for economic growth.

To sum up, our study provides an overview of factors that are related to growth and can be influenced by policy. It also shows the mechanisms behind these factors and which policy efforts are able to exploit their potential. Rather than reporting what has been found to work, we shed light on the question of what approaches could work. The study offers a menu, so to speak, of policy options, which includes particularly those elements that the quantitative and qualitative analyses suggest are important for growth. In this regard, the study does not serve as a blueprint for successful policies (in a region), but it offers tools to formulate concrete policy options on the basis of factors that are of value. The actual impact of a policy measure or an investment will subsequently have to be assessed on its own merits.

Limitations to the study

The chosen study structure also has several limitations.

- *Data*. We have taken into account as many indicators as possible of the set corresponding to the factors in the 'engine of economic growth'. However, data are not available on all the indicators, mainly because the analyses were carried out over 800 regions in Europe. At this geographical level there are, for example, hardly any data available on financing–venture capital in particular–investments and entrepreneurship.
- *Policy instruments*. The variables in the quantitative analyses are items with a certain level of abstraction and are not policy instruments. For example, one of the indicators we measured is the amount of (private and public) research & development in each region. Policy instruments such as R&D subsidies or specific tax relief may apply to this indicator. However, the observation that R&D (knowledge) is a robust factor that is linked to growth does not necessarily mean that R&D subsidies or tax relief effectively contribute to growth. In addition, several policy instruments are involved in stimulating R&D. This means that the *quantitative analysis* does not necessarily provide firm conclusions on concrete policy instruments. Therefore we try, insofar as possible, to make the translation of an empirically measured factor or indicator into a policy instrument, within the context of the specific case study–the *qualitative analysis*–by identifying the policies that have proved to contribute successfully to economic growth.
- *Causality*. To be able to interpret regression analyses as causal relationships, a number of important preconditions must be met. One of the main considerations in this study is that the independent variables (the explanatory variables, the factors) must be found to exert an effect on the dependent variables (the variables to be explained, growth), and not the other way around. This so-called *endogeneity problem* is discussed in Chapter 3. Since we cannot correct for the possibility of impacts in the opposite direction (e.g. due to a lack of data on the early stages of the examined period), and since it is also complex to include the instrument variables that have been put forward in the literature, the results of our quantitative analyses are not interpreted as causal relationships but as connections between variables. The connections between variables and economic growth characterise those factors that are important features of growth regions.
- *Growth or steady state?* In the study, we use a growth equation that serves to explain growth from regional characteristics. We follow the standard practice of correcting for the initial value of productivity (growth in added value per capita), corrected for the initial level of productivity per capita. This is dealt with in more detail in Chapter 3. The same is done for growth in employment. An important pragmatic reason for doing this is that the starting point affects relative growth; in a region that is not performing well at the outset, growth may be relatively strong simply because the initial level is low (the so-called *catching-up effect*). Conversely, regions with high levels of growth in the beginning tend to have low-growth paths. However, this also has implications at the theoretical level. By correcting for initial values, in line with the neoclassical growth theory (see Chapter 3), the notion of growth is mainly interpreted as growth towards a new equilibrium, with the relevant variables having an impact on the level it reaches. Seen this way, growth is a kind of increase in efficiency, and our aim is to use the variables to explain the differences between regions. Long-term growth (often explained in the literature by growth in technology) is implicitly included in the model we use and is assumed constant and homogeneous for all regions. At the same time, the literature shows that endogenous growth processes may also occur that are more heavily focused on structural improvements in long-term growth paths. This may be caused by innovation and new technologies, which can bring about major technological breakthroughs such as electricity and the microprocessor. However, assuming that, in the long term, every region has access to the knowledge about new technologies, then how do regional differences arise? This can be explained by the fact that local efficiency in the adoption of new technologies depends on other regional factors, including governance.

- *Good luck or good policies?* It is easy to attribute a region's success to the followed policies or to the quality of regional factors. We know that growth can be very unstable and that the characteristics of those factors are generally far more stable. Easterly et al. (1993) have documented this analyses that focus on individual countries. They seek to explain unstable growth during economic shocks, especially in the trade sector. It is important to correct for a cause-effect issue; how much of a region's growth is the result of international trade and shocks, and how much can be ascribed to the inherent qualities of the region itself? Thissen et al. (2017) show that regional growth can indeed be explained chiefly by international demand (demand growth) and to a more limited extent by regional characteristics (structural growth). However, significant sectoral differences can be seen here; some sectors are more sensitive to the regional characteristics than others. In our analysis, we take into account supra-regional factors by checking for country-related effects (so-called country fixed effects), but we still need to acknowledge that the international dynamics and economic shocks are dealt with somewhat deficiently. To gain a more accurate impression of this issue, we refer to the Winners and Losers website[6] (Thissen et al. 2017). The case studies also verify whether policies anticipated international shocks and changes in external demand.

Notes

1 http://www.europarl.europa.eu/document/activities/cont/201406/20140624ATT85724/20140624ATT85724EN.pdf.
2 http://www.semlep.com/news/2016/boost-for-region-as-government-pledges-multi-million-pound-investment/.
3 Quoted from the website: https://www.gov.uk/government/news/growth-deals-firing-up-local-economies.
4 Also see http://www.lsccgrowthcommission.org.uk/wp-content/uploads/2016/06/CASE_STUDY_-_GREATER_MUNICH.pdf.
5 See the publication of the What Works Centre for Local Economic Growth: http://www.whatworksgrowth.org/ on the way to perform this kind of evaluation studies.
6 http://themasites.pbl.nl/winnaars-verliezers-regionale-concurrentie/#/front?region=R175.

FULL RESULTS

1 Introduction

In recent years, the importance of urban regions for economic development has been underlined strongly, in both science and policies. Leading publications such as *Triumph of the City* (Glaeser 2011) and *The New Geography of Jobs* (Moretti 2012) are international examples. Along with numerous related publications, they stress the fact that cities are the engines of economic growth (OECD, 2006; World Bank, 2009). The OECD studies *Regions matter* (2009) and *Regions and cities; where policies and people meet* (2014a) are prominent surveys within a larger line of research on the importance of regions for economic growth and focus mainly on descriptions of policy efforts. Directed to national governments, they present the argument for new policies that are to be carried out *for* and *with* cities and regions.

In the case of the Netherlands, the plea in the OECD *Territorial Review* (OECD, 2014b) led to the recommendation for a national urban framework in which national policies should be streamlined far more around large and medium-sized cities. One of the policy lines that the Netherlands developed in this context was *Agenda Stad*. With this agenda, the national government aims to strengthen the competitiveness of Dutch cities and to make even better use of urban regions as growth engines for the economy (Ministry of BZK, 2015; Ministry of IenM et al., 2015). During its presidency of the European Union, the Netherlands took the initiative to further develop the Urban Agenda for the EU, also known as the *Pact of Amsterdam*. This document too stresses the idea that urban regions are highly important for the European economy: '...they are the powerhouses of economic growth, innovation and employment opportunities' (EU Urban agenda 2016[1]).

1.1 Defining the problem and framing the question

Due to the increasing importance of cities and urban regions for the economy, government policies aimed at the urban and regional economy are also becoming the object of scrutiny. Policymakers are faced with the question of which policies perform well with regard to supporting the potential for urban and regional growth.

An important observation about efficient performance is that economic tasks are context-specific and vary in nature and scope across regions. To be able to elaborate on these tasks in more concrete terms, it is necessary to gather information on the urban-regional context. For example, is it possible to establish the specific urban and regional factors that have contributed to the economic development path of cities? Are any of these factors invariably linked to growth and is it possible to identify the conditions under which certain factors contribute to economic success? A related question is, of course, whether these factors can be influenced by policies; what are the mechanisms driving urban growth that policies can focus on?

In short, the question is whether policies play an important role in the economic development of urban regions–and if so, what policies that would be. This broad question is the focal point of this research. Beforehand, we can note that the question is difficult to answer. This is because it requires isolating the impact of a policy, compared to the situation not regulated by that policy, while controlling for developments inherent to the economy itself (OECD, 2004). For this reason, policy measures or policy investments are often evaluated in detail, for example by means of an impact analysis or a cost-benefit analysis. Properly conducted evaluations provide insight into the effects of policies. In a regional-economic context, this means looking at the effects of a very specific measure in a certain region, in a certain period of time.[2]

It could then be argued that something in that context has probably served to stimulate economic growth. To answer the broader question of which policies are important (the things that really work), a large number of these evaluations should be used as the basis for a generalisation, taking into account the specific contexts. In other words, a kind of meta-analysis of evaluation studies. What is complicated about this is that many evaluation studies do not satisfy the criterion that policy effects must be easy to isolate (according to Max Nathan of the What Works Centre in his presentation for the PBL Autumn School held in October 2016). This also makes it difficult to draw more generic conclusions about the studies. With this research, we take a first step towards answering the question of what policies play an important role (what things work?) in regional economic growth. We do this in the three stages described below.

1.2 Research setup

Our study comprises three related parts: a literature survey, a quantitative analysis and a qualitative analysis.

1.2.1 Literature survey

We started our research with a survey of urban-economic and economic-geographic literature, focusing on the question of which factors are highlighted as important for regional and urban economic growth. Based on the literature, we described the conceptual connection between these factors and the mechanisms that drive growth. With this survey, we wanted to determine, arguing from the point of view of economic and geographic theories, which factors contribute to the economic development of cities and urban regions.

1.2.2 Quantitative analyses

In the next step, we performed quantitative analyses to examine the relationship between the economic development of regions and around 70 characteristics of the business climate of those regions, based on the literature survey. The examination covered a period of more than 20 years, and almost 800 regions in 27 countries in Europe. For all regions, we looked at growth in employment and added value per inhabitant (productivity of the region), considering both the economy as a whole and six individual sectors of the economy. The data used in the analyses are from Cambridge Econometrics' European Regional Database (April 2015 version). The 70 characteristics of the business climate were taken from several sources. A list has been included in the Annex.

To investigate the relationship between economic growth (in terms of added value and employment) by sector in a given region and the many factors of the business climate, we performed a simulation of regression analyses. The same setup is discussed in an influential article by Sala-i-Martin (1997), and a closely related methodology is presented in Florax et al. (2002). The simulation involved using many models (with different specifications) to estimate the impact of a certain factor by itself and in combination with other factors. This enabled us to find robust links. By *robust* we mean that we have investigated whether a variable remains statistically significant in practically all model specifications and whether the sign of the coefficients (negative or positive) remains the same. A relationship between a regional factor and economic growth is considered robust when the factor remains significant under all possible conditions (i.e. when other variables are added, then omitted and yet others added again). The question we can answer with this simulation regression analysis is that of which factors (variables) have a robust impact on economic growth of the region.

What works for one region does not necessarily work for another. To investigate this further, we looked at so-called *interactions* between factors. After all, it is possible that a factor is important for regional growth under special conditions. It could be, for example, that improving accessibility is only effective in regions with a high population density, or that the contribution of nature and green areas only works in regions that are already performing successfully.

1.2.3 Qualitative analyses

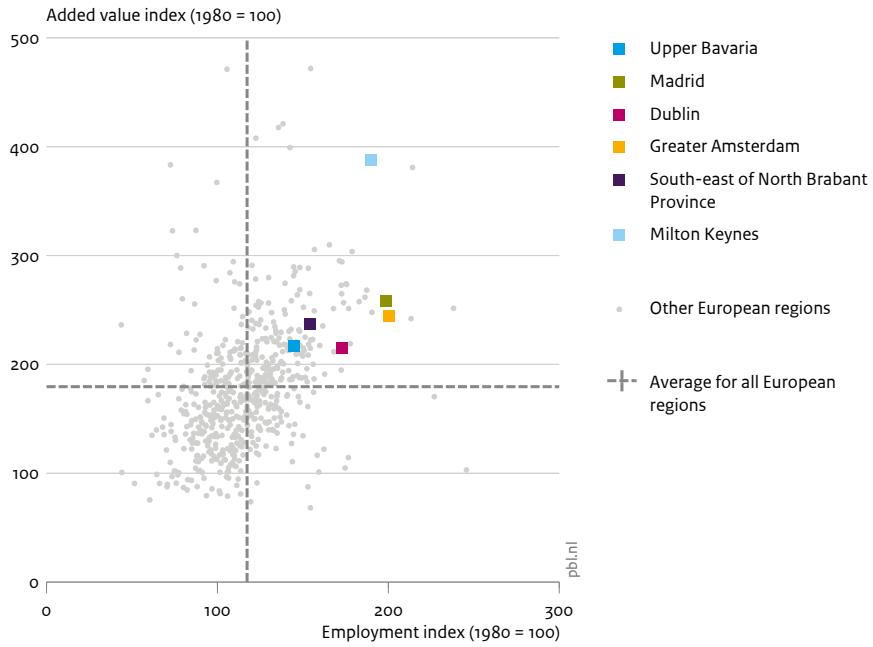
In addition to our quantitative analyses, we looked in more detail at six urban regions in Europe. The aim was to define the mechanisms behind regional economic growth in more concrete terms, and, particularly, to analyse the role played by policy. While model-based quantitative analyses provide general insight into the robust factors behind the economic growth of regions (based on statistical correlations), case studies enable us to make further progress in the search for those factors and circumstances that help to create a clearer picture of the causal process (Swanborn, 2013). The case studies focus on the mechanisms underlying economic growth processes and how policies have responded to them. Ultimately, this will provide lessons that may be applicable to other regions (Gerring, 2004; Stake, 1995).

1.2.4 Selection of cases

Gerring (2004) and Flyvbjerg (2006) note that case studies are particularly valuable when they provide insight into causal mechanisms rather than causal effects. To duly examine causal mechanisms, it is important to properly select the cases. In their descriptions of various types of case studies, Seawright and Gerring (2008) and Flyvberg (2006) include 'the extreme case', which is precisely the one that is of interest to our research. Flyvbjerg affirmed that taking random samples is not the most appropriate strategy when the aim is to gather a great deal of information about a certain phenomenon. This is because commonly occurring or more general cases, often do not contain an abundance of information. 'Atypical or extreme cases often reveal more information because they activate more actors and more basic mechanisms in the situation studied. In addition, from both understanding-and action-oriented perspectives, it is often more important to clarify the deeper causes behind a given problem and its consequences than to describe the symptoms of the problem and how frequently they occur. Random samples emphasising representativeness will seldom be able to produce this kind of insight; it is more appropriate to select some few cases chosen for their validity' (Flyvbjerg, 2006:13).

Extreme cases can be selected according to both the presence of factors that 'explain' economic growth and economic growth itself. In this research, we are interested in the factors behind regional economic growth and the mechanisms driving growth. For this reason, we consider exceptional growth performance of a region to be particularly important. This means that the results of such case studies are not necessarily representative for a randomly chosen region; they are mainly representative for regions undergoing growth. By selecting extreme cases, we therefore chose to maximise the variation in

Figure 1.1
Economic development of European regions, 1980 – 2012



Source: Cambridge Econometrics; edited by PBL

growth (or the mechanisms behind it), rather than minimise it (Seawright and Gerring 2008). Quantitative researchers often treat these extreme cases as outliers or errors and exclude them from analyses, whereas in qualitative analyses, it is precisely these unique contexts that interest us with an eye on understanding the processes of economic growth (Stake, 1995; Swanborn, 2013).

1.2.5 Selection of cases

For the case studies in this research, we selected the following six European regions based on their 'extreme' growth performance:

1. Munich (Germany);
2. Milton Keynes (United Kingdom);
3. Madrid (Spain);
4. Dublin (Ireland);
5. Eindhoven (the Netherlands);
6. Amsterdam (the Netherlands).

These six regions were chosen because they saw a strong increase in employment and added value over the 1980–2012 period. This means they meet the requirements for extreme cases and can provide insight into the causal mechanisms behind growth. In addition to strong growth, two other reasons played a role in the selection process.

We know that growth in employment in these six regions is for the better part related to regional and urban factors, and not necessarily to the presence of a favourable mix of sectors and to their location in countries undergoing rapid development (this so-called *regional* or *shift component* follows from a shift-share analysis documented in PBL 2016).

Figure 1.1 shows that the selected regions were among those with the highest economic growth in Europe in the studied period. The dotted lines in the figure show the average values of all of the nearly 600 regions and divide the figure into four quadrants. The six regions selected for this study were among the top regions in Europe in terms of growth in both added value and employment, which occurred much faster than average. Eindhoven, Munich and Dublin scored well on both growth indicators. Madrid and Amsterdam grew considerably in added value, but excelled particularly in employment growth, with the number of jobs almost doubling in both regions between 1980 and 2012. Milton Keynes showed exceptional growth on both indicators. While the region belongs to the European top, it should be noted that it is much smaller than, for example, Munich, Madrid, Dublin and Amsterdam. When smaller regions experience growth, they generally show higher relative growth rates than large regions.

1.3 Report structure

In Chapter 2, we describe the literature on the urban and regional economy, and we introduce a conceptual framework of the city as an 'engine of the economy'. This engine consists of several cogwheels that, both individually and in interaction with each other, can bring about growth.

In Chapter 3, we translate the cogwheels (factors) into variables, which we can apply in econometric models. Consequently, we estimate which of these variables are significant and how they correlate with economic growth, which is assessed in terms of employment and productivity (added value per inhabitant).

Finally, Chapter 4 presents a description of the six case studies in which we search for the mechanisms of economic growth and the policy efforts concerned. Applying the insights gained in the previous chapters, we consider all the cases from the conceptual framework outlined in Chapter 2, and check whether the adopted policies were geared towards the robust factors identified in Chapter 3.

Notes

1 https://citiesintransition.eu/publication/eu-urban-agenda.

2 For further details on how to carry out this kind of evaluation studies, see the publications of the What Works Centre for local economic growth: http://www.whatworksgrowth.org/.

2 Cities as engines of the economy

2.1 Introduction

Cities and urban regions are often characterised as 'engines of economic growth' (World Bank, 1991; OECD, 2006). It is a way of expressing the idea that the mechanisms behind economic developments function efficiently in cities and bring about more economic growth than in other places (Duranton, 2008a). In this chapter, we examine these mechanisms and the factors influencing regional-economic developments by means of a description of the spatial-economic, urban-economic and economic-geographic literature.[1]

In recent decades, the number of publications and empirical analyses on urban and regional-economic growth has increased rapidly. In this literature, several theoretical foundations–schools of thought–can be distinguished, each with its own perspectives. McCann and Van Oort (2009) provide a historical overview of these schools and describe relatively recent developments, such as those of the *New Economic Geography* and the *New Growth Theory*. Plummer and Taylor (2001) also describe the variety of currents in the literature, and more particularly, the assumptions about the mechanisms behind growth. This chapter does not aim to present the full range of nuances, differences and overlapping ideas in the various currents found in the literature, but rather to extract the factors that are important for regional-economic growth. In short, we give a description of the factors that are pertinent to the most important theoretical frameworks in the regional-economic literature. In broad terms, this involves factors that have to do with technology and knowledge (innovation), markets and competition, transactions, networks, and the relationships between companies, labour markets, culture and regional embedding (McCann and Van Oort, 2009; Plummer and Taylor, 2001). These factors come together, partly or as a whole, in the central concept of *agglomeration benefits*.

Therefore, we start by describing this concept in Section 2.2. This involves the explanations given in the literature for the achievements of cities with regard to the central concept of agglomeration benefits, and for the underlying mechanisms of *matching*, *sharing*, and *learning*. These mechanisms, which are outlined in the next section, explain why regional factors, such as a highly educated workforce or business clusters, have a major impact on economic growth, particularly in many urban regions. Quite often, cities are not simply the sum of regional factors that can explain economic growth, but above all, due to their mass and density, they accelerate the effects of these factors through the principles of matching, sharing and learning. Put differently, according to these theories, the whole (the urban region) is more than the sum of its parts (regional factors).

In subsequent sections, we look in more detail at the individual regional factors that are associated with economic growth. Regions, including urban regions, differ from each other according to the extent to which these factors have developed. The factors we look at are the clusters, human capital, entrepreneurship, knowledge infrastructure, physical infrastructure, capital and financing, conditions of the residential and physical environment (amenities), and governance.

A one-by-one review of these factors is a rather static approach to economic growth and, moreover, does not deal with the role of policies. Therefore, we discuss two specific perspectives in Section 2.12. The first is an evolutionary perspective on economic growth that explains the importance of casual events in the past and the subsequent path-dependent process. The second is a perspective on various policy concepts that have received a great deal of attention in the literature in recent years. These include regional innovation systems, ecosystems for entrepreneurship and smart specialisation. The closing section summarises the most important conclusions.

2.2 Agglomeration benefits[2]

Agglomeration benefits are advantages that businesses and households have when they are located near other businesses and households–the so-called agglomeration economies. The benefits can make businesses more productive and more innovative, and speed up their growth. Households also benefit from being in close proximity to businesses and each other. The existence of these external economies of scale with limited spatial

reach are an explanation for the geographical concentration of businesses and households and, by extension, for the existence and expansion of cities. After all, it is difficult to imagine people and companies huddling together, in the most expensive locations, if no advantages were to be gained from this.

There is consensus in the scientific literature that agglomeration benefits are a reality and that they are important for the economic development of cities and regions. Three important advantages for companies are typically attributed to locations in cities and agglomerations (Rosenthal and Strange, 2004). Firstly, cities have a larger and more specialised labour market (labour market pooling), which makes it easier to find suitable employees. Conversely, for workers it is also easier to find a suitable job (corresponding to their skills) in a city. The strength of the city lies in the more appropriate match between companies and the labour force.

A second advantage is the larger and more specialised market of suppliers (input sharing) that cities offer, as compared to non-urban areas. Businesses find their transaction expenses (cost of search and transport) to become lower when they are located closer to a complex of potential suppliers. This also means there is a greater chance of finding specialised suppliers, which are less likely to be present in more rural areas due to the absence of a market.

Finally, knowledge spillovers are a fundamental feature of the concept of agglomeration benefits; businesses benefit from the transfer of knowledge and from interactions with each other. These interactions may be formal, in the form of business relationships, but also informal, occurring by chance and unintentionally. Face-to-face contact often lies at the heart of these relationships. People need face-to-face contact to exchange personal and complex knowledge, to build trust, and to be able to make careful assessments of the potential of business relationships that are continually changing. Laying out product and service details, cooperating, closing business deals, and perhaps most importantly, learning from each other and being able to see how you stack up against your peers–in an effort to improve–all rely heavily on the possibilities offered by having personal contacts. Cities provide environments for these interactions and make it possible to have frequent face-to-face contact (Glaeser and Maré, 2001; Storper and Venables, 2004).

However, this does not alter the fact that businesses can, and often do, operate on a global scale. *New Economic Geography* (e.g. Krugman, 1991; Lafourace and Thisse, 2011) states that, among other things, marked clustering developments occur precisely as a result of falling transport and communication costs. The lower costs make it possible to serve a larger market from a single location, thereby exploiting economies of scale even more. Because of the different kinds of agglomeration benefits, the forming of clusters in turn offers opportunities to perform better in the competitive international playing field (Porter, 2000). In large cities, a home-market effect is also certain to occur. Simply because of their size, urban regions have more potential customers (who can be served at lower transport costs) than areas with less urban development. As a result, businesses in regional agglomerations are able to produce more varieties of a given product at a lower cost.

Households also benefit from being in the proximity of many businesses because the offer of potential jobs is greater (this is the argument of labour market pooling again), but also because the numbers of products and services on offer in the fields of hotels, restaurants, shops and cultural amenities are larger and more diverse in cities than elsewhere. This means that households in towns and cities have a consumption advantage. In addition, a concentration of households provides a basis for large or specific public facilities such as infrastructure, specialised education centres, and theatres and opera houses (Glaeser et al., 2001). Urban areas can also offer a certain aesthetic value (such as the Amsterdam canal ring) that is related to the historical concentration of households and businesses. These facilities provide a high-quality physical environment and make the city attractive as a place for people to settle. A concentration of households also presents more opportunities for social interaction. This can be seen, for example, in the advantages that cities are found to have in terms of finding a partner or a spouse (Gautier et al., 2010).

Thanks to this diversity of agglomeration benefits, in comparison to more rural regions, urban areas offer households more career opportunities and a wider range of features that make them attractive places to live in. A related point is that businesses, in turn, benefit indirectly from being in a location that is highly attractive to households, given that this increases the supply of potential employees.

2.2.1 Sharing, matching and learning

The mechanisms behind the agglomeration benefits mentioned above are often described as *sharing*, *matching* and *learning* (Duranton and Puga, 2004; Quigley, 1998). Sharing is understood as a mechanism that acts on certain facilities and services, but also on, for example, certain specialised businesses, allowing them to exist only or at a lower cost if there is a high concentration of households or businesses in the area. In practice, this is reflected in certain amenities that are present in cities and not in more rural areas, in the concentration of universities, research institutes, trade organisations and government institutions in densely populated urban areas, and by the proximity of larger numbers of more specialised suppliers.

The advantage of matching is that suppliers and demanders in urban areas can find each other more readily. It is also likely that a highly specific service or product is offered mainly in urban areas. Matching plays a role in the labour market, the market for suppliers and the market for consumers. Learning is primarily closely related to knowledge spillover but can also apply to the idea of understanding a customer's demand faster and better.

Most of the literature unambiguously accepts the fact that sharing, matching and learning are important mechanisms behind the economic success of cities. The way cities develop is closely linked to these mechanisms. It should be noted that there is also an effect on population structure known as *sorting*; the people with the highest levels of education work in the city. To date, not much research has been carried out on identifying the relative importance of the mechanisms. In other words, it is difficult to unravel the full impact of mass or population density on productivity for the individual mechanisms (Combes and Gobillon, 2014). Combes et al. (2012) do note that the impact of sorting is generally smaller than that of the three agglomeration mechanisms combined. For the case of the Netherlands, De Groot et al. (2010b) found that sorting accounts for about 50% of the productivity benefits of urban areas. The remaining 50% is the result of net agglomeration benefits. There is only a handful of studies that deal with the various channels of agglomeration benefits (Rosenthal and Strange, 2004). These studies point out that sharing, matching and learning are, more or less, all equally important (Ellison et al., 2010).

2.2.2 Innovating

Agglomeration benefits are habitually linked to productivity; in cities, employee productivity is higher. However, higher productivity is often also associated with innovation. This is because one of the main agglomeration mechanisms presented above is learning and the level of knowledge spillover in cities. Innovation can contribute to growth in productivity and employment by improving processes (process innovation), spurring further market innovation for a product (market innovation), and launching new products and services (product and service innovation).

The literature on the geographic distribution of knowledge and innovation shows that innovation is highly concentrated, even more so than economic activity in general. An important explanation for this is that innovation has stronger ties to its location than other economic forces attributed to an agglomeration. For example, it is recognised that labour markets operate at a higher geographic scale than knowledge spillovers driving innovations. Illustrating this point is the finding in Carlino et al. (2007) that, in metropolitan areas where the job density is twice as high as that in other urban areas, the intensity of innovation–expressed in the number of registered patents– is about 20% higher.

Though theories about knowledge spillovers have actually been formulated to shed light on the concentration of economic activities, they also appear to be appropriate for explaining the clustering of innovation. In addition, the evidence in the literature that knowledge spillovers strongly contribute to learning is far more convincing than the effects of, for example, sharing and matching (Carlino and Kerr, 2014).

Within the innovation sciences, there is a long history of research into the question of why innovation activities have a strong tendency to form clusters and why there is a close relationship between knowledge spillovers (mentioned above) and endogenous growth. This literature exists relatively separately from the mainstream literature on economy, a reality summarised by Carlino and Kerr (2014: 2) as: 'Innovation comes in many shapes and sizes, except in economic studies'.

The innovation sciences make an important distinction between inventing new products, services and processes, and actually launching products and services on the market. For example, numerous inventions have been patented, but most patents never go on to reach the point of becoming marketable. And, on the other hand, many innovations in products and services do not arise from a patent or R&D developments.

In this regard, Carlino and Kerr (2014) argue that the invention and actual commercialisation of new products can take place in separate locations. An idea can be dreamt up in one city and the market launch can take place elsewhere. Put differently, investing in innovation can bring about growth beyond one's own location, and does therefore not have to be related to the creation of local jobs for innovative scientists.

In the following sections, we discuss in more detail the factors that can lead to economic growth, whether or not in combination with the mechanisms of sharing, matching, learning and innovating.

2.3 Clusters and economic structure

The literature distinguishes three types of agglomeration economies, according to the characteristics of the economic structure of cities: 1) external benefits for all businesses in the city, regardless of the sector to which they belong; 2) external benefits for businesses within a single sector; and 3) external effects that result from the

diversity of sectors in the local area. They are also respectively referred to as *urbanisation benefits* (density and mass of population and businesses), *localisation benefits* (Marshall externalities, specialisation) and *Jacobs externalities* (diversity).

Urbanisation benefits (sharing, matching and learning) arise from the size and density of the urban area, whereas localisation benefits arise from regional concentrations of businesses operating in the same sector (specialised clusters), and Jacobs externalities from the diversity of sectors in a region (Rosenthal and Strange, 2004). The literature (De Groot et al., 2010b; Van Oort, 2004) also adds Porter externalities to the Marshall (and Arrow and Romer) externalities and to the Jacobs externalities (diversity). These involve, above all, the effect of competition. Competition compels businesses to bring out the best in themselves. It is a selection mechanism that ensures the most productive and innovative businesses survive.

The debate in the literature concerns the question of whether a specialised economic structure is better for economic performance than a non-specialised one, or whether it is a matter of having a diversified structure. For example, are potential knowledge spillovers and labour market mobility greater between businesses of the same type or rather between different types of businesses? In short, is it a question of specific clusters (the advantages of localisation) or of a diversity of activities (Jacobs externalities)?

A recent addition to this debate is the idea that diversity in and of itself may not be the point of interest, but rather the *related diversity*—the presence of sectors that are related to each other by means of a shared knowledge or technology basis. This idea holds that spillovers and input sharing mainly occur between sectors with a fully or partially overlapping basis, and not between unrelated sectors. When differences are too big, it is impossible to learn from each other, because the offered knowledge is not understood or cannot be fully appreciated. When there are not enough overlapping skills, it means there can only be very little labour mobility between businesses. While this kind of diversity may be interesting for programmes such as spreading risks related to the economic climate across sectors (the portfolio strategy), the economic yield to be expected from applying the idea of cross-fertilisation is smaller. According to Frenken et al. (2007), Jacobs externalities are above all based on related diversity, something that precisely in larger cities is strongly present. The mentioned urbanisation benefits are therefore especially the advantages that are linked to related diversity.

The debate on the type of agglomeration effects has drawn a great deal of attention in the literature since the publication of the studies by Glaeser et al. (1992) and Henderson et al. (1995), which found evidence of Jacobs externalities (diversity) and in particular localisation benefits (specialisation). These two groundbreaking studies were followed by numerous others attempting to demonstrate the existence of benefits from either specialisation or diversity. Once again, the literature is not in agreement about which could be considered the most important type of agglomeration benefits. In cities, both types of clusters advantages have their impact on the functioning of companies. Here, too, it is difficult to fully distinguish between the effects.

In general, however, urbanisation benefits are more prominent in cities with large numbers of knowledge-intensive businesses and services, while localisation benefits occur more often in geographical clusters housing specialist economic activity (Duranton and Puga, 2000). The meta-analysis by De Groot et al. (2010b) shows that a relatively large number of studies offers evidence of a positive effect of diversity on economic growth, but that there is no overall hard evidence of the effects of specialisation. There are also indications that the positive effect of diversity is most profound in high-tech sectors. Cities differ in economic performance because they have different sizes and specialisations, the mechanisms behind agglomeration benefits work differently, and other location factors also affect businesses. The differences in economic performance are becoming more and more strongly linked to the tasks that businesses carry out in production processes (Desmet and Rossi-Hansberg, 2009; Kok and Ter Weel, 2014). It is increasingly possible to dissect a production process into individual tasks and carry them out at the most efficient location (Ter Weel et al., 2010). For many tasks, the city is an efficient place, but not every city is equally attractive. While the general perception is that cities are remarkably efficient when it comes to exchanging goods, people and ideas (Glaeser, 2011), certain locations are more attractive than others (Porter, 2000).

In the literature, certain types of agglomeration effects are also linked to certain types of innovation. For example, Frenken et al. (2007) observe that related diversity is more likely to lead to radical innovations (new products) and employment growth. The combination of knowledge and technology between related sectors leads to new combinations (Schumpeter's *Neue kombinationen*), while localisation benefits are more likely to lead to incremental innovations and therefore to improved productivity. Saviotti and Pyka (2004) emphasise this difference in types of innovations. It should also be noted that unrelated diversity is more likely to generate a portfolio effect, thereby lowering the risk of high regional unemployment.

Frenken et al. (2007) give empirical proof that an economic structure characterised by related diversity does indeed lead to employment growth. It is precisely this related

diversity that is abundant in cities. Given that Frenken et al. (2007) find that the effect of related diversity is more powerful than that of density as such, it can be concluded that the key mechanisms are indeed those that operate in cities–the exchange of inputs, knowledge and information between sectors that have a high absorptive capacity and among which there is a wide overlap in people's skills. In other words, the processes taking place between related sectors are what allow cities to grow successfully in terms of employment rather than density alone. This is in line with evolutionary economics, which indicates that it is precisely the diversified cities, not the highly specialised ones, where innovations lead to new business activity. Apart from this, Frenken et al. (2007) do not find high levels of specialisation to have any effect on productivity growth–investments in research and development are the crucial factor there.

To conclude, it is relevant to mention the *cluster life cycle* defined by Menzel and Fornahl (2009), which distinguishes phases of emergence, growth, maturity and decline. In the emergence phase, there is a high level of activity in the fields of product innovation and the opening up of new markets, which goes hand in hand with job creation in particular. But in the maturity phase, efficiency and process innovation are more important, and these are mainly accompanied by enhanced productivity and loss of jobs. During the maturity phase, it is important for a cluster to take timely action and adapt to new markets or aim for renewal or transformation by diversifying towards new, related activities, turning an imminent phase of decline into a new phase of growth.

2.4 Human capital

The quality of the workforce is one of the factors that drive regional economies. The level of education and the skills of the labour force alone lead to higher levels of productivity, and the grouping of people with higher levels of education exerts an additional positive effect (an agglomeration effect, as described above). Cities attract talent. The process itself is reinforced by the fact that, in the cities, an economy arises that is driven by those talented individuals.

Storper and Scott (2009) note that many publications on the importance of human capital for urban economic growth focus on the attraction value of cities or regions for groups such as the highly educated, and innovative or creative individuals. In this context, the emphasis is on the importance of the so-called *amenities*, which are further discussed below. Examples of this can be found in the creative class theory by Florida, the work of Glaeser and many of his colleagues, and in the observation made by Clark about the city as an 'entertainment machine'. However, they indicate that an important explanation for urban-economic growth is not only provided by amenities, but also very particularly by the geographical dynamics of production and jobs, which takes effect through human capital.

In that light, Moretti's work (2012) is of particular interest. In his *New Geography of Jobs*, he describes the impact of human capital on regional economies. The first argument is the cluster effect; jobs that suit the growing knowledge economy have a strong tendency to form clusters. This clustering in turn attracts new innovative jobs, especially because businesses benefit from the proximity of many other innovative companies. They become more innovative and more productive because of the knowledge spillovers among them, the labour market benefits and the use they make of each other's inputs. In short, they are sensitive to the agglomeration benefits described above.

The clustering of knowledge-intensive and innovative jobs does not only drive the economic growth of cities but also leads to rapid development of local services. Moretti calculates that innovative jobs have a multiplier effect because the well-paid workers who hold them trigger the creation of other jobs in the surrounding area, especially in the field of local services. One innovative job leads to five extra jobs (Moretti, 2012: 60). They are positions in skilled professions (lawyers, teachers, nurses) and in low-skilled professions (waiters, hairdressers, carpenters). According to Moretti (2012: 60), for every new software designer hired by Twitter in San Francisco, there are five new job openings for bartenders, personal trainers, doctors and taxi drivers in the community. That makes the impact of innovative jobs three times greater than that of the traditional production sectors (Moretti, 2012: 13). This flywheel also works the other way around. Regions where innovative jobs are lost, feel an indirect, negative effect on other jobs there, such as those in the field of consumer services.

Moretti focuses exclusively on the trickle-down effect of the innovative sectors. In a recent study focusing on the Netherlands, Ponds et al. (2015) examine what the effect is of the presence of higher educated people–regardless of the sector in which they are active–on the number of jobs for groups with lower levels of education. Here too, there appears to be a flywheel effect, though somewhat less pronounced than the one referred to by Moretti; an increase of 1% in the number of higher educated people in the city population leads, on average, to 0.31% more jobs for low-educated groups in the same city (Ponds et al., 2015: 12). These publications suggest that people with jobs in the innovative sectors and people with a higher level of education cause employment options to arise for their lower educated fellow citizens because of their consumption potential and consumption behaviour.

The effect of human capital on regional, mainly urban, economies can be summarised by a quote from Moretti: 'The rising tide lifts all boats, at least all boats that are in the same city' (2012: 63).3

In cities and urban regions in the Netherlands these trickle-down principles also take place and a relationship has been observed between high- and low-paid jobs (PBL, 2016).[4] However, the relationship is not unambiguous and there are marked differences between cities.

2.5 Entrepreneurship

Entrepreneurial dynamism is another factor that stimulates growth of regional, and particularly urban, economies. Traditionally, the literature on entrepreneurship dealt with questions relevant to policy-making, such as: Who is to become an entrepreneur? How many jobs are created by entrepreneurship? Are small businesses more innovative than large ones? Which entrepreneurs have the greatest chance of surviving and growing? Should governments promote entrepreneurship? In recent decades, many answers have been provided to these questions. For example, there seems to be consensus on the fact that it is small businesses that are creating the largest number of new jobs, and that it is also precisely those businesses that, in recent years, have gone on to account for a larger share of the total number of jobs in most Western countries (Acs and Audretsch, 1993; OECD, 1998). Another answer has to do with the so-called *entrepreneurial spirit*, in the form of individual entrepreneurs, small businesses or the dynamics within larger businesses. Within the walls of existing businesses, this is also referred to as *intrapreneurship* or *entrepreneurial employees*. Existing businesses, including the larger ones, are paying more and more attention to the idea of giving space to the development of ideas hit upon by employees and to open innovation in general (Stam, 2013).

More recently, the literature on entrepreneurship has also been focusing on regions and cities, looking into the geographic dimension of entrepreneurship (Sternberg, 2009). An important observation is that entrepreneurial dynamism varies widely across regions (Bosma and Sternberg, 2014). Cities facilitate entrepreneurship and new economic activity (Carlino and Kerr, 2014; Glaeser and Maré, 2001). As a result, entrepreneurship has become one of the main drivers of urban growth (Glaeser et al., 2010). Sternberg (2009) specifies the factors that are important for entrepreneurship in the regional context, such as informal networks, former colleagues, collaborations, financiers and market opportunities. In short, entrepreneurship is mostly a regional affair.

The literature on entrepreneurship establishes a strong connection with the endogenous growth theory mentioned above, knowledge spillovers and cities. Entrepreneurship is the link between knowledge and growth. Acs et al. (2004) and Audretsch and Lehmann (2005a) argue that the endogenous growth theory pays little attention to how and why knowledge spillovers occur. The link is the mechanism through which knowledge is transformed into economically relevant know-how, that is, through entrepreneurship or new businesses. Several studies have indeed revealed that regions with a high level of entrepreneurial dynamism grow faster, and that many agglomeration effects arising from entrepreneurship are expressed in the form of growth (Acs and Armington, 2003). This is also called the *knowledge spillover theory of entrepreneurship* (Audretsch et al., 2006; Audretsch and Keilbach, 2007). The mechanism behind agglomeration benefits is precisely what causes the knowledge spillover driving economic growth to occur at the regional level (Audretsch and Lehmann, 2005b). A great deal of entrepreneurial dynamism arises around concentrations of knowledge and urban regions grow faster there. Therefore, there is also a connection with the theory of the economic structure of regions discussed earlier; a suitable structure can be exploited only when several economic activities are linked. Entrepreneurship and creativity are important key variables in achieving this.

2.6 Knowledge infrastructure

The importance of the regional knowledge infrastructure for the economic functioning of regions is already reflected in the factors dealt with above. The knowledge infrastructure is made up of universities and other education and knowledge institutions and plays a number of roles (Peer and Penker, 2016). These institutions have relationships with the labour market (they generate a pool of talent), with innovation (mainly through public research and development), and with entrepreneurship (as described in the knowledge spillover theory of entrepreneurship). In this regard, Florax and Folmer (1992) and Anselin and Varga (1997) show that universities play an important role in the knowledge spillovers towards innovative companies in their area. Mueller (2005) shows that in regions where there are many relationships between the academic world and the business world, this interaction leads to enhanced productivity and economic growth.

But universities also have an important role to play in building entrepreneurial capital, i.e. a form of social capital that strengthens the potential of individuals, organisations and places to operate with entrepreneurial drive (Audretsch, 2017). Universities can contribute to this through their curricula, especially when they focus on entrepreneurial skills. Given the diversity of their bodies

of knowledge, universities are a source of new ideas, which can be further developed in the process of entrepreneurship.

Although the literature mentioned above highlights the role of universities in particular, there is a role to be played, in a wider sense, to higher education as a whole. Moreover, the argument of technology transfer is also applicable to joint efforts of governments, knowledge institutes and businesses in the form of specific research institutes, such as the Netherlands Organisation for Applied Scientific Research (TNO), or institutes working at the forefront of technology.

It can be concluded that higher education institutions and public knowledge institutions are of great importance to regional economies. Cooke and Leydesdorff (2006) describe the involvement of these institutions in regional innovation systems and here too, there are not only direct links to innovation (research leading to innovation) but also indirect ones (as part of the system).

2.7 Physical infrastructure

The description of the concept of agglomeration benefits, points to face-to-face contact as an important foundation for the mechanisms that are related to sharing, matching and learning. Physical accessibility, both within and between regions and cities, facilitates these contacts. This may apply to neighbouring regions and regions that are well-connected to each other, for example through air links. Bathelt et al. (2004) summarise this as 'local buzz and global pipelines'. The literature provides a detailed description of the relationship between physical infrastructure and regional economic development. The main emphasis is on the importance of infrastructure with regard to transport costs.

Transport costs

Many lines of argument are not based on processes of interaction, but on the cost of transport. Bruinsma et al. (1995) show how transport infrastructure can have a structuring effect, in spatial and economic terms, where an improvement in the transport infrastructure leads to a reduction in costs. The construction of transport infrastructure affects transport costs that are incurred because shorter distances and higher speeds reduce the costs of fuel, capital and labour. The reduced intensity in the traffic system then leads to shifts in choices as to means of transport, route and time of departure, and to changes in the number of journeys per zone. The combination of lower transport costs and changes in the mobility habits of businesses, in turn lead to an increase in productivity in the regions in question.

Several studies have uncovered the economic effects of transport infrastructure. Duranton and Turners (2012) find that a 10% increase in the 'stock' of motorways in a region leads to an increase in employment of 1% to 5% over a 20-year period. Heuermann and Schmieder (2014) looked at the construction of high-speed rail lines in Germany and the effect it had on the size and performance of the labour markets in cities that suddenly found themselves to lie within acceptable travelling time from each other. The study shows that fast connections bring about productivity gains. Not only did far more people start to commute from one city to another, but these people also became about 3% more productive, compared to a reference group that did not commute.

Agglomeration benefits

In the case of the Netherlands, improved accessibility seems not only to generate direct travel time benefits but also–through agglomeration effects–to bring economic benefits for the country as a whole (Thissen et al., 2006). Many benefits for prosperity are brought about precisely by improvements in large urban areas, most particularly in Amsterdam and along the A2 motorway.

In a recent study, CPB Netherlands Bureau for Economic Policy Analysis reached a similar conclusion, namely that substantial gains are achieved by both making better use of existing agglomeration benefits and generating new agglomeration benefits. In CPB's analysis, the former is thought to be more important than the latter. To illustrate the point, a study was made on linking railway tracks across the IJ, the body of water that separates the northern part of Amsterdam from the rest of the city. The sample calculations lead to the conclusion that the agglomeration benefits account for approximately 30% of the total benefits. Another conclusion is that investments in infrastructure can lead to improved use of regions' strong facets. Thanks to shorter travel times it is easier to live and work in different places, even when they are relatively far from each other.

However, the economic effects of infrastructure also come with a side note. In practice, the effects of improvements in the transport infrastructure are often found to be limited, particularly in a country such as the Netherlands. Hoogendoorn et al. (2016) argue that in the initial stages there are diminishing returns. From an international perspective, the Netherlands has a very dense rail and road network and this means that improvements in transport infrastructure only bring about rather limited changes in accessibility. Consequently, the spatial-economic effects of additional infrastructure investments are also limited and, in many cases, they will not even be appreciable any more. A second consideration is that investments in transport infrastructure often lead to a redistribution of business activity between regions and, more markedly,

within regions. Within a region, for example, business activity in areas close to new infrastructure tends to increase slightly, but this is often offset by a drop in activity further afield. On several occasions a similar pattern has been observed in the redistribution of business activity between regions. If the improvement in accessibility is substantial, for example due to a reduction in traffic jams, investments in the transport infrastructure can lead to gains in prosperity. Nevertheless, Hoogendoorn et al. (2016) conclude that it is not easy to justify investments in infrastructure that aim to promote spatial-economic development in the Netherlands.

International connectivity

In addition to the 'local buzz', physical infrastructure is also important for trade and knowledge relationships with other places. Having properly functioning 'global pipelines' enables businesses to benefit from knowledge gained elsewhere. Frequently, they are even regarded a necessary condition to revitalise knowledge that is circulating at the local level. The localisation of economic processes, by cause of the limited geographical reach of increasingly complex knowledge, is occurring simultaneously with the expansion of economic interaction on a global scale. Also referred to in the literature as the *global-local paradox*, it is caused by decreasing transport and communication costs, an increase in the number of multinational corporations, intensifying trade and deepening interactions between scientists around the world (Sassen, 2002).

Maskell et al. (2006: 997) note that not only permanent clusters of businesses benefit from global pipelines, but temporary ones too, for example at events such as congresses, symposia and fairs: 'the short-lived hotspots of intense knowledge exchange, network building and idea generation'.

International connectivity in the form of proximity to an international airport plays an important role in these processes because it promotes the possibility of physical interaction. Conventz and Thierstein (2015: 132) put this as follows: 'The rise of the networked economy, the space of flows, and the growing spikiness of the global urban hierarchies are fuelled by advances in transport and telecommunication technologies as well as a growing mobility of global business elites and highly talented people. In the light of these trends, airports have gained centre stage. Through their capability of concentrating different [types of] flows, from local to global scale[s], airports have advanced to key nodes within the networked economy.' According to these authors, airports are therefore a key precondition for prosperity and economic growth in a network economy that continues to globalise.

2.8 Financing and capital

Along with technology and human capital, financial capital is another important precondition for economic growth in regions, while also serving as an accelerator of growth. Financial capital involves investments made by businesses and governments within the region and beyond and across national borders (foreign direct investment (FDI)). Sometimes it is a case of financing projects undertaken by businesses or government authorities for which businesses can borrow from banks to develop their investment plans. In this regard, there are not many differences among regions within the same country. But the financing of risky and uncertain processes in innovation and business development is another thing and requires the availability of venture capital. And in this aspect, regions do differ. Economically dynamic and powerful urban regions are interesting markets for venture capitalists (Mason and Harrison, 2002; Martin et al., 2005). Venture investors are literally in the midst of these dynamics. This is expressed in what is called *the 25-minute rule*—they operate in the vicinity of the companies in which they invest, at a maximum distance of roughly 25 minutes, (Moretti, 2012). This reduces the costs of maintaining contact, or transaction costs. Building trust with regard to resources, knowledge, behaviour, goals and circumstances is a decisive issue here (Fritsch and Schilder, 2008).

It is worth noting that the presence of venture capital and dynamic entrepreneurship are interrelated characteristics of dynamic urban regions (Moretti, 2012). The literature also mentions the importance of Business Angels. Mason and Harrison (2008: 309) define an angel investor as a 'high net worth individual, acting alone or in a formal or informal syndicate, who invests his or her own money directly in an unquoted business in which there is no family connection and who, after making the investment, generally takes an active involvement in the business, for example, as an advisor or member of the board of directors'. Unlike venture capital, funding provided by business angels is directly linked to the investors themselves, i.e. it is their personal equity, and it is precisely for this reason that they maintain direct contact with the businesses in which they invest (OECD, 2006). While business angels operate over larger geographical areas than venture capitalists, their activity is strongly linked to the local level, especially in regions where entrepreneurial dynamism is high (Kraemer-Eis and Schillo, 2011).

2.9 The residential environment and the physical environment

The literature also highlights the importance of the quality of facilities with regard to economic development (e.g. Glaeser et al., 2001; Florida, 2006; Marlet, 2009). Proximity being a significant factor, these facilities, which are also referred to as *amenities*, particularly include the cultural offer in a city (performing arts venues, pop venues, cinemas and attractions), the culinary offer (range of restaurants), and public parks and gardens.

Nathan and Overman (2013: 398) consider this factor to be more important for urban growth than those related to the economic structure mentioned above. They argue that policymakers should concentrate more on making cities more attractive: 'Policymakers should focus more on horizontal policies that aim to make cities work better, in ways that help firms grow. That is, we need what we might call 'agglomeration policy''.

De Groot et al. (2010a) looked into the prices of land in highly developed urban areas and in rural areas, and have shown that about 34% of the discrepancy between areas can be explained by differences in the accessibility of places of work and differences in wages (referred to as agglomeration benefits on the production side) and as much as 40% by consumer considerations. Of these, 22% can be attributed to amenities that are related to density, such as venues for the performing arts, the hotel and catering industry and the range of day-to-day and luxury retail outlets. The presence of national monuments and historic city centres, parks, nature, the sea and a ring of canals accounts for the remaining 18%. In short, this is yet another analysis that shows that the factors that make cities attractive have a relationship with a region's economic performance. Not only does the quality of the residential and physical environment make a difference, but it can also be argued that there are various kinds of facilities in cities that provide a wide range of options for social interaction.

Storper and Scott (2009) note that the role of amenities in economic growth processes is particularly important for a workforce of highly educated, creative and innovative individuals. For this group of knowledge workers, the agglomeration effects are the greatest, and they highly value cities with many amenities. However, Storper and Scott also state that, at the same time, there also needs to be a concentration of knowledge-intensive production or services; cities with many amenities but no jobs have less growth potential.

2.10 Governance[5]

The last factor highlighted in the literature that may be important for urban and regional economic growth is the quality of the public administration and the institutions. This refers to the way in which cities and urban regions are governed and development processes are driven. Governance practices are also related to institutions: the entirety of written and unwritten rules, habits and routines that form the basis for interaction (Edquist and Johnson, 1997). 'Administrative pressure' and 'inefficient governance' (such as the 'scale' of authority) are named as issues that negatively affect economic performance at the urban level (OECD, 2014c). Other aspects to be considered are corruption and sensitivity to lobbying campaigns.

However, the quality of governance also involves the way in which regional actors try to optimise the benefits and minimise the disadvantages of agglomeration. Examples of these efforts include focusing on a few cities and clusters (concentration areas) in order to maximise economies of scale, focusing on building networks aimed at realising knowledge combinations, and allowing a thousand flowers to bloom with an eye towards unexpected combinations and radical innovation (generic versus specific). These kinds of policies are also concerned with the way wealth distribution issues are to be dealt with (efficiency versus equity).

With the emergence of the knowledge economy, awareness has grown that the innovation process is no longer linear and is not brought about by companies alone. The various parties that play a role in the innovation system–knowledge institutes, businesses and government–have begun to work together more closely in the form of what is also called *triple helix* collaboration.

Though highly commended, triple helix collaboration is still an abstract concept that is interpreted in different ways. Two flavours can be distinguished in the combined collaboration actions between the parties (Etzkowitz, 2008). On the one hand, there is *laissez-faire* cooperation, which involves bilateral rather than triangular relationships. The main focus is typically on businesses, while government authorities and universities play a more supportive role, introducing facilitating regulations and providing knowledge and talent. This form of cooperation often does not go beyond identifying common interests and using them as a basis for action. The other flavour of cooperation is a balanced configuration, which sees the three parties as equal partners. New relationships and conditions are created and, while all parties retain their own identity, they step outside their traditional roles and also take over roles from each other. In this way, parties complement each other where necessary, but hybrid forms providing added value can also arise.

This process of complementing each other occurs, for example, when local businesses are unable to renew themselves and are in danger of falling behind. It can also happen when a government invests public money, through investment funds, in start-ups and existing companies, a task traditionally assigned to the business world. In the Netherlands, several regional development agencies operate in this field. Along with this, universities can actively work on the transfer of the knowledge they have developed.

Where roles overlap, valuable interaction takes place. The intersection of the various parties is the place where synergies can arise and it can also become a major potential source of innovation and economic growth. In the words of Etzkowitz, co-coiner of the triple helix concept, here 'innovation in innovation' is possible. To ensure this added value is realised, *laissez-faire* cooperation is not enough–balanced cooperation is what is required.

Another term of topical interest in the literature is multi-level governance (Hooghe and Marks, 2003; Kern and Bulkeley, 2009). This refers to administrative coordination processes that take place between actors (e.g. between cities, and between government and market parties), between sectors (cross-sectoral; transcending domains) and between levels (multi-layer, e.g. between municipalities and the central government).

2.11 The engine of regional-economic growth in brief

The previous sections present our discussion of eight factors that are highlighted in the literature as important for regional economic growth: 1) clusters, 2) human capital, 3) entrepreneurship, 4) knowledge infrastructure, 5) physical infrastructure, 6) financing, 7) the residential and the physical environment (amenities), and 8) governance. Looking upon these factors as cogwheels, Figure 2.1 is a representation of the engine of regional economic growth. In the discussion of the cogwheels, various interconnections have emerged. The engine of the economy functions optimally when all wheels rotate and accelerate each other. Ultimately, it is the agglomeration benefits and innovation that lead to growth in productivity and employment in urban regions.

However, there is no uniform path towards economic success: different types of economies are driven by different combinations of cogwheels (Weissbourd and Berry, 2004; Audretch and Fritsch, 2002). The core issue, however, is the extent to which economies are capable of innovating. This ensures that businesses can grow, employees have good (interesting) jobs and consumers get higher quality goods and services. Agglomeration benefits, and the mechanisms of matching, sharing, learning, are important catalysts for innovation and growth. Put briefly, the urban growth engine consists of a large number of parts that, as an interconnected whole, reinforce each other, aided by innovation processes and growth processes (Figure 2.1).

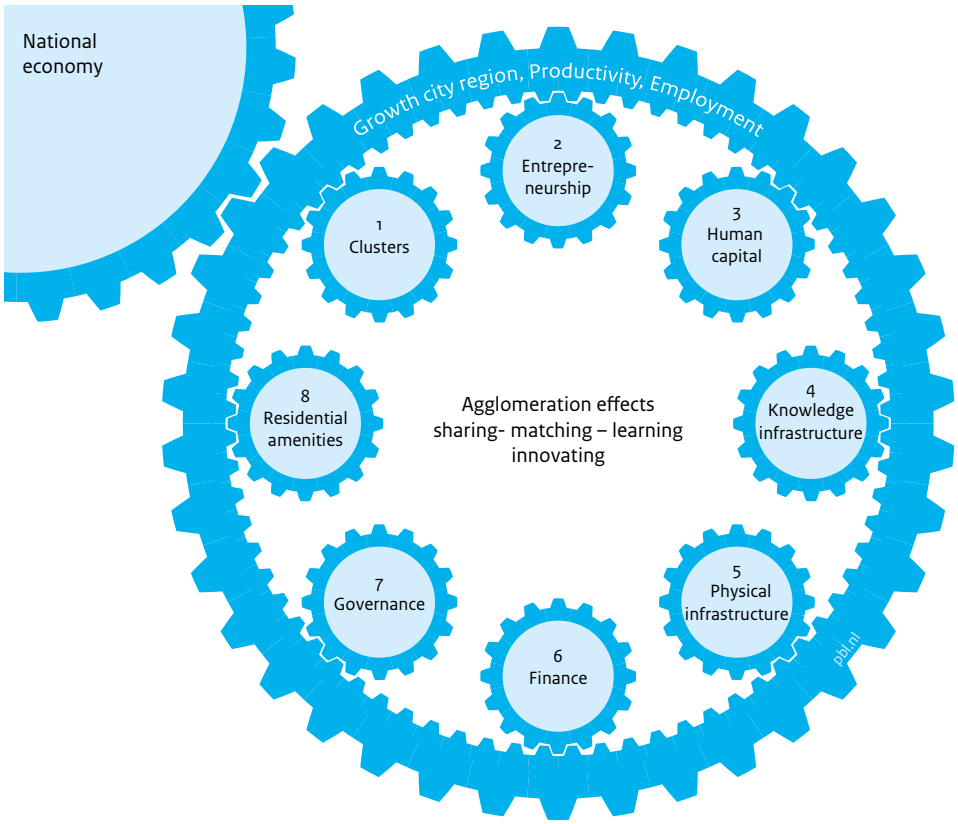
Agglomeration does not only have benefits, but also comes with disadvantages that function as a 'counterforce'. The benefits of spatial concentration logically lead to higher demand for land, offices and homes in places where several businesses and households are already settled. Since an increase in the supply of these location-bound 'products' is only possible or allowed to a limited extent, the higher demand will be reflected in higher prices. The outcome is that businesses and households are faced with higher costs. Spatial concentration of businesses and households may also lead to traffic jams and, in consequence, to longer travel times and higher expenses. Finally, spatial concentration can lead to issues concerning quality of life, the so-called *disamenities*, such as an increase in nuisances and insecurity, and rising environmental pollution in the form of higher concentrations of particulate matter.

A final remark about Figure 2.1 is that regions are not isolated systems and that many generic national factors also have an influence on regional-urban growth. This mainly has to do with national institutions and policies in the fields of education and technology but can also apply to issues such as taxes and migration. An interaction exists between generic and regional factors. Policies and institutions, for example, interconnect at the regional and the national levels, reinforcing or weakening each other. It is also possible to fully or partly transfer generic factors, such as taxation (expanding tax territories) and social security (decentralisation) to the regional level. Conversely, regional factors may serve as a model for practices to be employed at the national level. Another point is that some factors play a role at several levels. To give an example, national-level factors (legislation, policy) determine the functioning of labour markets, which, however, are mostly regional in nature. This is due to the upper limit for commuting tolerance in different groups of employees, and to the possibilities of job changes given the sector structure (Van Oort et al., 2015).

2.12 A perspective on growth

The key elements behind regional and urban economic growth have been discussed in the previous sections; the eight cogwheels in the engine for economic growth, all derived from a broad perspective on economic literature. The core of the engine is made up of agglomeration benefits, the advantages that businesses and people experience by operating in close proximity to each other.

Figure 2.1
The engine of regional economic growth



Source: PBL

However, the fact that these benefits exist does not mean that every city has the same conditions for growth. This section therefore presents a more dynamic outlook on economic growth in cities and regions, and in sectors.

A telling example of the fact that some places flourish while others fall behind is given in Enrico Moretti's *New Geography of Jobs*. His book opens with the story of David Breedlove, a highly educated worker who in 1969 faced the choice of staying in Menlo Park or moving to Visalia, a three-hour drive away. Both located in California, these places were closely comparable 40 years ago, being attractive to a broad middle class of properly trained professionals. Today, the contrasts can hardly be more striking. Menlo Park is strategically located in what is now Silicon Valley. Visalia has the second lowest percentage of highly educated people, is among the cities with the lowest wage levels, has high crime rates, suffers from high pollution levels and has poor-quality schools. Breedlove chose Visalia, precisely because of the quality of life at that time and because he wanted his children to grow up in that environment. But he saw his environment become marginalised, while further away Silicon Valley prospered into one of the most powerful and innovative regions in the world.

The second example that Moretti mentions is the flourishing of Seattle. Microsoft was founded in Albuquerque and moved to Seattle in 1979. This was not because it was an ideal place for a high-tech company at the time. In that period there was an infamous billboard on the outskirts of the city: 'Will the last person leaving SEATTLE - Turn out the lights'. In *The Economist* Seattle was described as a 'City of despair'. Forty years ago, Albuquerque and Seattle were broadly comparable. In 1970, the proportion of people with a high level of education (corrected for population size) in Seattle was 5% higher than in Albuquerque and salaries were slightly higher– probably because of the presence of the Boeing Company. The differences were not big. Today, the situation is very different: Seattle has 45% more highly qualified workers than Albuquerque and the income gap has widened considerably. In this example too, the contrasts between the two places are enormous. Due to the presence of Microsoft, Seattle has evolved into a huge technology hub.

Moretti uses the two examples to illustrate the idea that some places perform very successfully in the present-day knowledge and innovation economy, while others dwindle. In addition, he has supported the idea with quantitative analyses. In these cases, as pointed out above in the section on human capital, success has to do with the clustering of high-tech jobs and innovative jobs, which have a strong impact on the rest of the economy in the region. In cities that do not take the trick in the card game, a negative spiral develops: jobs disappear, which has a negative effect on the rest of the economy in the region. In the two examples, there is a self-reinforcing effect of agglomeration benefits and cluster benefits, which has consequences for the entire metropolitan region. Moretti calculates that one innovation job leads to five other jobs in the same region. Higher wages (which, in the case of the United States, means higher regional tax revenues), also lead to a higher quality of public services.

Over the last 30 to 40 years, the mechanisms of agglomeration have led to geographic changes in the United States, divergence being the main trend. In his work, Moretti observes that much of the success of urban regions has to do with agglomeration benefits. That is, with the eight cogwheels described earlier. At the same time, important initial or basic conditions are relevant in ensuring that regions realise their potential. And sometimes it is the case that the choices of large companies, such as Microsoft, Apple and Google, make a huge difference to the development potential of regions. A related issue is that the initial choices are not always very easy to direct and are partly based on chance rather than rational economic arguments.

Evolutionary developments

The literature dedicated mainly to describing these developments is that of evolutionary economic theory. Change and adaptation are core concepts in evolutionary economics. The theory analyses how new variations in the economy arise, how the environment affects the selection of activities that are to survive and how this not only leads to a certain degree of stability, but also to lock-in and the disappearance of economic activities. From an evolutionary point of view, businesses have limited freedom of behaviour and therefore their capacity to adapt is deficient. Businesses sometimes find themselves locked up, limited to following a path that was taken at a certain point in the past. They become conservative and avoid taking risks—except if they are able to innovate. Innovations in technology and organisation forms, whether radical or not, can also go hand in hand with changes in the selection environment itself, in a process of co-evolution. The evolutionary view holds processes of change to be path-dependent (Boschma et al., 2002).

In geographic terms, the choice of location made by organisations is the reason some companies and sectors cluster intensively, making those regions grow faster than others. These issues are also commented on by Moretti (2012). The value of the insights from evolutionary economics lies in the fact that it considers the evolution of an industry sector in a region. Chance plays a role in the development of a region, particularly in the initial phase. But after that, a large company's choice of location, spin-off companies, and the functioning of agglomeration forces are less accidental. One could say that chance in the initial phase is what determines the spatial pattern of a sector. This is also known as the *windows of locational opportunity*. At the beginning of the process, the windows are open (for all regions), but once a growth process is unfolding, other essential conditions take on an important role. As described above, the spatial clustering of all kinds of economic activities brings about benefits, such as extensive infrastructures and a range of local, specialised suppliers, and knowledge spillovers. This is an endogenous and self-reinforcing mechanism (Boschma et al., 2002).

The environment can affect new sectors in two ways. In the first place, the environment can provide certain triggers that incite actors to pursue technological renewal. Secondly, the environment can form a favourable setting for production, for example by ensuring the presence of certain location advantages such as labour, capital, a consumption market and raw materials.

With regard to the cogwheels in Figure 2.1, we can therefore add that the success of business sectors in regions is partly due to chance, particularly in the initial phase of a new sector. Moretti, for example, writes that in the case of Microsoft, Gates and Allen wanted to return to their hometown Seattle. Not a rational economic decision. We may also add that a region can already have certain advantages in the early stages of its development. Accessibility of the region or facilities that are already present (amenities and the quality of the residential environment) can play a structuring role in this regard. Then a self-reinforcing effect occurs: more businesses and institutions arise around clusters. Whether a sector or cluster can continue to develop depends mainly on its ability to adapt and on the learning processes that take place at the regional level. To achieve ongoing development, creativity and innovation are crucial. Take, for example, the concept of related diversity, described above: the presence of sectors that are related to each other through a joint knowledge or technology base. The idea is that spillovers take place mainly between sectors with a fully or partly overlapping basis, but do not occur between unrelated sectors.

There is a good chance that the development of new sectors and innovation within sectors—and therefore new growth paths—are related to the existing economic structure, as well as to factors such as a manifest trigger or

simply chance. Consequently, the existing economic structure is what really determines the region's absorptive capacity for new technologies. To give an example, the step towards software development is more likely to be made when regions build on previously gained knowledge and skills in computer hardware than when they build on knowledge and skills acquired in the agricultural sector. This is because in the latter case the steps required in the development of knowledge and skills are too great. In addition, businesses in the software industry are less likely to establish themselves in regions that lack features such as the presence of suppliers and a specialised labour market.

2.13 A perspective on policy

It can be deduced form Figure 2.1 that several policy areas are involved in regional economic growth, including sectors and clusters, labour markets, education, entrepreneurship, infrastructure, innovation, agglomeration issues and spatial planning. These policy areas do not, and should not, function in isolation from each other, but there should be a so-called *policy mix* aimed at economic growth. The policy mix that performs best depends heavily on the regional context. In the literature, the policy mix–the policy interaction between the cogwheels in Figure 2.1–is described more and more in terms of systems (innovation systems and ecosystems for enterprise) and certain regional fields of specialisation (smart specialisation). In this section we describe the perspective on policy and provide a brief discussion of these systems.

2.13.1 Regional innovation systems

An innovation system is made up of organisations that contribute to innovation. The activities of these organisations and their interactions are embedded in a variety of institutions, such as laws, rules, standards and customs (Boschma et al., 2002). Innovation systems can be national but, since many processes apply to regions, it is also possible to refer to regional innovation systems. Details can be found in the literature on innovative environments (Camagni, 1991), technological districts (Storper, 1992) and learning regions (Asheim, 1996), and in numerous follow-up studies on these publications. Networks are very important in regional innovation systems: networks of businesses and networks connecting businesses, knowledge institutions and government authorities.

Often these networks (also referred to as *embedded companies*) have grown historically, conditioned by the coming together of location-specific and path-dependent circumstances. The contextual characteristics of these systems are essential for their structure and performance and are difficult to generalise (WRR, 2013). Their success should not be sought in blueprints of specific configurations with a pretension to uncover universal, context-independent validity, but in an underlying logic of how components and conditions interact with each other. Such insight into the 'depth structure' of the spatial dynamics is a basis for attempts to develop configurations that attune to specific circumstances and possibilities. In this regard, the Netherlands Scientific Council for Government Policy (WRR) observes that:

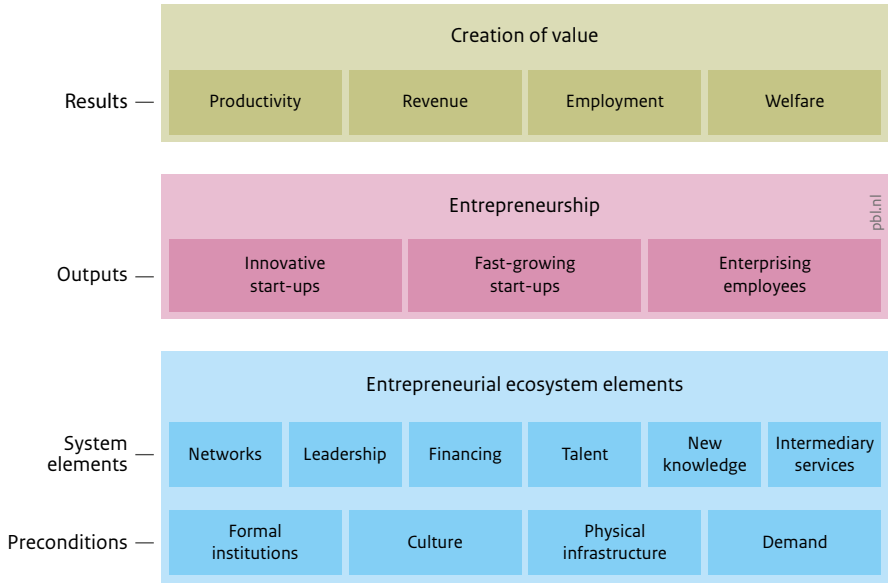
The government should preferably not provide support in the form of subsidies for products, nor designate companies that are expected to become successful. Also, it should operate as little as possible along the lines of the idea that the market needs to be corrected with isolated measures (e.g. in the form of R&D incentives, the training of more technicians or help with financing). Instead, it should preferably focus on enabling proper functioning of the innovation system as a whole, through the promotion of good networks, stimulating regulations and supporting institutions, and through the formulation of strategic directions that parties can to use to orient themselves. The change is complicated: product and market interventions require more time and are less visible. However, they do provide positive results. (WRR, 2013: 16)

2.13.2 Entrepreneurial Ecosystems

A way of thinking that is strongly related to the innovation systems rationale is that of *entrepreneurial ecosystems* (Acs et al., 2017). In analogy with the concept of ecosystems in biology, it deals with the context, the external environment in which entrepreneurial dynamism unfolds. But, in contrast to biological ecosystems, the focus is on the entrepreneur (Stam, 2015). Another difference is that entrepreneurship is not only the result of the system, but that entrepreneurs are the central players (leaders) in the creation of the ecosystem and its functioning. As a result, the role of the government becomes more modest: it is the 'feeder' of the ecosystem, and the entrepreneurs are the 'leaders' (Feld, 2012).

This concept, too, is based on the assumption that entrepreneurs are in the best position to identify opportunities and limitations, with the government acting as a facilitator. In this context, knowledge institutions play a less dominant role than in, for example, regional innovation systems. Stam (2015) lists the factors affecting a successful ecosystem, as presented in the literature. They include leadership (a visible, accessible, committed group of entrepreneurs), intermediaries (mentors, consultants, financiers, incubators), density of the network (of interactions between the community actors), active government (aimed at entrepreneurs), talent (good skills found in the workforce and in start-ups), professional services (support services), commitment (events for entrepreneurs organised by entrepreneurs), businesses (large anchor companies working together in

Figure 2.2
Entrepreneurial Ecosystem



Source: Stam (2015)

the cluster) and capital (to finance entrepreneurs at different stages of their lives).

These factors are not the ingredients of a standard recipe. In the same publication, Stam quotes Isenberg (2010), who indicates that public leaders should see these ingredients more as a set of nine principles that apply when building an entrepreneurial ecosystem. They highlight the role of local conditions and bottom-up processes.

Stam then goes on to summarise the system in terms of system elements and preconditions. The system elements are entrepreneurial networks, leadership, financing, talent, new knowledge and intermediary services. The success of an ecosystem is to a large extent determined by the presence of these elements and the interactions between them. The preconditions consist of social and physical conditions that facilitate or obstruct interaction (formal institutions, the local culture, the physical infrastructure) and a market with a demand for new products and services. Access to this market is increasingly related to the position of the ecosystem in the global market, rather than being an internal affair within the ecosystem itself.

2.13.3 Smart specialisation

An important concept in the literature is smart specialization. 'Smart specialisation emphasises economic potential and the mechanisms whereby such potential is most likely to be realised, and it provides a method by which policymakers where enabled to best identify the types of priorities most appropriate for their context' (McCann and Ortega-Argiles, 2013: 26). Further details on the concept can be found in Foray (2015).

While the original concept is abstract and non-spatial, in recent years it has been further developed at the regional level with regard to applicability and concreteness. As a result, smart specialisation overlaps to a great extent with the elements in the above-mentioned literature on regional innovation systems, but goes further in a number of aspects, especially in the role played by government authorities in this system. Smart specialisation strategies–the policy framework around the concept–are explicitly based on policy-led prioritisation in the system and on the need to experiment with policy design and policy actions (McCann and Ortega-Argiles, 2013).

The core of the concept is the innovation dynamics of entrepreneurs and businesses, and the conditions that government authorities offer for the potential for innovation. 'Entrepreneurs will search out the smart specialization opportunities within their domain. These entrepreneurial search processes play the role of identifying and exploiting the potential advantages of general-purpose technologies to generate the targeted economic domain (production or services) through the co-invention of applications' (McCann and Ortega-Argiles, 2013: 26; also see Foray et al., 2009, 2011).

The entrepreneurial search process will lead to entrepreneurial discovery and ultimately to the introduction of a new activity in a region. This process often takes place spontaneously, through the evolutionary mechanism of related diversification described above. New activity is therefore often enclosed in the broader set of activities in the region, and other related undertakings (referring to both companies and knowledge infrastructure) will also agglomerate around new operations. In this regard, smart specialisation covers the entire process from search efforts and discovery to introduction and agglomeration.

The fact that smart specialisation is relevant mainly at the urban and regional levels has everything to do with the mechanisms driving growth described in the previous sections. The most suitable domain for smart specialisation is the region (McCann and Ortega-Argiles, 2013), while the growth mechanisms are related to embeddedness, relatedness and connectivity; businesses are embedded in regional networks of economic activities that are all related to each other and linked to other nearby or readily accessible places.

The government can play a role here by supporting the process of related diversification, thereby ensuring ongoing renewal of the regional economy. This is not a top-down process, in which the government decides which specialisations there are to be in the future, but quite the opposite: it is a bottom-up process in which government authorities and companies work together following the method of discovering and learning. Unlike in the case of generic, national policies that are rolled out across all regions, here the regional context plays a crucial role: 'the smart specialization approach is very consistent with the place-based logic in that it explicitly argues for policy frameworks that are tailored to the local context on the basis of the best data available, the most detailed knowledge, and an explicit consideration of the realistic potential of the region' (McCann and Ortega-Argiles, 2013: 31).

Government authorities and businesses join hands and, using the most detailed knowledge of the 'regional DNA' available at that moment, go through the process of learning and discovering, ultimately arriving at a strategy aimed at smart specialisation, in which realistic priorities–that is, priorities with proper regional embedding–are set. These priorities often have to do with strategic domains and not necessarily sectors. In other words, activities that enable sectors to transform or that create new sectors. Foray (2015) calls them 'transformative activities'. They can include general purpose technologies, such as ICT, biotechnology and cleantech, provided they are prioritised according to the regional context. For example, the introduction of ICT in a region marked by intense specialisation in tourism will be different from that in a region that has a health care cluster. And the development or application of biotechnology in a region with a large amount of greenhouse cultivation will differ from that in a region housing a large chemical industry.

This means that policies aimed at smart specialisation are vertical policy efforts–efforts that are not focused on 'picking winners' (in sectors or technologies that are already doing well), 'backing losers' (sectors in a phase of decline) or 'cathedrals in the desert' (sectors or technologies that are foreign to the regional economic structure). Smart specialisation policies are concerned with activities that are a diversification of existing undertakings and that are, first and foremost, new and well embedded in the region.

2.14 Another, more prominent role for governments?

Economists often argue that a government that actively participates in the economy is susceptible to making wrong decisions (government failure), as the market is better at knowing what is best. Although the argument of government failure is still frequently used, in the last few years the viewpoint has changed markedly: from the idea that governments should limit themselves to setting conditions to the belief that governments could, and should, play a far more active role. This change is partly supported by systems thinking, in which the government assumes an active role to eliminate certain (non-generic, context-specific) barriers, and also partly by ideas about employing smart specialisation strategies. These ideas have also been linked to what is known as the *New Industrial Policy* (Rodrik 2004, 2008; Aghion et al., 2011).

The essence of this new policy is that in recent years the 'standard theory' of market failure has been complemented with ideas about another form of market failure: the fact that markets face obstacles to structural transformation. At the heart of the reasoning, as outlined by the Netherlands Scientific Council for Government Policy (WRR, 2013), is the notion that growth implies structural change from less productive to more productive activities, but that such structural transformations often do not occur spontaneously. Existing technologies and sectors tend to develop along the paths they took earlier on.

An example is structural transformation towards a cleaner economy. Oil producers will mainly search for ways to deliver oil in better and cheaper ways, but they will not be looking into the production of solar energy. Extraction, production, transport and distribution of oil have very high sunk costs, and it is not easy to write these off quickly. In this case, a process of change requires a certain degree of creative decommissioning–a strategic process of conversion or dismantling existing interests and

structures (Aghion, 2005). System breakthroughs often need a helping hand. Within this reasoning, governments play a role in promoting structural transformations. In a few words, the tenets of New Industrial Policy involve initiating a higher level of production and not getting stuck in your ways and only doing what you are good at now. It proposes a shift from a government that focuses on avoiding market failure to one that focuses on avoiding system failure and transformation failure.

In the field of innovation policies, the literature is also reporting a trend break, with the argument that innovation mainly takes place in businesses (the market) shifting to one that holds that governments are to be active in innovation. *The Entrepreneurial State* by Mariana Mazzucato (2013) is a prime example. The author sets out a line of reasoning and demonstrates why the market cannot do without a government. In her view, the government itself initiates change by creating a demand– clear cases being the military communication system that evolved into the Internet, and the feat of putting a person on the moon. A point of criticism here is that programmes and generation of demand at such large scales are more appropriate for large countries such as the United States, China and Russia than for small countries such as the Netherlands. Moreover, many societal challenges (that involve the government acting as a challenger) are not, to quote Frenken and Hekkert (2017), 'lunar problems'.[6] In other words, they are not problems that can be settled with heavy investments in technology, but rather 'ghetto problems': social problems for which there is no consensus about their exact nature, about who the problem owner is, and least of all about what the solutions might be. This kind of complex problems cannot be solved with a large-scale technology push.

Finally, we have noticed that there is a serious appeal for more decentralised government: 'The most important issue is shifting control over economic development to a lower level. At the regional level, it is often easier to reach all those involved, to signal the right direction and to keep in touch with new developments. Moreover, there are great differences between the regions in the Netherlands and it is rational to do justice to that diversity. National policies must support the process' (WRR, 2013: 15).

2.15 Summary

The literature shows that government authorities play a significant role in regional systems that operate around companies, entrepreneurs, regional authorities and knowledge institutions. The common denominator of these regional systems is that the tasks are context-specific and the result of path-dependent processes. This calls for bottom-up and joint development of regional policies that continually adjust to changing circumstances and to new insights into the effectiveness of the adopted approach. Therefore, the required distribution of policy efforts over the 'cogwheels of the growth engine of the economy' will vary from case to case.

The policy efforts covered in the literature differ in the extent to which they establish priorities beforehand. Sometimes this only happens to a very limited degree, or not at all, and the policy effort is horizontal: the government creates favourable conditions for all businesses and activities, without setting priorities. In other cases, however, the line of approach is vertical: the government prioritises and streamlines all manner of core elements of the system around a certain specialisation. Since the functioning of innovation systems can vary per sector, and per set of actors, the elimination of barriers quickly assumes a vertical character. Here *vertical* is used in the sense of the sector or the set of actors and networks that the policies focus on.

In a smart specialisation strategy, the specialisation is preferably not defined too narrowly, and consists of related activities. In addition, the systems are aimed at ongoing diversification and not at preserving existing strengths. Rather than 'picking winners', the main concern is much more about 'backing challengers', those who defy the established order. Here, policies can provide room for experimentation and assist innovators, for example through entrepreneurship plans (entrepreneurial ecosystems) and investments in the knowledge infrastructure. Often, these new activities will evolve spontaneously from existing specialisations as a result of an evolutionary diversification process. It is hard to determine beforehand what exactly those new activities will be. When new activities are due for scaling up, policies can shift towards cluster programmes with measures that may include promoting a complex of businesses and specific research institutes. It is the point at which policies should focus on increased specialisation in those new activities with an eye on achieving higher productivity levels. Consequently, a shift may occur from older sectors to these newer ones. The main point is that the cluster continues to innovate and diversify, thereby making sustainable economic growth possible. Unidirectional specialisation without diversification can ultimately lead to economic decline. None of this has anything to do with a master plan, devised beforehand, in which winners are chosen; it is all about processes evolving towards interaction between government, the business world and knowledge institutions.

Finally, we see a shift in the role of government towards that of a social challenger. A change that is in line with the shift from a focus on avoiding market failure to a focus on avoiding system failure and transformation failure. A role for a government that generates a demand and sets a prospect for the future.

Notes

1 In this chapter we focus on urban and regional-economic literature, a relatively young branch on the tree of economic thought. The most important contribution of the development of this spatial theory is that more mainstream economic theories 'often lack a territorial dimension, such a dimension is crucial for understanding regional competiveness and growth.' (Martin (2005) in: Thissen et al., 2013: 10). Mainstream theories according to Martin (2015) are: Classical economics, Neoclassical economics, Keynesian economics, Endogenous growth theory, New trade theory, New institutional economics, Business strategy economics.

2 Parts of this section have already been published in Ponds and Raspe (2015) and Raspe et al. (2015).

3 See PBL (2016) for an analysis of the relationship between the proportions and the growth of high-paid and low-paid jobs in urban regions in the Netherlands.

4 See also: http://themasites.pbl.nl/verdeelde-triomf-banengroei-en-economische-ongelijkheid/.

5 Parts of this section have already been published in Lekkerkerker and Raspe (2015).

6 http://www.mejudice.nl/artikelen/detail/innovatiebeleid-in-tijden-van-maatschappelijke-uitdagingen.

3 The impact of regional factors on growth

3.1 Introduction

In Chapter 2, we introduced the idea of the city as an engine of economic growth. An engine consisting of eight cogwheels that, both individually and in interaction with each other, can bring about economic expansion (Figure 2.1). In this chapter, we examine the factors that the eight cogwheels stand for. Our aim is to quantify as many of them as possible and use regression analyses to estimate the relationships between their presence, weight and regional growth. To perform the analyses, we translated the factors into empirically measurable components and worked with the resulting total of around 70 different indicators, or variables. A single factor, therefore, consists of several indicators. Descriptions of the indicators are listed in the annex to this report.

In Section 3.2, we look for robust factors: those that are significantly linked to growth in employment or productivity in the region. Our study considers all possible conditions, with variables being included and then left out again. The results of the simulations are presented in Section 3.3 in the form of heat maps. In Section 3.4, we also look at the context the factors are set in. We want to investigate whether certain variables have a significant impact that is conditioned by the presence of other factors. For example, the potential of universities (public knowledge) generating knowledge spillovers has impacts that are probably more pronounced in urban areas or around specific clusters of knowledge-intensive businesses. Based on the literature discussed in the previous chapter, we analyse a number of so-called *interaction effects* that point to context-specific impacts. In Section 3.5, we outline the profiles of the six regions that are analysed in detail in Chapter 4, using the same variables that were identified for the regression analyses.

3.2 Searching for robust factors

Since the introduction of the economic endogenous growth theory in the 1980s and the publication of the highly influential article in which Mankiw et al. (1992) emphasise precisely the importance of classical economic growth theory for empiricism, a very large body of empirical literature has been produced on the determinants of economic growth. This literature focuses mainly on growth at the national level, and to a lesser extent to growth at the regional and urban level. What the currents of classical growth and endogenous growth have in common is that they mainly look for statistically significant relationships using empirical rather than theoretical methods. In this context, researchers such as Sala-i-Martin (1997) have been quick to point out that many of the statistically significant links that have been found are not robust. This means that the relevance of the relationship depends on the other determinants in the models. And the same dependency sometimes even applies to whether the relationship is positive or negative. Only few determinants appear to be truly robust. Further details on this issue can be found in Florax et al. (2002), who confirm the finding, and in Easterly et al. (1993), who observe that 'what works for growth' can, for the greater part, be attributed to chance, rather than to properly enacted policies.

To examine the robust relationships between the characteristics of the regional business climate and growth of the economy as a whole and by sectors, we performed a simulation of regression analyses, in line with Leamer (1983, 1985), Levine and Renelt (1992) and Sala-i-Martin (1997).[1] We used numerous model specifications to estimate the impact of around 70 different variables and combinations of variables. They correspond to the eight factors mentioned above and characterise the business climate of regions. Considering nearly 800 regions in 27 countries in Europe, the examination assessed the growth paths of regions over a period of more than 20 years. In all cases, we investigated employment growth and productivity growth (measured as added value per capita), for the economy as a whole and for six sectors of the economy: agriculture, construction, manufacturing, financial and business services, non-market services, and trade (that includes wholesale, retail and ICT-related activities). Differentiation by sector provides insight into the regional characteristics that are specifically linked to the growth in a certain sector, and also into the question of whether the characteristics related to growth of the economy as a whole are also beneficial for a certain sector.

Our basic regression model follows, insofar as possible, the now classic setup of Mankiw et al. (1992), who in turn follow the theoretical basic model of Solow (1956). It explains the growth path towards a theoretical situation of equilibrium. Therefore, our explanation of growth does not focus on the very long term, but rather on the medium term, and assumes that this growth will lead to a balance that depends on regional characteristics. This approach was chosen because long-term growth is difficult to predict and depends to a large degree on technological growth (breakthroughs). We assume these technological developments to be relatively homogeneous across countries because knowledge spillovers, trade and migration lead to their geographic spreading. However, the ways in which countries and regions may accommodate long-term growth opportunities depends on their specific characteristics. For example, a properly trained and flexible workforce can adapt more easily to changing technological circumstances than a less flexible workforce. Differences in economic growth in the chosen model may therefore also be interpreted as differences in efficiency growth. It is worth noting that endogenous growth models–however important they may be–do not perform as well as neoclassical growth models in terms of explanations and predictive power. This has to do with the nature of what needs to be explained; technological growth is, after all, difficult to predict. In short, our results can most fittingly be interpreted as determinants of stable production levels, the factors influencing growth from one level to another over time (the text box below provides further comments on the interpretation of the analyses).

Our aim is to explain the annual growth rates over the 22-year period, from 1991 to 2012. The growth rates of employment and productivity (expressed as added value per inhabitant) are represented here by y, and can be calculated as follows:

$$[ln(y_{2012}) - ln(y_{1991}) /22].$$

This expression takes into account the compound annual growth rate. The regression model used for our simulations is:

$$\frac{\ln\left(\frac{y_t}{y_{t-n}}\right)}{n} = \beta_0 + \beta_1 \ln(y_{t-n}) + \beta_2 g_p + d_l + \boldsymbol{X}\gamma,$$

Where
y_i stands for employment or added value added at time,
n is the elapsed period of time,
g_p is growth in the labour force,
β_i are the parameters to be estimated, and
d_l are the dummy variables for countries.

Our approach allows each country to have a different average growth rate, for example, as a result of national institutional circumstances.[2]

$\boldsymbol{X}$, finally, stands for the variables that can vary in our model, along with the corresponding coefficients. In total, there are 63. For each regression in our simulation, we use a set of 26 variables that do not vary (including the initial situation,, and the dummy variables for countries,) along with 4 indicator variables that vary structurally. For each indicator variable, all possible combinations with the 3 others are considered. Therefore, when the simulation finalises, each of the possible combinations of the 63 varying variables and 4 indicator variables has been taken into account.

This gives the following number of possible combinations, and thus the number of regressions for each sector:

$$\frac{63!}{4!\,(63-4)!} = 595.665$$

This also means that each variable is present in 39,711 regressions. The simulation provides us with a database of the coefficients (impact) of the indicators and the related significance values, which we can then further analyse.

The list of all the 63 variables that characterise regional business climates is included in the annex to this report. The list includes a description of how they were measured and the sources that were used. The aim of the study is to determine which of these regional characteristics are robustly linked to the economic growth of regions. For the sake of completeness, the annex also includes a table of correlations, which shows the strength of the relationship between two variables. For the simulations, a relationship that is strong or even too strong is less relevant, because changing patterns are used to include variables in the models.[3]

3.3 Heat maps

The results of the simulations are presented in the form of heat maps. They indicate, by growth model, *the number of times* a variable is found to be significant under all model specifications (at a significance level of 95%). The heat maps also show what the sign of the impact generally is: does the significant variable affect growth positively or negatively? Therefore, the values in the heat maps range from -100% to +100%. A value of +100% or -100% means the variable was found to be positively or negatively significant in *all* the simulation regressions that were run. A value of 0% suggests the variable is not significant in any of the models. Each simulation involves a total of almost 600,000 individual regressions. Therefore, there are variables that are always, or almost always, significant.

Interpretation of the regression analyses

By measuring the economic growth of a region and using regression analyses, we attempt to explain growth based on the region's characteristics, as presented in the literature. An endogeneity problem is likely to arise here, because the variable to be explained (growth) may also have an effect on the explanatory variables (the characteristics of the region). This is most clearly the case for those variables related to facilities in the everyday environment, such as cultural amenities and restaurants: these elements make cities attractive and can bring about further growth (see Chapter 2), but it may also be the case that economic growth has created opportunities for certain facilities. In other words, in regions where the economy grows rapidly, there are more and better facilities. The endogeneity problem mainly has to do with causality (the cause-and-effect relationship) between the explanatory variable and the variable to be explained.

One of the ways to remedy the problem is to include an instrumental variable in the models: a variable that has an effect on regional characteristics but not on regional or urban growth, which is the variable to be explained. The inclusion of such instrumental variables means causalities are estimated more accurately (reliably). However, it is very complicated to work out a suitable instrumental variable for this kind of model. There are significant limitations to both the theoretical conception of such a variable and efforts to measure it empirically.

Therefore, when considering causality, the results of the regression analyses should be interpreted with a certain level of caution. We prefer to talk about *the coherence* between variables, even though the literature does make reference to *cause-effect relationships.* The coherence between variables and growth point towards the mechanisms of growth: they characterise the factors that are important for regions where growth takes place.

It should be noted that the lack of pure causality does not matter much when it comes to characterising and prioritising each variable relative to all the others (establishing which are robust and which are not). After all, we are not interested in causal relationships in the sense of that in the statement: by adding more culture (a museum), the economy will grow by a certain percentage. What we do want to find is those variables that are robustly linked to growth. Whether they are necessary conditions for growth processes or whether growth itself affects these variables, is not relevant. The variables characterise the mechanisms behind growth. In the descriptions of the case studies in the next chapter, there is more room to analyse these mechanisms.

These are what we call the *robust variables*. There are also variables that are only occasionally significant, and there is a set of variables that are barely significant or not at all. While the last group is of little interest, the former is all the more important.

3.3.1 Employment growth

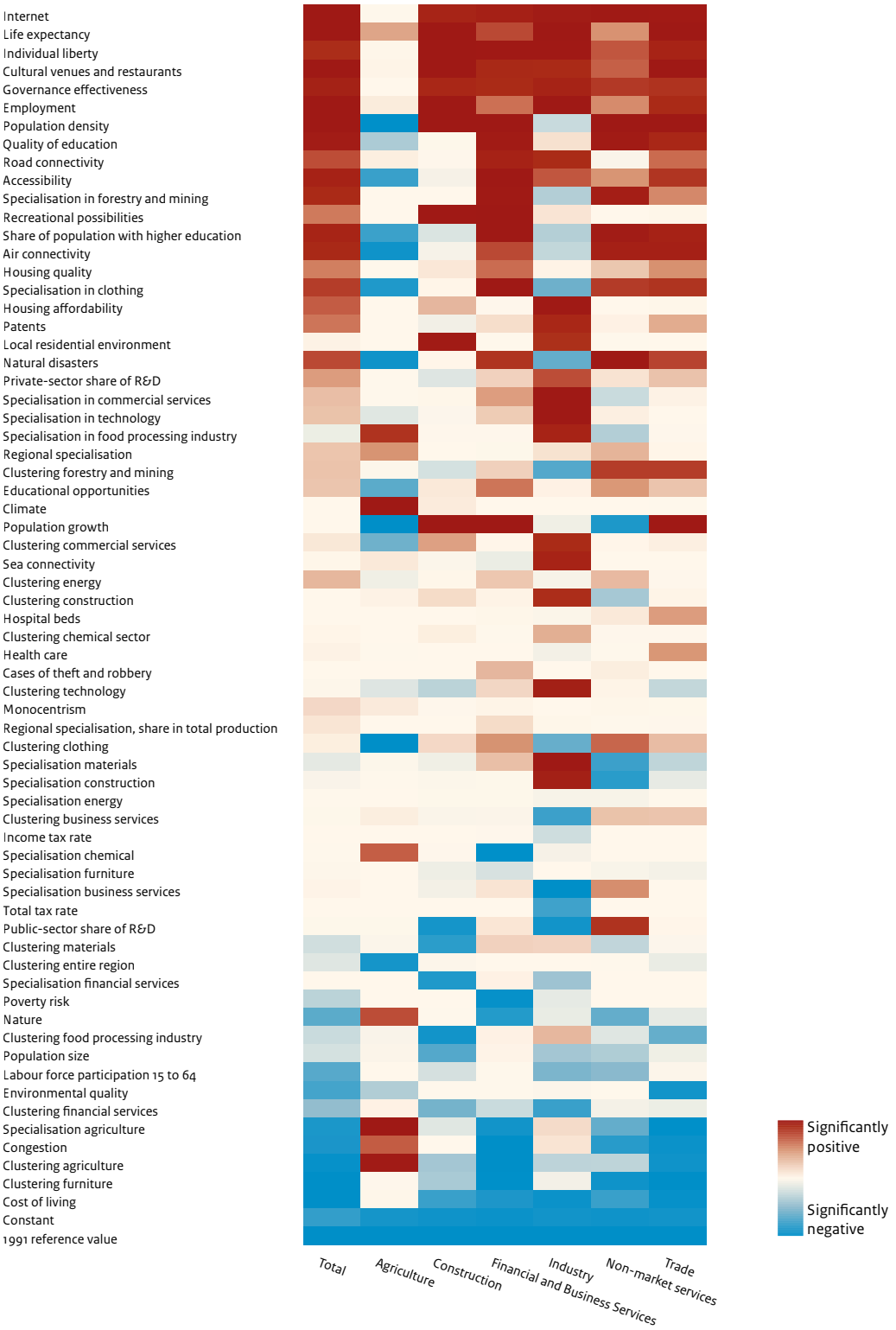
The results obtained by the model for overall employment growth (Figure 3.1, column 1), reveal that of the 70-odd variables, only a few are robust, that is, only a few are almost always significant. The value for 1991 is of course negatively significant, as it is the variable that determines the growth specification. Regions with a high value at the outset grow less rapidly relative to regions with a low starting value (also expressed by the simile that younger children grow faster than older children). Regions with a high starting value are able to grow fast in absolute terms, but, in relative terms, their growth is less marked because of the large base from which their growth takes place.

The main negative variables (blue cells) affecting employment growth are *congestion* and *cost of living*. Regions experience a brake on economic growth when people lose many hours because a large part of their travelling time is spent on congested roads, and when the cost of living is high (high prices for products)[4]. Both congestion and cost of living are negative externalities: location variables that are unfavourable to economic development. In addition, Figure 3.1 shows that regions with a high level of *clustering and specialisation in agriculture* also generally experience a negative effect on growth. This too can be explained. Regions where agriculture is the dominant sector often have only few other growth sectors. Finally, both *nature* and *environmental quality* are negatively related to growth. Regions that score high on nature are often on the periphery and have little economic activity and therefore limited growth. Regions with a high, negatively significant score on environmental quality have high levels of air pollution, noise pollution, CO_2 and particulate emissions. They are therefore relatively unattractive areas to live and work in. The models reveal that these regions experienced fewer economic developments because of poor quality of the environment.

The variables that are positively and significantly connected to employment growth in the regions also emerge in Figure 3.1 (red cells). One of the most important is *population density*: a variable that ensures that the

Figure 3.1

Heat map results regression analyses employment growth



Source: PBL

mechanisms behind agglomeration benefits function efficiently. Density is relevant for all kinds of economic processes related to matching on labour markets, and to the sharing of inputs and knowledge spillovers by companies. It is also clear that, while population density is connected to growth, population size (mass) is not. It is therefore not necessarily the largest cities that grow most rapidly.

Along with density–a variable that partly reflects the urban nature of a region–proper *accessibility* is also positive for growth. This applies to accessibility in general (several modalities by both road and rail), and more specifically to *air connectivity*. In recent decades, regions with good international connectivity have grown faster than others with a less attractive position in the international network. The combination of density and international accessibility has been referred to in the literature as 'local buzz and global pipelines' (Bathelt et al., 2004). The international dimension is also confirmed by the positive impact of the variable *Internet*. Regions with highly developed digital connectivity (the number of households with high-speed access to the Internet and with high levels of usage) have benefited from the Internet in their economic growth. Although much of the economic dynamics takes place at the local level and is driven by regional conditions, a good position of the region in international networks is also important.

Chapter 2 mentioned that agglomeration benefits are particularly substantial for knowledge-intensive activities: innovative, creative and highly skilled jobs. This idea reappears in the empirical models. The *share of the population with higher education* has a robust and positive connection with economic growth of regions. The same applies to the presence of first-class education. The variable *quality of education* is determined by, among other things, the quality of universities, whose presence is important for entrepreneurial dynamism, and therefore also for growth in employment. In relation to the quality of the labour force, a low unemployment rate (measured by the variable *employment*) is also positive. Here, a low level of unemployment is to be interpreted as standing for a relatively properly trained workforce, whose skills match the demand of the companies in the regional economy. In addition, there is a relatively weak link between low unemployment levels and strong regional growth in employment (PBL, 2016): successful cities are often home to a large group of inactive people who are relatively unaffected by the economic success of the region. We can therefore assume that low unemployment is mainly related to the skills level of the workforce.

Another positive connection observed in Figure 3.1 is in the field of health: the regions that have grown the fastest have high *life expectancy*–an indication of a healthy labour force. There may be a number of mechanisms behind this link. For example, a vigorous workforce is often more productive and more innovative, which can exert an economic effect. It may also be the case that businesses choose to expand their production activities in precisely those regions where this human capital is concentrated.

The effect of urban facilities, or amenities, also appears in Figure 3.1, with the quality of *cultural amenities and restaurants* found to be positively linked to the growth in employment in regions. These amenities make regions attractive, and they can also lead to interactions and encounters that, subsequently, produce economic benefits (see Chapter 2).

The last variable that is positively linked to growth is *governance effectiveness*. This indicator serves to represent several others that relate to the effectiveness and quality of policies (as defined by the World Bank), and to the fight against corruption. The empirical analyses show that particularly those regions with competent, high-quality governance have experienced strong economic growth.

From Figure 3.1 it is clear that with regard to employment growth, the regions of interest are those that are readily accessible and generate a large number of agglomeration benefits by means of their population density. They are characterised by concentrations of people with a high level of education, by the exceptional quality of education, and by the large number of cultural offerings. However, there are also negative externalities, such as traffic jams, polluted air, noise pollution and expensive locations.

Based on the simulations run in the regression analyses we can also conclude that only some of the 70-odd variables are robustly significant. These variables have already been highlighted in the literature, and, with the descriptions offered above, we can confirm the conceptual model of the urban region as an economic growth engine. The simulations also reveal that while there is heterogeneity in the impact of the variables, there is no real variation in the direction of the impact: only very few variables change signs within the large set of specifications.

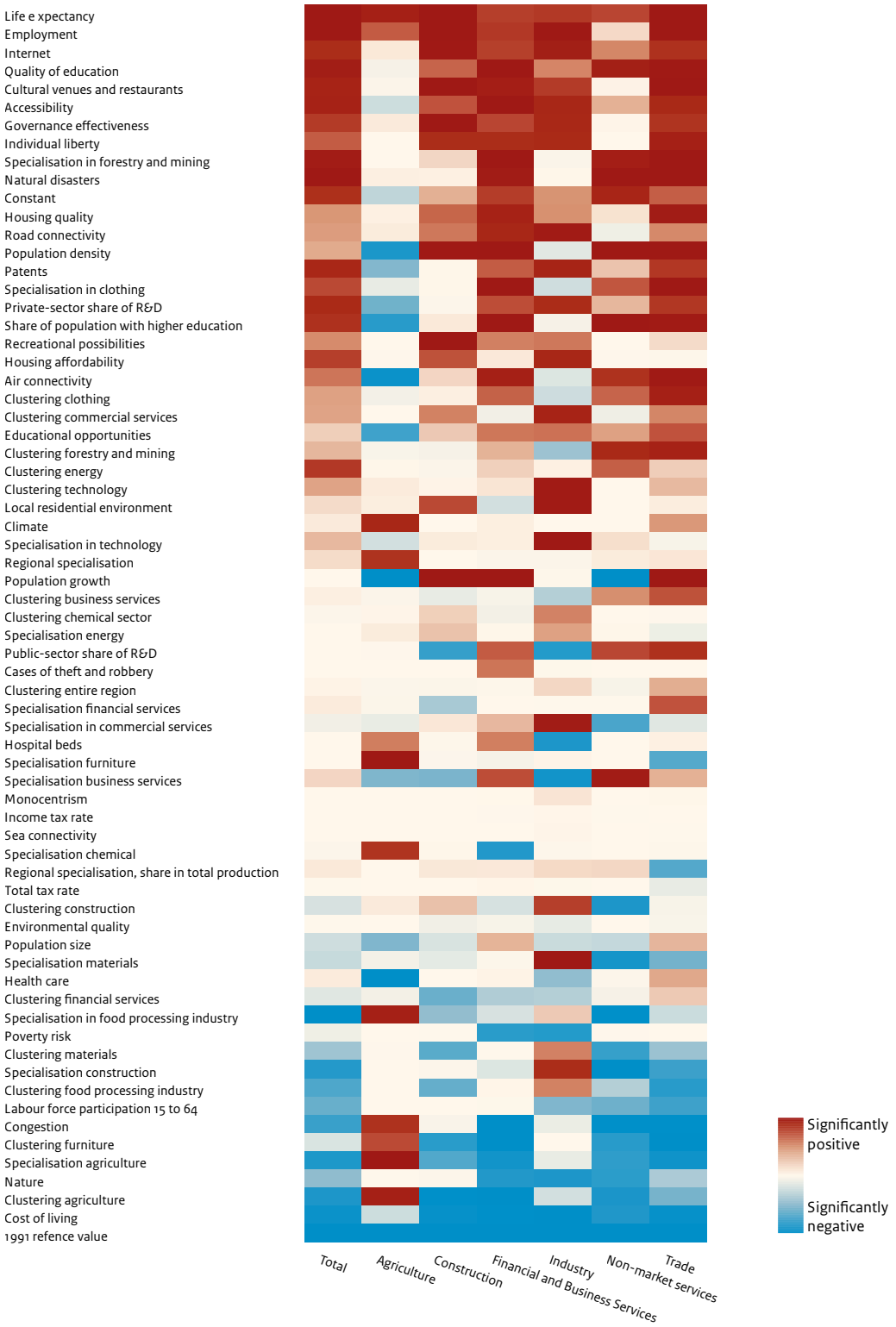
To obtain a more detailed interpretation of the heterogeneity in impact, we will now look at two other analyses. Firstly, we examine how impacts vary from one sector to another. Secondly, we analyse whether some variables are only significant under certain conditions, or more specifically, when other characteristics are also present.

3.3.2 Sector-specific employment growth

In this section, we deal mainly with the variables that are relevant for specific sectors. Figure 3.1 shows the impact of the variables on growth, column by column for six broad sectors: agriculture, the building industry, financial and

Figure 3.2

Heat map results regression analyses productivity growth



Source: PBL

business services, industry, non-market services and trade. What attracts attention is that the models for services (financial and business services, non-market services) and trade (that includes consumer services) have the strongest relationship with urban characteristics such as population density and population growth. These service models resemble the overall model the most, while agriculture and industry differ the most from it.

Looking at agriculture, it is notable that many of the variables that are significant for overall regional growth are not relevant for employment growth in the sector. Moreover, some variables that are positively significant in the overall model, such as *population density* and *population growth*, are actually *negatively* significant for agriculture. In other words (and this is not entirely surprising): the character of urban settlements slows down developments and employment growth in agriculture, which does better in rural and peripheral regions. *Specialisation* and *clustering* within the agricultural sector do have a positive influence. For agricultural businesses, a location close to other farms appears to be beneficial. This is partly due to geographic and physical options: since agricultural activities cannot be carried out everywhere, these businesses concentrate in certain areas, which become highly specialised as to the sector. However, the clustering variable also shows that these companies use each other's inputs in the production chain and thereby benefit from each other's proximity. The exchange of inputs is a firm indication that, for companies operating in the field of agriculture, proximity is an important factor in the development of the sector. Finally, we see that the *climate* variable is positive for the agricultural sector. This is confirmed by the observation that agriculture scores well on employment growth mainly in regions that are located in Europe's peripheral parts, outside the core economic area, where they enjoy a favourable climate, with low extreme rainfall and sunshine.

The building industry makes up a sector that is present especially in or near urban areas. In this sense, they follow the population and businesses. This is reflected most particularly in the fact that population growth and population density are positively linked to employment growth in the sector. This means an urban environment is important for the building industry, but this does not have much to do with the mechanisms behind agglomeration benefits. It is also found that attractive cities–those with high life expectancy and a broad range of cultural amenities and restaurants–are important for growth of the sector. Above anything else, it seems that the building industry thrives in growing, attractive cities.

Financial and business services (knowledge-intensive services) do well particularly in regions where the characteristics that benefit overall growth coincide with those that benefit the sector. Likewise, the characteristics that have a negative effect on overall growth are also detrimental to the sector. The growth in these knowledge services is therefore strongly linked to the urban environment (population density, population growth), accessibility and the presence of a highly educated labour force. Congestion and a high cost of living have a negative impact on the growth in financial and business services. In addition, Figure 3.1 shows that risk of poverty also plays a negative role. This is an indication that the financial and business services sector has seen strong growth particularly in rich regions (where few people are on low incomes).

As for growth in employment in industry, a number of specific variables emerge. For this sector, *specialisation and clustering of technological activities* are decisively positively linked to growth of the sector. *Specialisation* with regard to materials is also relevant. It therefore seems that, particularly for industry, and less so for services, *clustering* is an important factor when it comes to choosing a location. In Figure 3.1, we can also see other examples of variables, such as *patents*, that are far more important for industry than for other sectors. Population density and population growth play a far less important role in employment growth for the industry sector. We can therefore conclude that, for the growth in industry, the cluster benefits (the localisation benefits mentioned in Chapter 2) are more important than the broader set of benefits related to an urban setting that are brought about by population density. In contrast with other sectors, *sea connectivity* is an important growth factor for employment in the sector.

The non-market services, particularly those offered by the public administration and not-for-profit institutions, have undoubtedly grown most dramatically in regions with high *population density*, but they have not grown in places with high *population growth*, a variable that is found to be negatively significant. It therefore seems that this sector evolves particularly well in cities where it is already present in high concentrations, such as capitals, rather than in new cities undergoing rapid growth.

Finally, we see that employment growth in the trade sector is very similar to overall employment growth in regions. Here, both *population density and population growth* are positively linked to growth of the sector. It also benefits from the presence of *cultural amenities and restaurants* and from a high *life expectancy*.

3.3.3 Productivity growth

Besides simulations for employment growth, we also ran simulations for productivity growth in regions, measured as added value per inhabitant. Figure 3.2 shows the results of the regression analyses. What attracts attention is that productivity growth is positively linked to, in particular, the variables *life expectancy* and *employment*. Earlier on, we

referred to this as the vitality of human capital in the region. These characteristics are more important for productivity growth than others such as population density. We can therefore conclude that generic agglomeration benefits are not expressed as strongly as the specific qualities of the workforce. *Quality of education* and a sizeable *share of the population with higher education* in the workforce are other variables that are robustly linked to productivity growth. This is yet another confirmation that the human capital factor is very important here. Figure 3.2 also shows the effect of urban amenities. For example, *cultural amenities and restaurants* have a positive connection with productivity growth in the regions.

In comparison to the results of the models for employment growth, fewer variables are found to have a robust negative impact on productivity growth. In fact, the only robust negative link to productivity growth is *cost of living*. This means that productivity growth is subject to pressure in places where the cost of living is very high. At the same time however, expensive places have high levels of productivity, and therefore it is more difficult to achieve high relative growth. As for *congestion*, the variable is less robust in its impact on productivity growth than on employment growth. Figure 3.2 also shows that regions that are highly specialised in the *food industry* are negatively affected by congestion.

All in all, it is clear from Figure 3.2 that productivity growth mainly takes place in regions with a strongly developed human capital base. However, when considering specific sectors, other regional characteristics also play a role in productivity growth, and more so than in employment growth.

3.3.4 Sector-specific productivity growth

In the estimates of employment growth by sector, it was found that the models for services produce very similar results to the overall model. In productivity growth, the same applies, but there are also differences: the results for industry are closer to those of the overall model than, for example, agriculture, whose results are almost a counter mould of those of other sectors. Population growth and air connectivity in particular, and to a lesser extent, population density and human capital, are variables that are negatively linked to productivity growth in agriculture.

In the growth model for the agricultural sector, we see that only relatively few variables are positively significant. The most important ones, as in the case of employment growth, are specialisation and clustering of the own sector. Therefore, the sector has grown and been productive mainly in regions that have specialised intensively in agriculture.

The construction sector has increased its productivity mainly in urban regions with high population densities and high population growth, especially in areas where agriculture is not greatly clustered. Furthermore, the regional characteristics that define quality of life are important for growth in the added value of the building industry: a wide range of *cultural amenities and restaurants*, multiple *recreational possibilities* and high *life expectancy*. In short: attractive cities. Another positive variable is *governance effectiveness*.

The most important robust regional characteristics that are positively connected to growth in industrial productivity are *specialisation* and *clustering* of industrial activities. In specialised regions, industries enjoy cluster benefits and are able to use each other's inputs in their production chains. The materials sector also exerts a positive effect: in regions with an over-representation of businesses in the materials industry, companies in the manufacturing sector grew faster. Also important for productivity growth in the industry sector are good accessibility by road and the variable *employment*. Above, we related this variable to the existence of a highly qualified workforce.

For its productivity growth, the sector of financial and business services has benefited particularly from the presence of good *education* and a considerable *share of the population with higher education* among the workforce. The human capital factor is therefore positively significant for this sector. However, the agglomeration benefits brought about by *population density* and *population growth* are also robust and positively linked to growth of the sector.[5] Figure 3.2 also shows that good *accessibility* is positively connected to growth. The development of these knowledge-intensive services perfectly matches the 'local buzz, global pipelines' concept described in Chapter 2. Cities buzzing with activity, which bring together knowledge workers in particular, and are readily accessible (nationally and internationally), are found to have grown the most in terms of productivity. On the contrary, high levels of *congestion* and a high *cost of living*, do not contribute to productivity growth.

The heat map in Figure 3.2 shows that the productivity of non-market services, especially public services (where this mainly concerns salaries), also grew strongly in regions that have high *population density* and a large *share of the population with higher education*. The *natural disasters* variable is also positively linked to the growth in non-market services. The urban setting is key to a proper interpretation, as densely populated regions are both highly vulnerable to natural disasters and have a strong concentration of non-market services in areas where many people live close together. Also, strong growth in productivity and employment in the non-market services did not necessarily take place in cities with the greatest population increases.

In the heat map, the trade, retail and wholesale sector is very similar to that of the non-market services, although the variables that define the quality of the conditions of living are more prominent: high life expectancy and a broad range of cultural amenities and restaurants are positively robustly linked to growth of this sector. The same applies to air connectivity. Regions that are highly specialised in the clothing industry grew faster in terms of trade productivity.

3.4 Does context matter?

The simulations we ran to estimate the effect of a wide range of variables on the economic growth of regions reveal that a number of these variables are important and robust. What we do not know yet is whether certain variables reinforce others in their effect. We tested this by including so-called *interaction effects*, where *interaction* refers to the situation in which the impact that an independent variable has on a dependent variable is affected by a third variable. Expressed in formal terms, the effect of variable X_1 on Y varies according to the values of X_2. The interaction term that is added to the models–the product of the two variables that, by themselves, determine the main effect in models that do not consider interactions–is therefore actually a conditional effect. A certain variable has an effect, but the effect is more marked in certain situations. For this reason, interaction effects are also interpreted as turbo effects. The effect of one regional characteristic depends on another that reinforces the effect. It should be noted that this also applies to negative effects, which therefore can be reinforced too.

To select the variables that can be expected to have an interaction effect, we fall back on the conceptual model of the growth engine introduced in Chapter 2. There, we described various factors, along with the mechanisms behind the agglomeration effects: *sharing*, *matching* and *learning*.

Agglomeration benefits are strongly related to *population density*. It was therefore included as a variable in calculations on interactions with all the other variables. With these calculations, we aimed to verify whether locations with high population density cause other variables to have stronger or more marginal effects on growth. In addition to density, we also considered *air connectivity*, which serves as an approximation of a good position in a global network of locations. Locations with an international quality can offer advantages because knowledge and trade relationships and other types of cooperation can be established through them. In Chapter 2 we mentioned that population density and international connectivity are also described as 'local buzz and global pipelines'. The buzz stands for the hive of cooperation and interaction activity between businesses: formal and informal, paid for and free of charge, planned and spontaneous. Aiming to also take learning effects into account, we checked the interaction effects of a knowledge-related variable. A high level of knowledge in public and private institutions and in businesses can cause other variables to have a greater effect. We include both private and public R&D as an approximation of the knowledge infrastructure.

Heat maps of the interaction variables

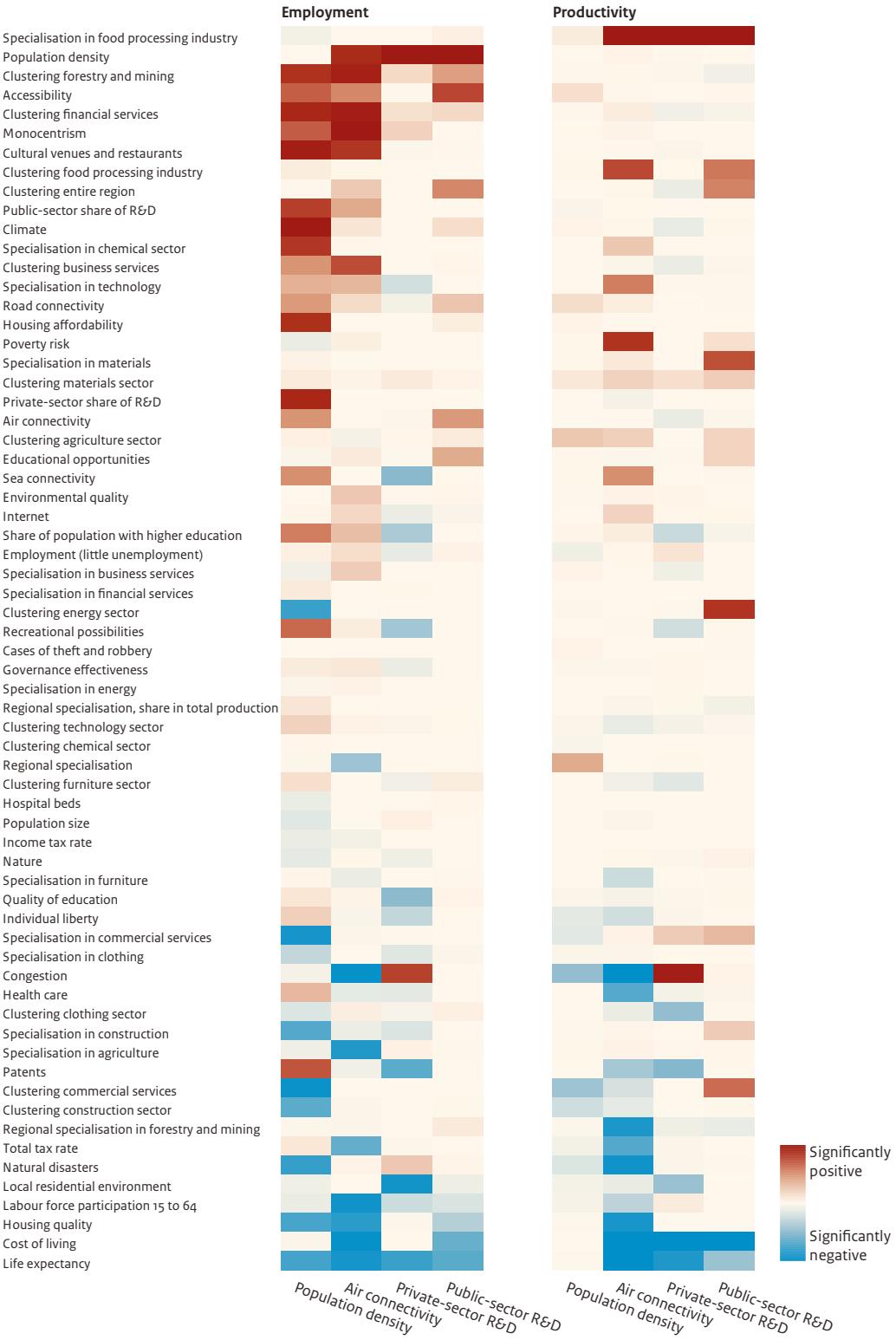
To calculate the interaction effects, we applied the same simulation procedures as for the models that were used for calculating the main effects only. Here too, the results are summarised in a heat map (Figure 3.3). It only represents the models for total growth, not those for individual sectors. This is because we have no separate hypotheses about the impact of interaction variables on a particular sector, especially not at the level of the broad sectors we are examining. Therefore, Figure 3.3 shows the effects of the interaction variables on overall employment growth and overall productivity growth. The four leftmost columns provide the results of the employment growth models and show the interactions between the set of individual variables and–from left to right–population density, air connectivity, private R&D and public R&D. The four columns on the right show, in the same order, the interactions derived from the productivity growth models.

A number of important conclusions follow from Figure 3.3. It is clear that population density causes the effect of other variables on regional employment growth to become greater. This applies, for example, to private R&D. Population density therefore can be said to increase the impact of knowledge on growth. The effect of knowledge is marked most particularly in cities with a high population density, which is in line with the argumentation in the literature that knowledge (especially that tied to the individual) is shared more easily among actors who are located near each other. This interaction has a robust effect on employment growth, but not on productivity growth. In cities, it is therefore more likely that knowledge will lead to new activities (new businesses or new jobs in existing businesses) than to increased productivity. Frenken et al. (2007) indicate that the difference between growth in employment and growth in productivity can be coupled to the difference between radical and incremental innovations. Radical innovations often bring about new activities, whereas incremental innovations are far more likely to be efficiency improvements within existing production processes. This line of reasoning suggests that a large knowledge base in businesses leads to stronger growth because it enhances entrepreneurial dynamism.

Population density also reinforces the effect of *cultural amenities and restaurants*. The variable is already known to have a positive robust main effect, but its influence is even

Figure 3.3

Heat map results regression analysis with interaction effects for growth in employment and productivity



Source: PBL

more significant in high-density regions. While the main effect is most likely that it enhances the appeal of regions, thereby attracting and retaining more companies, the interaction effect seems mainly to point to the fact that cultural amenities provide an environment for interaction–meeting places–which stimulates economic processes.

Figure 3.3 also shows that population density has a positive influence on the effect of *climate* on growth. Above, we observed that this variable achieves high scores especially in areas outside the economic core area of Europe, i.e. in the more peripheral parts of Europe. The interaction effect indicates that employment growth occurs mainly in cities in those parts of Europe.

Finally, population density also appears to enhance the effect of *housing affordability* on growth. Housing affordability means that the price per square metre (divided by income per capita) is relatively low. Therefore, in affordable cities growth is higher than in cities where housing is very expensive.

The second interaction effect is that between the full set of variables and *air connectivity*. Figure 3.3 shows that good international connectivity strongly conditions regions in countries with a monocentric urban structure. The heat map in Figure 3.1 shows that the variable *monocentrism* by itself does not have a positive effect on employment growth, but here we see that the combination with good international accessibility *does* bring about an effect. Monocentrism also has a positive effect on the clustering of financial services. This means that regions with a substantial cluster of financial services benefit most from the combination with air connectivity–having a large airport with flights to many destinations. For productivity growth, air connectivity also conditions the effect of strong specialisation in the food industry.

In the models in which variables interact with *private and public R&D*, we also observe turbo effects: the two knowledge variables enhance the effect of population density, but when they grow, the impact of density will also receive an extra boost. In more general terms, heavy concentrations of knowledge are an important growth factor especially in cities (regions with a high population density).

3.5 Case studies

In this report, we discuss six regions in an effort to identify the causal mechanisms driving economic growth and, more particularly, the corresponding policy efforts. The next chapter presents a historical policy analysis for the regions Munich, Eindhoven, Milton Keynes, Dublin, Madrid and Amsterdam. We chose these six because, compared to the almost 600 other regions in Europe, they are among those with the highest levels of growth (see Chapter 1).

Before moving on to the in-depth description in the next chapter, here we offer some further details on the profiles of the six regions. To do this, we work with the same variables that were used for the simulations in the regression analyses presented in this chapter.

Figure 3.4 shows the scores of the 6 regions on the 70-odd variables of the regional business climate. All scores are displayed on a scale of 10 equally sized divisions (percentiles). It should be noted that all variables were taken into account with regard to the NUTS2 classification that is a slightly higher geographical level than NUTS3 that we used to measure the growth of the region. For example, for the Eindhoven region (the south-east of North Brabant province in the Netherlands) we provided the data that correspond to the level of the province as a whole.

We see that the regions have clearly dissimilar profiles and score well on several indicators. Eindhoven and Munich, for example, have a strong profile with regard to knowledge. Both regions are among the top in Europe in terms of patents and private R&D. Munich also achieves a high score on the proportion of public R&D and does particularly well on clustering within the technology industry: many businesses in this sector use each other's inputs in the production chain. In the Eindhoven region, interaction between technology businesses is less intensive and more inputs are received from outside the region (also see PBL, 2012). The Munich region also scores highly on clustering of refining activities, the most important part of the forestry and mining industries. Both Munich and Eindhoven obtain top scores on the qualification of their labour forces: they have a relatively low unemployment rate (*employment* indicator), a high labour force participation rate in the age group of 15 to 64, and a relatively large share of the population with higher education. Both regions are at the European top in terms of educational opportunities and quality of education. Finally, the quality of Internet access in the Eindhoven region is also very good.

Milton Keynes is another region with a clear-cut knowledge profile. It is among the top in terms of both public and private R&D, and it has excellent educational opportunities. These scores are largely determined by its location near the prestigious university of Oxford. In addition, the labour force has a relatively high level of education and a high labour force participation rate in the age group of 15 to 64-year-olds. Also, life expectancy is high and so is the score on housing quality.

Figure 3.4
Characteristics of case-study regions

Source: PBL

The Amsterdam region is characterised mainly by a high score on the share of the population with higher education, excellent educational opportunities and good air connectivity. It also scores well in the digital domain: the Amsterdam Internet Exchange (AMS-IX) has turned the region into an important Internet hub. Madrid is the largest agglomeration in our study; it also scores well in terms of life expectancy and housing quality. As for Dublin, we see the region does well on clustering of business services and specialisation in the chemical industry and in refining.

Finally, these regions achieve above-average scores for housing quality, life expectancy and, except in the case of Madrid, cultural amenities and restaurants.

3.6 Summary

This section is an outline of the most importan findings of the quantitative analyses discussed above. The simulations performed in the regression analyses show that several variables are robustly linked to economic growth in the areas of employment and productivity. We illustrate this with the numbers C1 to C8, which correspond to the factors–the cogwheels–in Figure 2.1.

- In the case of employment growth, the main points are agglomeration benefits arising from population density (the core of the engine), good accessibility (C5), highly qualified human capital (concentrations of highly qualified individuals; C3) and also high quality of education (C4) and a high level of cultural offerings (C8). A negative effect on employment growth is exerted by traffic jams, air and noise pollution, and expensive locations–the variables that make the physical environment less attractive (C8).
- The characteristics linked to productivity growth are mainly related to the labour force (C3) and, more specifically, to highly developed human capital.
- The context in which growth processes take place makes a difference. Certain characteristics condition others in their effect on growth. This is most apparent for knowledge (C4) and culture (C8) that come out particularly well in high-density regions, i.e. in relatively large cities.
- Certain sectors of the economy benefit from specific characteristics of the business climate. Industrial companies, for example, benefit from specialisation and clustering (C1) of technological activities and materials. Clustering is a more important location choice factor for industrial activities than for services.

In short, only a limited number of factors are important for regional economic growth. Differentiating by context and by sector also matters. Good insight into these factors also makes it possible to identify those policy areas that are important for economic growth.

Notes

1 Our approach is classical is sense that it considers all possible combinations. An alternative is the Bayesian method (as described in Lavergne et al. (2004); see also Fernandez et al. (2001)). Both deliver the same results.

2 It should be noted that an important variable from the Solow model is not present here: the savings or investment quote. The variable is not available for the NUTS3 aggregation level we applied (it is already complicated at the NUTS2 level). Therefore, it is highly likely that our economy-related variables, such as specialisation of economic activity in a region, are approximations of the investment quote.

3 There are only very few combinations of variables with a correlation higher than 90%. The combination of patents and private R&D is the highest, at 95%. A simple growth comparison that uses these two as explanatory variables shows standard errors and R-squared values that are similar to those of a growth comparison in which only patents are used. As a result, overall there is little cause for concern about the so-called imperfect multicollinearity.

4 It is worth noting that the correlation between a high initial value (many jobs) and high cost of living is not strong. Therefore, the large regions are not necessarily the expensive regions.

5 Specialisation in *forestry and mining* is also a robust, positive characteristic. Within this group, *refineries* are the branches with the most important economic activity and they are strongly present in powerful agglomerations such as Paris and Munich, and also, for example, in the Rotterdam region.

4 Case studies

4.1 Introduction and chapter structure

Focusing on policies in six urban regions
In this chapter we discuss six regions that, in recent decades, have been economically successful. Sections 4.2 to 4.7 cover Munich, Eindhoven, Milton Keynes, Dublin, Madrid and Amsterdam. The focus is on the policy efforts made in these regions in last few decades, in relation to their significant economic growth. Our research is based on intensive literature studies.

The analysis examines, region by region, the eight factors (cogwheels) that were identified as drivers of regional economic growth: 1) clusters, 2) entrepreneurship, 3) human capital, 4) knowledge infrastructure, 5) physical infrastructure, 6) financing, 7) governance and 8) Residential amenities (see Figure 4.1 and the description in Chapter 2). It also covers the connections between the adopted policies and the regional and supra-regional context, including economic structures built on past developments, random events, political circumstances and macroeconomic and institutional reforms that have an effect beyond the level of the region. This chapter therefore does not focus so much on factors that explain growth, as the previous chapter does, but on the way policies have been carried out and on which mechanisms underlying growth, policies are related to.

The economic development of regions
The growth paths of the studied regions differ widely, as can be seen in Figures 4.2 and 4.3. The Eindhoven region (the south-east of North Brabant province) and the Munich region (Upper Bavaria) had similar, balanced growth paths for both employment and added value. However, employment in the Munich region was flat in the 1990s. It was an important period during which the regional authorities had to pull out all the stops (see the case study in Section 4.2). In the south-east of North Brabant province, employment fell in the early 1990s. It was in fact a sharp decrease and it also led to government intervention (see Section 4.3) but the region recovered faster than Munich. Government intervention continues to be urgently important though, as both employment and added value declined again at the beginning of the 21st century. As a result, the region is more vulnerable than Munich, where employment and added value did not fall.

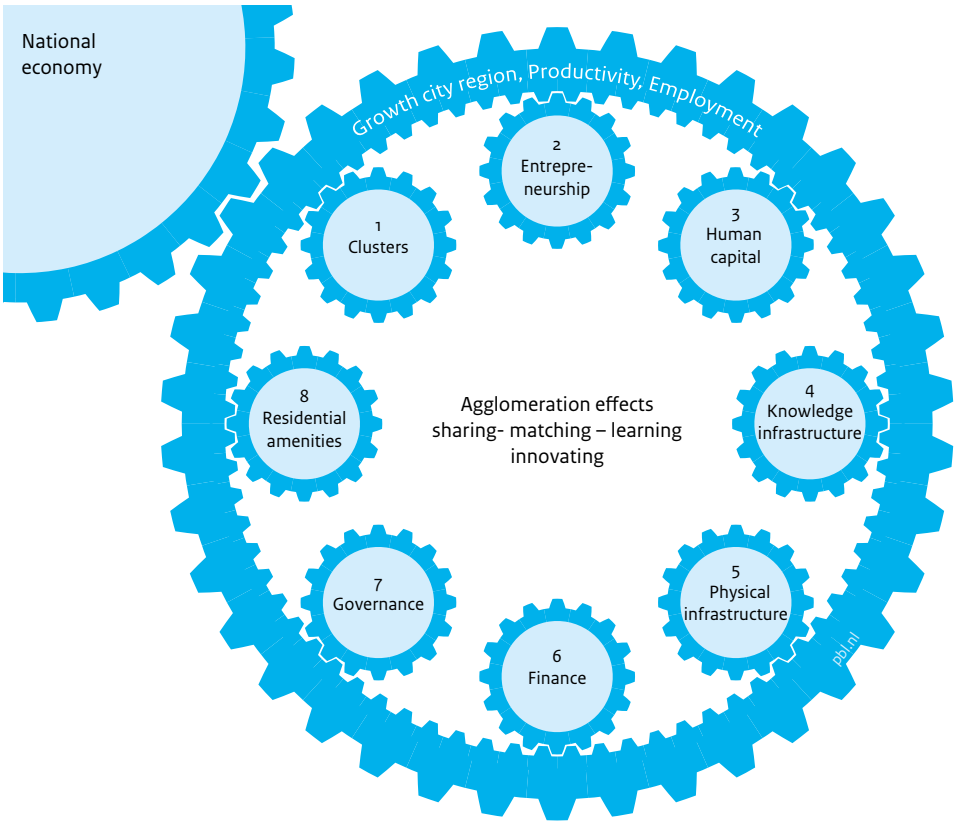
In the case of Milton Keynes, the growth path for employment started off with marked increases. In the late 1980s and early 1990s, it levelled off and then rose sharply again. But added value saw a steady increase throughout the examined period. The wild fluctuations in employment are related to population growth, and the steady growth in added value has to do with the attractiveness of the region for highly productive companies that provide financial and business services (see Section 4.4). These sectors were hit more than average by the financial crisis of 2008, which is revealed by a small dip in the graph.

As for Dublin, what is noticeable is that growth started in a later stage. Despite institutional and macroeconomic reforms, it took the region a long time to start catching up with Europe. Its one-sided economic structure based on agriculture prevented an earlier start of the growth path. Moreover, in the 1980s, its added value even decreased due to the oil crises. The region had to wait until the 1990s for substantial economic growth to begin (see Section 4.5). The inflow of foreign investments played an important role in this development.

Madrid went through a period of exceptionally high growth from the mid 1990s until the crisis. It acted as a magnet for people, businesses and investments. This magnet effect was further strengthened by large-scale government investments in urban mega-projects (see Section 4.6). In both Dublin and Madrid, the financial crisis wreaked havoc from 2008 onwards, putting an end to their period of strong growth.

Chapter structure
Each of the case descriptions starts with an outline of the regional context and the implemented policies. The discussion focuses mainly on the most distinctive factors, which are labelled C1 to C8 in correspondence to the cogwheels in Figure 4.1. Subsequently, the initial conditions are discussed, which concern the path-dependent developments resulting from chance events in the past that form the basic conditions for the creation of

Figure 4.1
The engine of regional economic growth



Source: PBL

a growth path. This is followed by the implemented policies (roughly covering the past 30 to 40 years) and regional development paths.

The report concludes with a question (that links back to the previous chapter), concerning the extent to which the profiles of the regions are also reflected in historical policy efforts?

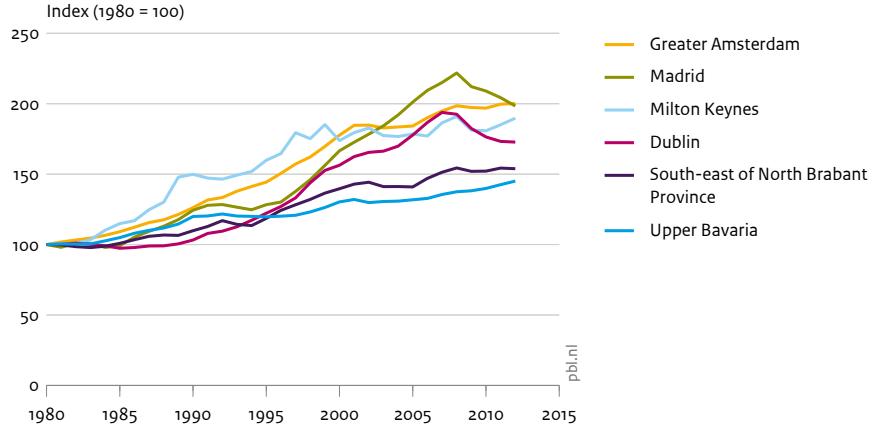
4.2 Munich

4.2.1 Outline

After the Second World War, the Munich region (Upper Bavaria) mainly pursued policies in the field of urban development and spatial planning. The relocation of Siemens from Berlin to Munich proved to be of great importance. Siemens opted for the physical space in Munich, which was readily available and attractive (the urban region did not have extensive, obsolete industrial areas), and did not want to pay the reconstruction tax in Berlin. They were followed by many other companies, such as BMW and Allianz. In addition, the West German federal government chose Munich as the location for the establishment of a new knowledge platform for the defence industry. These events were important drivers behind the gradual emergence of a relatively young and progressive high tech and services sector. The 1960s and 1970s were marked by strong economic growth, with demand for labour far exceeding supply. This led to large immigration flows from northern and southern Germany (particularly people with higher levels of education) and from southern and eastern Europe (predominantly those with a low or medium level of education). Including the important role played by the government, altogether this meant a solid foundation for success was built.

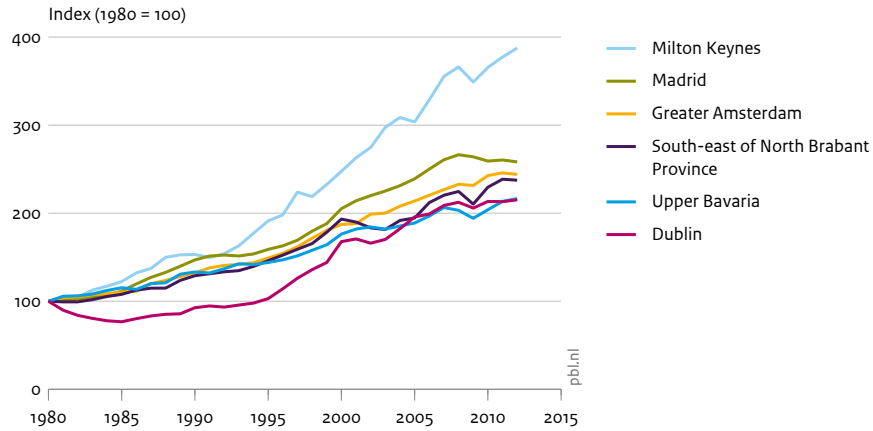
In reaction to, among other things, the economic downturn in the defence, electrical and machine industries in the early 1990s, the government shifted its focus from investing in (C5) physical infrastructure to investing in the innovation system. Heavy investments in (C4) knowledge infrastructure and (C3) human capital were made particularly by the federal state of Bavaria. As a result, new faculties were opened at universities, new higher education institutions and training and technology (transfer) centres were set up, and additional funding for

Figure 4.2
Changes in employment, per region



Source: Cambridge Econometrics; edited by PBL

Figure 4.3
Change in added value, per region

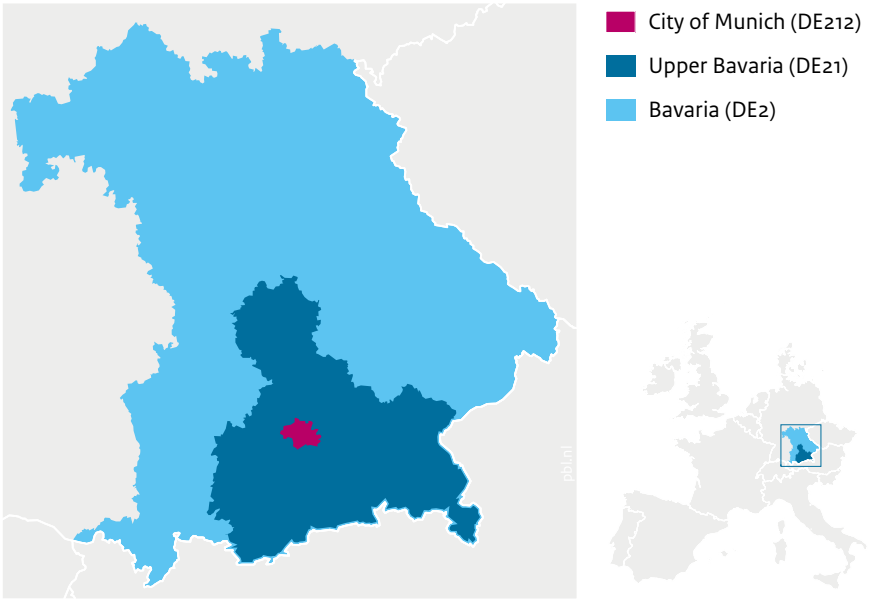


Source: Cambridge Econometrics; edited by PBL

research programmes was made available. It also led to the creation of funds using (C6) venture capital, the most important of which are administered by Bayern Kapital, part of the LfA Staatsbank. With an eye on high-tech start-ups in particular, this venture capital was aimed at stimulating (C2) entrepreneurial dynamism in the region.

Along with the solid foundation of high-tech and services sectors that had already been laid, this development contributed to the emergence of what the literature has labelled *institutional thickness* and the *Munich mix*. Institutional thickness refers to the concentration of knowledge institutions (e.g. Max Planck Society, Fraunhofer-Gesellschaft, Technical University of Munich (TUM) and the University of Munich (LMU), supporting government services (e.g. Bayern Innovativ and Bayern Kapital) and the prolonged and intensive interaction between public and private actors. The concentration led to a shared strategy with a clear focus on high tech and innovation. The Munich mix refers to the economic structure formed by a few large companies that dominate global markets, surrounded by a network of medium-sized and small businesses that operate in close conjunction. The Munich mix represents a related diversity of activities, with a number of core specialisations in the high-tech sector (e.g. electronics) and the services sector (e.g. banking, insurances and the media). In addition, the national government, the federal state of Bavaria and the region of Upper Bavaria have coordinated and streamlined policies such as those for technology, industry and energy.

Figure 4.4
Location of Munich, Upper Bavaria and Bavaria



Source: Eurostat, adaptation by PBL

All in all, this means full multi-level (C7) governance has been achieved. There is interaction between actors (large and small enterprises, the market and the government), between levels of administration (the German national government, the federal state of Bavaria and the city of Munich) and between sectors. Examples of the latter are the coordination between car manufacturers and the electrical industry and between banks and the high-tech sector, but interaction can also take place through cross-sectoral, leading-edge technologies such as laser and optical technology, microsystems and traffic technology for the car, electrical and machine industries.

In terms of policies, Bavaria chose to focus on new activities (technologies) that led to a stimulation of innovation in several strong (C1) clusters in the region. Recently, the Cluster Initiative Bavaria opted for seventeen innovation clusters–not necessarily based on individual sectors–and five umbrella themes that touch on societal challenges, such as *Energiewende* (energy transition), climate change and the ageing population. Some commentators have suggested that the range of seventeen clusters is an indication that public financing is drying up. There is no longer a clear focus on certain technologies, but now every sector is somewhat involved and the emphasis is on creating platforms for interaction. In contrast to earlier programmes, which were financed by the sale of state-owned shares, the cluster programmes are started up by the private sector and involve less public money. The government is less able than before to define clear focal points through large-scale investment programmes.

Finally, the (C7) Residential amenities play an important role. Munich is considered to be among the cities with the highest quality of living in Germany. This is, first of all, because of the high quality of the education system, health care and care facilities, and the quality of the infrastructure. The second reason has to do with the region's experience value: the old city centre, which was rebuilt in its original style; the mix of historical buildings; the proximity of attractive nature areas (the Starnbergermeer, the Zugspitze, the green environment, which has been kept open according to the principle of compact, urban and green); major events (Oktoberfest); and cultural facilities and trade fairs.

4.2.2 Geographic and administrative demarcation of the region

Figure 4.4 shows the NUTS statistical classification of Munich (DE212), Upper Bavaria (DE21) and Bavaria (DE2), which corresponds to, respectively, the administrative boundaries of the city of Munich (with an elected city council and mayor), the administrative district of Upper Bavaria (an extension of the federal state)[1] and the federal state of Bavaria (with an elected government and parliament). The data presented in the introduction to this chapter are those of the Upper Bavaria region (DE21). In addition to Munich (approximately 1.5 million inhabitants), the region has two other medium-sized cities with

autonomous powers (*Kreisfreie Stadt*): Ingolstadt (about 130,000 inhabitants) and Rosenheim (about 60,000 inhabitants).[2] Below we will discuss the policies of the city of Munich and the federal state of Bavaria in detail. The policies developed by Upper Bavaria are in line with those of the federal state, which has many competences in economic policy in particular. More recently, the Munich Metropolitan Region (EMM, *Europaïsche Metropolregion München*) was created as a body for collaboration between six cities and rural municipalities that cuts across administrative boundaries. We will refer to this again below.

4.2.3 Initial conditions

Strong regional government

The Federal Republic of Germany is made up of 16 federal states, or *Bundesländer*. Enjoying their own constitutions, parliaments and governments, these states have many competences. In addition, they sit on the Federal Council, a body through which they are represented in the Federal Parliament. This means that they also have a considerable deal of influence on national and even European issues. Each federal state is administrated by a government with ministers and a prime minister, elected by its parliament, the *Landtag*, which itself is formed by direct election every four or five years. This system originated immediately after the Second World War.

The population of the federal state of Bavaria is approximately 12.7 million. In addition to Munich (with around 1.5 million inhabitants), there are six other large cities: Ingolstadt, Nuremberg, Augsburg, Würzburg, Fürth and Erlangen. Munich and Ingolstadt lie in the administrative district of Upper Bavaria, which has a population of approximately 4.5 million.

Establishment of businesses and knowledge institutes after the Second World War

The present-day economic structure of the Munich region has its roots in the 19th century (Clark and Moonen, 2014; Duell, 2006; Rode et al., 2010). The region did not have large deposits of raw materials in that period, which meant that industrialisation remained relatively limited. It became a centre of commercial activity, and under Napoleon it was even the third largest trade centre in Europe, after Prussia and Austria. This function of the region as a hub, along with the role of Munich as the residence of the royal family of Bavaria meant that the city created a strong foundation for art, science and architecture (Von Streit et al., 2010a). The science basis led to the industry focusing mainly on high-tech activities, such as precision instruments and photographic materials. According to Hülsbeck and Lehmann (2005), the absence of industrial infrastructure also had a positive effect on development after the Second World War. While it did not have to invest in the reconstruction of old, existing sectors, the region saw itself forced to invest in new industries. In addition, as there were hardly any outmoded industrial areas, a great deal of open space was readily available for new economic activities. This means the initial conditions were different from those of areas such as the Ruhr region, which had a high concentration of obsolete industries.

In this regard, the decision made by the Siemens company in the 1950s to move from Berlin to Munich is revealing. The move was partly driven by the substantial payments imposed on companies based in Berlin after the Second World War, as a contribution to the war reparations the city had to pay. According to Clark and Moonen (2014), the move worked as a catalyst for a critical mass of banks, insurance companies, media organisations and manufacturing businesses. After Siemens, companies such as BMW and Allianz also chose for Munich. The defence industry too played an important role in the emergence of Munich as a magnet for high tech and talent. The arms industry grew markedly in the 1960s. Opportunities were seen for West Germany. Munich was chosen as the location for a knowledge platform (that included a federal university and the Max Planck Society) and its defence industry received many federal investments. This was a leg up towards the development of an advanced technological industry, especially in microelectronics (Rode et al., 2010). Finally, the federal state of Bavaria managed to attract many national investments for university education. The 1960s and 1970s were marked by strong economic growth, with demand for labour far exceeding supply. As documented by Duell (2006), this led to large immigration flows from northern and southern Germany (particularly people with a higher level of education) and from southern and eastern Europe (predominantly those with a low or medium level of education).

Open space and physical investments

Large parts of the old city centre had been destroyed by bombings during the Second World War, but after the war, Munich, unlike many other cities, aimed to rebuild as much as possible of its centre in the original style (Rosenfeld, 2000). Today, this historical character contributes greatly to the attractiveness of the city, but it has also led to criticism because it gives the impression of being a denial of the Nazi past. In some cases, the link with the war has intentionally been made visible. Examples are abstaining from repairing damage to the exterior of the Alte Pinakothek art museum (bullet holes and impact marks of grenades) and using the Nazi centre Haus der Kunst, commissioned by Hitler, to exhibit modern art–the art form of which Hitler disapproved.

As mentioned before, there was enough physical space in post-war Munich to support growth. Up until the early 1960s, a strongly monocentric planning model was adopted. Due to increasing car use, the *Alstead*, the heart of the old city centre, became blocked. Added to the negative

effects of congestion was the threat to the preservation of the city's historical character. In 1963, the city implemented the Jensen Plan, which was a more modern, polycentric model. It involved dividing the city into functional expansion zones with housing, recreation, industry and commercial activities, and diverting traffic around the city centre along ring roads, and building the U-Bahn (underground railway) and S-Bahn (suburban light rail) networks (Rosenfeld, 2000). With these moves, the city also took into account the further development of its international character. The search was for a combination of cosmopolitan influences (and the modern infrastructures and architecture that accompany it) and traditional urban values related to the identity of the *Altstadt*. The process of urban development and redevelopment, including the construction of the underground network, and the promotion of the international character of the city was accelerated by the 1972 Olympic Games (Bontje et al., 2011).

In 1992, Munich opened a new international airport, which further improved the region's position in an international network. After Frankfurt, Munich is the second largest German hub for Lufthansa, Germany's main airline company. Clark and Moonen (2014) note that this airport has given the Munich region more competitive power than, for example, Hamburg, Cologne and other economically healthy German regions. At the same time, investments were made in the site of the old airport, leading to the creation of a business centre with space set aside for trade fair facilities and offices (Clark and Moonen, 2014). The City of Munich holds shares in the airport and collaborates with the airport management company on the region's international connections.

In terms of international connectivity, Munich is among the top 50 cities in the world, and in the category of medium-sized cities, it is among the top five. Substantial investments in international air connectivity continued after 2000 (Clark and Moonen, 2014). Between 1998 and 2006, a high-speed light rail linking Nuremberg, Ingolstadt and Munich was developed, with further investments for upgrades being made after that.

Institutional thickness

What attracts attention in the Munich innovation system is what is sometimes referred to as *institutional thickness* (Koch and Stahlecker, 2006; Rode et al., 2010). It refers to the density of relevant institutes in the federal state of Bavaria with a high concentration in Munich, These are:

- institutes that operate in the research and development phases of knowledge, such as the LMU and TUM universities; the numerous Fraunhofer-Gesellschaft public research centres, including its nine main institutes (5 of which in the immediate vicinity of Munich) and a further 22 secondary centres (5 in Munich)[3]; the 13 Max Planck institutes (12 in Munich)[4]; the Helmholtz Zentrum (German Research Centre for Environmental Health) and the German and European patent offices;
- government and semi-government institutions that are involved in knowledge sharing and knowledge valorisation, such as the Bavarian Research Foundation; the Bavarian Research Alliance (BayFor); Bayern Innovativ and Bayern International;
- institutes that focus on economic policy research, such as the Centre for Economic Studies (Ifo).

What is relevant is not only the presence of leading high-tech research institutes, but also the interaction among them and the interaction with industry, policymakers and economic researchers. The innovation system of the Munich region is described as a highly interactive mix of private and public actors and research institutions. Amin and Thrift (1995) interpret the term *institutional thickness* as the whole of social and cultural conditions that promote economic growth. In addition to the core elements–the need to have strong institutions and a high level of interaction–the authors point to the great relevance of a sense of pursuing the same goal and of coordinating efforts between parties. Rode et al. (2010) and Clark and Moonen (2014) confirm this idea, noting that institutional thickness has been built up and strengthened over a long period of time. In the Munich region, this has led to stable cooperation and the joint development and formulation of a strategy in response to the intense international dynamics the region was facing.

Rode et al. (2010) also noted that institutional thickness brought about the appearance of an enterprising, active government. This applies to the local and regional authorities and to the federal state of Bavaria and the German national authorities. According to Clark and Moonen (2014), the intensive relationship between the city of Munich and the federal state is particularly important. They streamlined their action programmes over a period of several decades (EMI, 2012). Rode et al. (2010) conclude that institutional thickness is a core element of the region's economic success. They also use the term *triple helix* to refer to the connection between the top levels of the business world, universities and public research centres, and the government. These actors not only work together following a joint strategy, but they have also contributed to the promotion of the city and the region as an economic and innovative hotspot.

Munich mix

Koch and Stahlecker (2006) affirm that, in addition to the advantages of agglomeration and the proximity of several leading international companies and public institutions, it is especially the diversity in its economic structure that makes Munich so powerful. The region is unique because of the combination of its local dynamics and its function as a global hub. According to these researchers, not only

does this combination constitute a breeding ground for new companies and the generation of new ideas, knowledge and qualifications, but the economic structure is, due to its size and diversity, also a domestic market that demands innovation.

The combination of diversity and specialist clusters is also called the *Munich mix*–the *Münchner Mischung* in German (Clark and Moonen, 2014; Evans and Karecha, 2014): an economic structure in which several sectors play a role, and both large, internationally operating companies and small and medium-sized enterprises cooperate successfully. In this context, Clark and Moonen (2014) also speak of a 'cluster of clusters'. The concept of *related diversity* is crucial here (Asheim et al., 2007). Munich's economic structure is not only diverse, but also consists of specialised growth clusters in leading sectors in which private and public actors combine their knowledge in new applications (Evans and Karecha, 2014). If there is a certain level of connection between actors in terms of knowledge and skills, then sharing knowledge is easily done. Taken together, these circumstances reduce the region's sensitivity to economic shocks in a specific sector.

Multi-level governance

The interaction and coordination between the various levels of government is a characteristic of Germany, which is particularly relevant in Bavaria and the Munich region. Together with institutional thickness and the Munich mix, it denotes the existence of full multi-level governance between actors (large and small, the market and the government), between sectors (cross-sectoral) and between administrative levels (Bavaria, Upper Bavaria and Munich).

At the administrative level, the federal states sit on the Federal Council and therefore also have an influence on national policies. Conversely, many affairs filter down from the national level to the federal states, such as the German industrial policy, which focuses heavily on technological clusters. Examples are The High-Tech Strategy Germany (followed since 2006), Germany Leading-Edge Cluster Competition[5] and go-cluster.[6] The federal states have their own cluster policies, but they are linked to each other through the German Cluster Platform.[7] Efforts to identify new branches within existing strengths are an example of coordination practices between the federal state of Bavaria and the city of Munich. At the level of Bavaria, this is done through Bayern Innovativ and at the level of the city through Perspectiv München (City of Munich, 1998/2002).

Another example is the national programme *Energiewende* (energy transition), whose objectives have been implemented in the region and linked to technology and cluster policies (see below). Leading scientific institutes, such as Fraunhofer-Gesellschaft, Max Planck Society and Helmotz, are spread throughout Germany under a common denominator and are also strongly represented in the Munich region. A final example is the financing of start-ups. At the level of the city of Munich, this takes place through Munich Startup, which in turn is related to the Bavarian regional investment bank LfA Group, and especially to the BayStartUP programme.

Altogether, it is clear that the authorities have played a prominent role in Munich's success factors: physical investments, the Munich mix, institutional thickness and multi-level governance. In the following sections we highlight the role of the public authorities in establishing this system in the federal state of Bavaria and the city of Munich. The diversity in the economic structure emerged, in part, through an autonomous process that involved large companies settling in the city and the authorities taking steps to meet the need for space for other economic activities that followed. Other physical investments, such as those made in the airport, also facilitated the process. But as stated before, the Munich mix refers to the interaction between public and private, and between large and small actors. The government has made substantial investments in the regional innovation system and in reinforcing cluster processes, as will be shown below.

4.2.4 Human capital, knowledge infrastructure and financing

From spatial planning to innovation systems

In the 1960s and 1970s, policies were mainly designed to meet the space requirements of businesses and they were directed to the creation of universities and knowledge institutes. After that period, policies slowly shifted to investments in specific knowledge for the industrial sector and in knowledge circulation. As early as the 1980s, priority technology policies were implemented in the Bavarian Innovation Programme (BayIP) and the Bavarian Technology Introduction Programme (BayTP), in fields such as the life sciences, ICT and mechatronics (Berger, 2002). Another expression of these policies was innovation systems thinking, which expanded enormously during the economic downturn of the early 1990s. Rode et al. (2010) mention a number of causes of the economic stagnation in the region. The high-tech defence industry received fewer orders because of the less tense relations between the west and Russia. As the Munich region was highly specialised in precisely this field, it was hit extra hard by the falling investments. In the automobile, electrical and machine industries, which are highly export-oriented, it also led to redundancies. On top of all this, two threats were lurking in the region. First of all, the unification of East and West Germany might lead to Berlin becoming the new economic and cultural centre. Secondly, large parts of the industry sector were at risk of being relocated to low-wage countries. Both threats served as prompt to reflect on a fundamentally different strategy for the future.

Reversing the downward spiral: Offensive Future Bavaria
This future strategy was expressed in an extensive implementation and coordination programme known as *Offensive Zukunft Bayern* (OZB)—Offensive Future Bavaria. The federal state sold its shares in energy and infrastructure companies and invested the money in new high-tech initiatives. An example is Bayern Kapital, established in 1995, which received an investment of 75 million euros of public money to provide venture capital for start-ups, particularly in the high-tech sector. Since then, Bayern Kapital has invested over 250 million euros in more than 250 companies. The five currently operating funds are: Seedfonds Bayern, Clusterfonds Start-Up!, Innovationsfonds, EFRE and Wachstumsfonds Bayern[8] (Clark and Moonen, 2014).

Offensive Future Bavaria went through three phases, with OZBI starting in 1994 and OZBIII (High Tech Initiative) in 1999. The programme ended in 2006. After the first round of selling shares, the federal state sold its shares in state insurances during the OZBII phase and its shares in the energy and industry sector during OZBIII. The programme consisted of:

- investments in knowledge infrastructure and human capital, such as the opening of new faculties in universities, the creation new higher education institutions and training and technology centres, and additional funding for research programmes outside universities;
- international knowledge sharing, involving initiatives such as extra funding for the Bavarian Research Foundation, and the establishment of the Bavarian Research Alliance (BayFOR), Bayern Innovativ, Bayern International and technology transfer centres;
- valorisation, involving venture capital investments, start-ups and commercialisation of knowledge by SMEs such as BayernBG (private equity fund), Bayern Kapital (high-tech venture capital), BayTOU (high-tech start-ups), technology promotion programmes (BayTP) and start-up incubators.

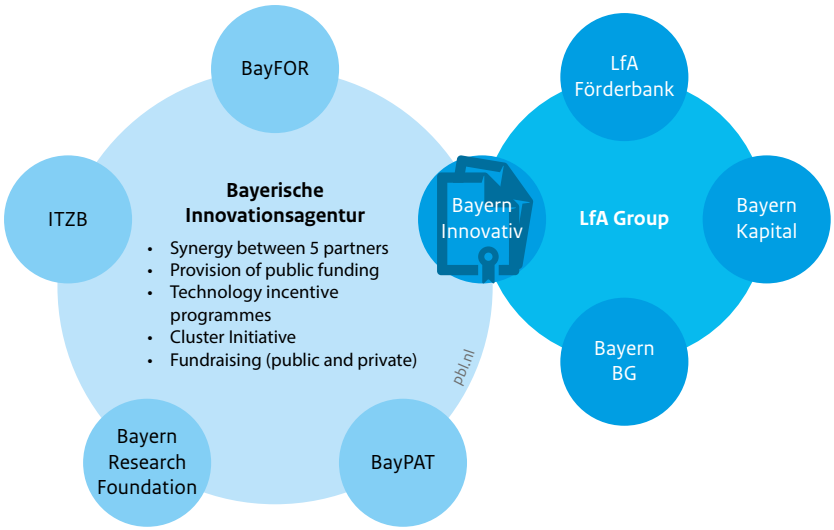
The Offensive Future programme had a budget of nearly 4 billion euros (Bavarian State Government, 2011a), comprised over 80 projects and provided support for more than 450 innovative but risky start-ups in the form of subsidies and loans (Evans and Karecha, 2014).

In 2008, more state funds were sold. In line with past initiatives, the BayFIT programme of the federal state of Bavaria continued to make efforts towards strengthening the knowledge infrastructure, promoting technology transfer to the market, supporting networks and clusters, supporting start-ups and, finally, setting up technology promotion programmes (BayTP).

Combining regional strengths in research and innovation.
Most of the bodies and promotion programmes discussed above still exist in 2018. This points to a high degree of continuity in policy. One consequence of the large number of programmes and organisations involved in execution is that policies have become fragmented and are therefore unclear for companies and institutions that want to appeal to them (Commission HdFplus, 2014). Accordingly, information and coordination costs are high. Fragmentation also leads to inefficiency issues when applying for federal and European subsidies. In order to streamline things, the *Haus der Forschung* (Research House) was launched in 2010. Directed at the five independent organisations BayFOR, BayPAT, Bavarian Research Foundation, Bayern Innovativ and IZTB (project management for technology stimulation projects), the objective of the Research House is to improve cooperation and steer practices towards greater transparency. The idea is to identify and supervise promising federal and European projects more effectively, find partners more quickly and make knowledge transfer (start-ups, patents, conferences, forums) more efficient. In 2014, the umbrella structure for cooperation between the five partners was continued under the name *Bayerische Innovationsagentur*, while expressly maintaining the five strong brand names (Kommission HdFplus, 2014).

The Munich region also has a long tradition of supporting the economy financially. In addition to the Staatsbank BayernLB (one of the six banks managed by German federal states), the Bavarian State bank (LfA Förderbank Bayern) was set up in 1951 as a regional development bank investing in SMEs that had difficulties accessing the general banking system.[9] The bank offers loans with a low interest rate, risk guarantees and independent advice. Several partner initiatives have been developed from within this bank, such as BayernBG (private equity), Bayern Innovativ, which is discussed below[10], and Bayern Kapital, referred to earlier. All these initiatives are interrelated with the OZP programme. Figure 4.5 shows the connection between public and public-private institutions as part of the overall innovation system in Bavaria. The Bayerische Innovationsagentur is shown on the left and the financial partner organisations are on the right. Bayern Innovativ is the connection between the two.

Figure 4.5
Research and innovation in collaboration



Source: LfA Group

Source: PBL, based on material provided by the LfA Group[11] and Kommission HdFplus (2014).

In addition to a financial strategy with clearly defined targets, the financial cluster itself is also important in the region. The city of Munich specialises in financial services, insurance services, asset management and risk-bearing financing. An important role is played by large companies, such as the Allianz Group, Munich Re, DAS, Unicredit and the Bavarian Insurance Chamber. But the public actors in the financial clusters also play a role in the economic stimulation programme. For example, public banks provide a great amount of financing to SMEs (Clark and Moonen, 2014). Ranking 37th in the Global Financial Centres Index, Munich is among the top 50 global financial hubs, and among the top 10 in Europe.

Relationship between the city and the federal state

As the capital of the federal state of Bavaria, Munich plays an important role in regional policies. Above it was mentioned that the city constitutes a separate level of administration, but the city's budget for economic development is much smaller than that of the federal state (Duell, 2006). The policies formulated by the city focus on spatial planning and infrastructure, the labour market, education, infrastructure to support businesses and start-ups. Despite the political differences and the strict control exerted by the federal state, the two levels are well tuned to each other (Duell, 2006; Rode et al., 2010). Joint projects, such as the development of the regional airport, often see the establishment of an organisation with both Bavaria and the city of Munich on the Supervisory Board. The processes are not entirely free of conflict. For example, no agreement was reached on the way to cover the costs of further expansion of the airport and on whether or not to develop a high-speed magnet train.

Given that the urban area of Munich continues to expand and commuting patterns transcend the level of the city, regional cooperation on issues such as infrastructure and housing has been something of a struggle for quite some time now (Blatter, 2006). The present-day administrative boundaries do not correspond to the scale of the problems in those areas. In 2008, a bottom-up effort led to the establishment of the Munich Metropolitan Region (EMM), a structure for cooperation between the cities of Munich, Ingolstadt, Augsburg, Rosenheim, Kaufbeuren, Landshut and the surrounding rural districts (*Landkreise*). Although Clark and Moonen (2014) believe that progress has been made, for example in projects such as the high-speed rail and unified ticketing systems for multimodal journeys, many political and cultural differences still form an obstacle to cooperation. Additionally, many local authorities do not discern the importance of the larger geographical scale.

Human capital and knowledge infrastructure in Munich

The city of Munich also introduced a policy strategy during the period the OZB programme was operational: *Perspektive Munich* (City of Munich, 1998/2001). It is an integrated development concept for the city, which

combines economic, social and spatial objectives in a flexible and proactive way. This strategy too was important for the economic development of the city, because it meant that urban development plans and approaches to the built environment were streamlined largely towards economic and social goals (Thierstein et al., 2008). Another critical factor, as Clark and Moonen (2014) indicate, is that the national government was involved in developing the strategy. Several institutions, such as the International Technology Forum Bavaria, Bayern International and Invest in Bavaria, were established to provide support for the new cycle of internationalisation[12], with a special focus on further exploiting the knowledge hub function. According to Clark and Moonen (2014), the strategy made it possible to reinforce the connections between SMEs, R&D activities of large companies, research institutions and commercial specialists. The *Perspektive Munich* strategy is another initiative that has been maintained for a long time by subjecting it to ongoing evaluation and adaptation (e.g. the policy documents by the City of Munich, 2005, 2007, 2015).

An important aspect of the city's policies in this period of 'Perspektive Munich' is its commitment to human capital. This started in the early 1980s with the application of European subsidies. The strategy document Economic Development and Employment Policies for the City of Munich (City of Munich, 1999) served to launch the city's Employment and Qualification Programme (MBQ[13]). The programme is aimed at enhancing the match between supply and demand, especially for new industries: ICT, space technology, measurement and control technology, environmental technology, biotechnology and transport management systems. The city and the employment office worked closely together (Verbund Strukturwandel GmbH, currently named Müncher Arbeit). Rode et al. (2010: 13) conclude that there is also a synergy between academic and vocational education (dual system) offered jointly by the federal state, the city and businesses. Munich is the only German city responsible for its own schools, and as a result, the level of local coordination is high.

In 2002 and in 2005, the city of Munich accentuated its policies with the strategy Munich–City of Knowledge (City of Munich, 2005): the central concept was knowledge as a production factor, but social and cultural sources were also important. This policy line gave rise to specific institutions such as the Munich Technology Center (MTZ) and the Munich Business Startup Office (MEB), a collaboration effort between the municipality and the Chamber of Commerce. The central premise of the city council was that society has become a knowledge society whose main features are knowledge development and knowledge exchange, and that is precisely cities, and Munich in particular, that facilitate these practices in an optimal way. Action agendas were drawn up to strengthen the knowledge base of the city, to ensure knowledge is engaged in the city and the urban economy, to support growth sectors, to attract and retain talent and to reinforce organisational capacity.

4.2.5 Entrepreneurial dynamism

Strengthening the knowledge cluster with its potent high-tech component not only benefited the established-order companies in Munich, but more particularly also the city's entrepreneurial dynamism. The local standards that had to be met were among the highest in all of Germany (Bergmann et al., 2002). Koch and Stahlecker (2006) confirm this in a piece of research, for which they conducted many interviews with experts and entrepreneurs. Munich is described as highly dynamic in the field of entrepreneurship, partly because of the rich diversity in its economic structure and its robust knowledge infrastructure.

The funds that were set up specifically to support entrepreneurship have already been referred to above. They are an integral part of a much broader, active entrepreneurship policy, which was initiated mainly by the federal state of Bavaria. Hülsbeck and Lehmann (2005) coined this policy *Between Laptop and Lederhosen*. They use the term to illustrate the two dimensions to the policy: a traditional entrepreneurship policy aimed at sectors that are not knowledge-intensive, and an entrepreneurship policy aimed at innovative and high-tech activities. One of the things that reflects the success of the policy is the fact that Munich then, as it still does today, topped the lists of start-up intensities in German regions for both knowledge-intensive and more traditional businesses (Audretsch and Keilkeilbach, 2003).

From the early 1990s, entrepreneurship policy was enriched with education programmes through the development of specific knowledge and skills. The education programmes themselves were streamlined with entrepreneurship policies (Hülsbeck and Lehmann, 2005). Following that period, policies had a strong focus on the dissemination of knowledge: the diffusion of research and technology to businesses (mostly SMEs) in the region. Hülsbeck and Lehmann (2005) describe the special policy initiatives that were used for this purpose, including *Hochsprung* (aimed at networks), *Fluegge* (aimed at financing) and BayernPatent (to commercialise patented knowledge). Universities and colleges of higher education set up Technology Transfer Centres. But the period also saw the creation of 23 technology-oriented incubators that offered convenient and inexpensive business space and facilitated collaboration between scientists, technical engineers and company managers.

4.2.6 Residential amenities

Munich benefits from its high-quality physical environment. Above we mentioned the renovation and rebuilding efforts to bring the old city centre back to its original state. The mix of historical buildings, attractive nature (Starnbergermeer and the Zugspitze), major events (*Oktoberfesten*), and urban facilities and fairs mean that Munich has been one of the most important tourist centres of Germany for many years (Evans and Karecha, 2014). Munich is considered to be among the cities with the highest quality of living in Germany. This is supported, not least, by the high quality of the education system, the health care and care facilities, the quality of the infrastructure and numerous cultural facilities (IW Consult, 2010). But the city of Munich has also used its spatial planning to pursue policies targeted at creating and maintaining its status as an attractive city. Spatial planning has focused expressly on combating urban sprawl, with the specific aim of creating density in the city (City of Munich, 2005). In its 2005 policy document, the city summarised its approach as 'compact, urban and green'.

Munich has also linked its initiatives towards creating an attractive environment for living and working to the retention and attraction of talent, which is achieved, among other things, through special policies aimed at students (City of Munich, 2005; EMI, 2012). Another link is that between physical development and new economic activities. An example of this is the transformation, in the 1990s, of plots of land formerly used by the military. The aim was to combine the preservation of existing activities and the development of spaces for new activities such as biotechnology, ICT and the media (Rode et al., 2010). With the move, the city wanted to prevent locations from becoming monofunctional and to create synergies between old and new companies.

4.2.7 Clusters

A focus on developing and applying cluster-relevant technologies

An important concept in the policies of the federal state of Bavaria is the significance of combining local knowledge with strong networks of public and private organisations, at multiple levels within and outside the region (Kommission HdFplus, 2014). In this way, the region attempts to use its Munich Mix to achieve ongoing renewal. The previous section mentioned that the formulation of a joint strategy and a high degree of coordination between actors are considered to be important features of the city's innovation system. OZBI partly built on previously identified technological focal points in the region, a point that was already made in policy documents of the mid 1980s (BayStMWV, 1985). In the early 1990s, the Federal State Ministry of Economy, Media, Energy and Technology (BayStmWI), worked together with research agencies such as the Ifo, Roland Berger and McKinsey to perform an analysis of the global growth potential of high-tech markets (Berger, 2002). The analysis was translated to the context of those technologies with a strong presence in the Bavarian economy, such as green biotechnology for the agricultural and food industries, mechatronics and new materials for the electrical and mechanical industries. Consequently, the OZB focused mainly on areas such as: life sciences and medical technology, ICT, environmental technology, space travel, new materials and mechatronics (Berger, 2002; Koll and Pilgrim, 1991; BayStMWVT, 1994; Little, 2000). At the time, policies therefore concentrated on technologies that are important for several, regionally strong sectors, rather than on specific sectors. This attention for specific high tech can be seen today in organisations that deal with project execution, such as Bayern Innovativ (energy, materials, mobility, electronics, environmental technologies) and Bayern Kaptial (venture capital for high-tech SMEs). The high-tech focus is also present in technology stimulation programmes, such as BayTOU (high-tech start-ups) and BayTP, which deals especially with ICT, electric vehicles, new materials and the fields of microsystems, biology, genetics, health care and energy.

In this context, Cooke et al. (2012: 49–50) refer to Bayern Innovativ as a 'textbook example' of a diversification strategy related to the existing potential of the region. That is to say, identifying key technologies with cross-sectoral potential (see Table 4.1). According to the authors, this strategy contributes to the timely renewal of clusters and to cross-fertilisation between clusters.

At the level of the city of Munich too, it is recognised that combining new niches with traditionally strong industries is a beneficial approach: 'The combined potential of Munich's old and new economic niches was recognised within a flexible development framework called Perspective Munich, which also involved the state government. This has allowed spatial decision-making to foster links between SMEs, in-house R&D of large firms, research bodies and commercialisation specialists'(Clark and Moonen, 2012: 11).

In the Research, Innovation and Technology Programme (BayFIT) of the Bavarian State Government (2008), many of these focal points are still recognisable. They include the life sciences (mainly biotechnology and systems biology), ICT, efficient production technologies (mechatronics, automation, robotics), new materials (intelligent materials, nanotechnology and microtechnology) and cleantech (energy efficiency, transport and environmental technologies, electric transport, innovative technology-based services and renewable raw materials such as biofuels).

In the comprehensive research plan (*Gesamtkonzept*), Technology and Innovation, the Federal State Government (2011a) emphasises that it is desirable to ensure a large

Table 4.1

Matrix diagram showing relationships between clusters and technologies as a strategy for diversification

	Technologies									
Branches	**Biotechnology**	**Laser/optics**	**Knowledge-based systems**	**Microsystems technology**	**New materials**	**Chemistry**	**Medical engineering**	**Energy/environment**	**Traffic engineering/logistics**	**ICT**
Automotive industry		■	■	■	■	■		■	■	■
Electrical industry	■	■		■	■	■	■		■	■
Mechanical engineering		■	■	■	■		■	■	■	■
Food industry	■									
Chemistry/pharma	■			■	■	■	■			■
Building industry					■			■		
Plastics/timber	■				■					
Ceramics	■				■		■			
Textiles					■		■			
Metal processing					■		■		■	■

■ Combinations based on the application of technology in a cluster

Source: Cooke et al. (2012: 50), based on data from the Bayern Innovativ website.

degree of autonomy for research institutions. This means sufficient space is made for creativity and spontaneity, without the government determining the exact frameworks and subject areas. Nevertheless, with an eye on achieving critical mass and excellence, the authorities also recognise the importance of continuity in the chosen strategies. The focal points that have been selected are therefore once again in line with those from the past: life sciences, ICT, efficient production technologies (mechatronics, automation, robotics), new materials (intelligent materials, nano and microtechnology), cleantech (energy efficiency, transport, environmental technology, renewable raw materials, electric transport), innovative technology-based services. In addition to these focal points, the strategic objectives of the *Gesamtkonzept* are related to increasing public interest in research and science. The objectives aim at optimising the conditions for research, technology and innovation, which includes attracting the best researchers, and providing tax concessions, R&D infrastructure and financing for SMEs. But they also intend to increase the competitiveness of all kinds of companies and to improve cooperation in attracting federal and European funds (also see Innovative Agentur).

Cluster initiative Bavaria

In addition to the focus on technologies, which is discernible in numerous programmes and organisations, cluster platforms have been set up since 2006. The most recent initiative is *Cluster-Offensive Bayern*–Cluster Initiative Bavaria (StMWIVT, 2014, 2017). Here too, the focus is not per definition on sectors (with the exception of some cases such as the chemical industry) but rather on 5 thematic competences covering 17 technology- and industry-oriented innovation clusters (see Table 4.2). Each innovation cluster is administered by its own management team and has its own centre for information, communication, coordination, knowledge transfer and innovation. Three of these clusters are also recognised by the national cluster programme Germany Leading-Edge Clusters Competition (*Spitzencluster*-Wettbewerb): MAI Carbon (textile area comprising Munich, Ingolstadt, Augsburg), biotech (Munich) and medicine technology (Medical Valley in Nuremberg). In fact, compared to the rest of Bavaria, all the innovation clusters in Table 4.2 are well represented in Munich (Duell, 2006; Von Streit, 2010b).[14]

Table 4.2
Cluster Initiative Bavaria subdivided into five themes and seventeen innovation clusters

Theme	Innovation cluster
Mobility	Aerospace
	Automotive industry
	Rail engineering
Materials	Chemistry
	Nanotechnology
	New materials
	MAI Carbon
	Forestry
Health	Biotech
	Medical technology
	Food
Energy	Energy technology
	Environmental technology
Digitisation	ICT
	Sensor technologies
	Electrical industry
	Mechatronics and automation

Source: StMWIVT (2017); https://www.cluster-bayern.de/en/

The cluster programme can also be seen as a change in policy-making caused by the drying up of public financial resources. Rode et al. (2010) and Von Streit et al. (2010b) conclude that the wide scope of the seventeen innovation clusters may be an indication that public funding has been used up. Instead of maintaining a clear focus on certain technologies, every sector is now somewhat involved and the emphasis is on creating platforms for interaction (Von Streit et al., 2010b). In contrast to previous programmes, which were financed by the sale of federal state shares in energy and infrastructure companies, the cluster programmes are initiated by the business world and involve fewer public resources. The government is less able than before to indicate clear focal points with large-scale investment programmes. According to some, the focus has shifted to low-key projects, dialogue and the mobilisation of private parties

A focus on social issues

The future-oriented sectors also have a distinctly green component. Biotechnology, cleantech, green energy and sustainable means of transport were already acknowledged in policy-making at an early stage (Rode et al., 2010). The *Gesamtkonzept* Research, Technology and Innovation (Bavarian State Government, 2011) discussed above also pays attention to social developments in relation to Bavaria's innovation and technology policies. The issues that are dealt with are a declining workforce (and, by extension, the attempts to attract talent and generate enthusiasm for Bavaria); increasing competition from globalisation (trying to remain the top region); climate change (involving energy saving, the implementation of sustainable energy generation, and climate adaptation); the creation of new technologies for production, distribution and consumption of energy (enhancing cleantech); health care, mobility and communication (the combination of life sciences, electric transport, ICT); the increasingly interdisciplinary character of technological developments in the network economy (with great concern for transcending sector borders and setting up interregional networks). These issues touch on the cluster themes listed in Table 4.2.

Recently, a large amount of attention has been given to energy in the *Energiekonzept 'Energie innovativ'* (Bavarian State Government, 2011). The reasons for this are the future scarcity of fossil fuels, the increasing demand for energy, climate change and the nuclear disaster in Japan. The government of the federal state summarises this in its objective 'beyond oil and the atom'. One of the measures that has been taken is the opening of the energy agency Energie Innovativ[15], which organises the coordination and information between the academic world and the business world in the field of energy. Eight challenges have been defined. The first is to speed up the introduction of sustainable energy production. The aim is to ensure that 50% of the electricity consumption is sustainable by 2021. The agency is going for several sources, including hydropower (foreseen to cover 17% of the electricity consumption in 2021); wind energy (an increase from 0.6% currently, to 6% to 10% by 2021); thermal and photovoltaic energy; bioenergy (from 6% to 10%); solar energy (from 3% to 16%); ambient heat, using systems such as heat pumps (from 0.5% to 4%), and geothermal energy (from 0.6% to 1%).

Other challenges are the expansion of the energy network, more efficient energy consumption, more efficient heat consumption, the expansion of the natural gas infrastructure, sustainable mobility, a single European energy market and the exploration of new energy technologies. Four R&D themes have been formulated for the last challenge: energy generation, energy efficiency, energy storage and energy networks. The *Energiekonzept* serves to define each challenge in specific detail (*'was wir wollen'; 'was wir tun müssen', i.e.* 'what we want to do'; 'what we need to do'). Examples are *Merkblatt zur Förderung von Energieeinsparkonzepten und Energienutzungsplänen* (StMWIVT, 2015), Direction of Stimulation Efforts towards Energy Saving and Energy Consumption (*Bayerisches Energieforschungsprogramm* 2015[16]) and the *Bayerische Energieprogramm*–Bavarian Energy Programme (StMWIVT, 2016), published in 2016, in which much of the *Energiekonzept* is promoted.

Another example showing that the state of Bavaria and the city of Munich in particular feel strongly about issues concerning climate and the environment is the *Umweltpakt Bayern*.[17] This coalition between the state of Bavaria and the business world arose in 1995 and aims to achieve greener economic growth. The initiative was reinforced in 2015 with the signing of the document Strengthening the Environment and the Economy. Yet another example is the *Bayerische Klima-Allianz*[18]: in 2004, the public authorities and semi-public institutions such as the urban districts, professional associations of architects, trade unions and sports federations signed a joint declaration on cooperation to combat climate change. Finally, 2014 saw the establishment of the Bavarian Climate Protection Programme 2050 (*Klimaschutzprogramme 2050*) and the BayKLAS Climate Adaptation Programme (*Bayerische Klima-Anpassungsstrategie*).

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4.3 South-east of North Brabant province (Brainport Eindhoven)

4.3.1 Outline

There are at least four factors that underlie the economic success of the south-eastern region of North Brabant province: the proactive role of policy, the cluster of knowledge-intensive companies, the knowledge infrastructure in the region, and the dynamics of entrepreneurship. The story of the Eindhoven region, however, starts with the establishment of leading companies such as Philips and DAF. The growth path of the region is highly path-dependent, having felt, for several decades, considerable influence from these companies, both positive and negative. Positive, due to the expansion these companies underwent and the social role they played in the region. Negative, because of the impact these companies had on the region when they found themselves in dire straits.

The difficult times created a sense of urgency that brought private and public parties together, and that reaction in turn formed the basis for the current (C7) governance model. Secondly, the knowledge-intensive (C1) cluster proved crucial. Philips may have turned Eindhoven into a company town, but the region as a whole was also able to continue to develop into a cluster of companies with a strong R&D profile. Consequently, the south-eastern part of North Brabant has grown into a *Brainport* of international relevance. This Brainport arose from the strong specialisation in high tech and at present consists of a cluster of related knowledge-intensive businesses with several subspecialisations, including mechatronics, robotics and advanced materials. Another decisive factor was the transition from a closed innovation system to an open one in which companies work together and share inputs, such as products and knowledge. A characteristic feature is the High Tech Campus, which evolved from a Philips R&D centre into a location that currently houses more than 125 companies. Investments in (C4) knowledge infrastructure and (C2) entrepreneurship were also important, one example being the establishment of the Eindhoven University of Technology. Finally, business activity in the south-eastern part of North Brabant took place in a context of proactive policies, partly out of necessity given the conditions of economic hardship, and partly due to the tradition of public-private partnerships and the adoption of the triple helix model, which, in addition, is strongly multi-level oriented thanks to the involvement of various tiers of the administration. The city of Eindhoven (and the campuses within it), the region, the province of North Brabant, national policies and cross-border cooperation structures all played a role in the success of the region.

4.3.2 Geographic and administrative demarcation of the region

Figure 4.6 shows the statistical classification (NUTS) for the city of Eindhoven, the south-eastern part of North Brabant (NL414), and North Brabant province, as a whole (NL41). The division of North Brabant corresponds to the administrative boundaries of the province (which has an elected provincial council), and the division of the city coincides with the municipality (with an elected city council and mayor). The data presented in the introduction to this chapter correspond the region formed by the south-eastern part of North Brabant (NL414). The region has about 750,000 inhabitants. In addition to Eindhoven, which has approximately 250,000 inhabitants, the region has 22 other municipalities, of which Helmond is the largest with over 90,000 inhabitants.

4.3.3 Initial conditions

Ups and downs

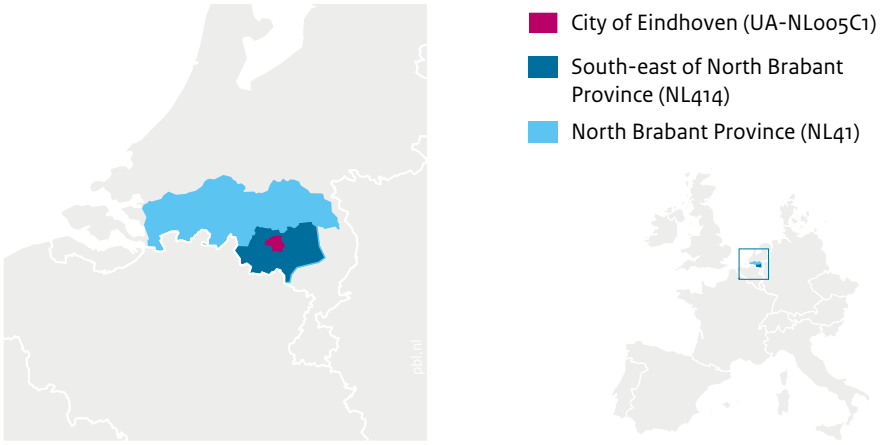
The economic development of the region has seen several periods of ups and downs that have been decisive for the more recent developments in the area (also see Van der Meer et al., 2008).[19]

At the time of the first, and especially the second, industrial revolution, the foundations were laid for the economic structure of the region. Philips was founded in 1891 and changed the appearance of the city because of its size (in 1916 Philips already had 3,700 employees), the corresponding factories, the dwellings for its workers and the institutions that arose around the company, such as the savings bank Coöperatieve Centrale Boerenleenbank Eindhoven, the present-day Rabobank. Philips was so actively involved in the economy and public housing that it is fair to say that Eindhoven was a company town (Havermans et al., 2008).[20] In 1928, business activity was also started by the truck manufacturing company Van Doorne's Aanhangwagen Fabriek (DAF) that, like Philips, was of great importance to the region.

Founders of other businesses in the region were often former Philips employees who had also received their training at the company. The work experience made collaboration a straightforward exercise. An example of these spin-offs is the company set up by P. van der Leegte, a metalworker who resigned from Philips and started manufacturing metal products for Philips and DAF in 1952. This company has grown into the present-day VDL Groep. Philips and DAF and their spin-off suppliers have strongly influenced the growth path of the region.

In the period 1970–1985, Philips was still by far the largest employer in the region. In 1971, the company had 99,000 employees in the Netherlands (almost 370,000 worldwide), of whom almost 41,000 worked in Eindhoven (Havermans et al., 2008). But, as mentioned above, several spin-off

Figure 4.6
Location of City of Eindhoven, south-eastern part of North Brabant, and North Brabant as a whole



Source: Eurostat, adaptation by PBL

businesses emerged from Philips. Another example is ASML (machines for the semiconductor industry), which was established in 1984 and employed 100 people in 1985. Though today the concentration of firms in the knowledge and manufacturing industry is still characteristic of the south-eastern part of North Brabant, the basis for this was laid a long time ago. A network of smaller suppliers was active around the large corporations, creating their own jobs.

In the period 1983–1993, the presence of large companies showed its downside. Philips and DAF were hit hard by the economic recession. The period saw the bankruptcy of DAF and the launch of Operation Centurion at Philips, which involved mass redundancies. In the early 1990s, the large-scale reorganisation of Philips and its suppliers led to the loss of tens of thousands of jobs in the region. Worldwide 55,000 jobs disappeared (Horsten, 2016). The symbolic and emotional low point of this period was the company's relocation to Amsterdam at the end of 1997 (De Zwart, in E52 2015).

But between 1993 and 2000 there was also economic recovery and there was room for expansion. In 1999 the High Tech Campus was developed on the site of the former Philips physics laboratory (Natlab).[21] During this period, policies were intensified and focused initially on European subsidy programmes: the European Commission designated the south-eastern part of North Brabant as an Objective 2 region, which opened up all kinds of possibilities for structural strengthening of the economy (Lagendijk and Boekema, 2008).

The economic downturn produced a sense of urgency and resulted in numerous initiatives and new economic activities in the region. In the period between 2000 and 2009, the region developed into Brainport: going beyond high tech and beyond the city of Eindhoven, it is a network economy operating in an internationally recognised knowledge region. An example of a component of this network economy is the High Tech Campus. In the first stages, the Philips research departments–which until then had been scattered over the city–were concentrated on this campus, but in 2003 Philips decided to open the site to other companies as well. This proved to be a successful move. The interaction taking place on the campus led to new innovations. In a short time, almost a hundred other companies were housed on the site in addition to Philips. It was referred to as 'the smartest square kilometre in the world'. In 2004, national recognition of the importance of this region for the Dutch economy was summed up in the concept of *Brainport* (Ministry of VROM et al., 2004).

The revitalisation of the region, therefore, had a lot to do with the presence of Philips and with the opportunities that arose when Philips shrank dramatically in terms of employment and in terms of physical space. To quote De Zwart: 'As it moved away, Philips left behind two things that the city still reaps profit from today: knowledge and space' (E52 2015).

After 2008, the region had to show its resilience once again during the financial and economic crisis. At that time too, the spatial legacy of Philips was important. 'There were many inexpensive plots of land suffused with industrial history. The ideal habitat, it turned out, for a new, productive group of urban dwellers: the creative class' (De Zwart, in E52 2015). The Strijp S site is an example of redevelopment of a location for the new economy. Old Philips buildings were transformed into creative clusters

of design, technology and cultural industries, including the Klok building (a collaboration project between Housing Association TRUDO and the city council) and Witte Dame, which now houses the Design Academy (Fernandez, Maldonado and Romein, 2009).

Philips sold the Campus in 2012. It went on to grow into an R&D ecosystem with more than 125 companies and institutes employing over 10,000 researchers, developers and entrepreneurs. In the words of the Campus itself, the preferred way of working is that of open innovation: 'This involves Campus companies sharing knowledge, expertise and R&D facilities with each other to be able to innovate faster, better and in more customer-oriented ways'. In addition, companies on the Campus work closely together with businesses elsewhere in the region.

4.3.4 Governance

Triple helix and multi-level governance

The description of the ups and downs of economic development shows especially how important Philips and DAF and the related high-tech cluster were, and still are, for the region. The way the region responded to the mass redundancies at DAF, Philips and their suppliers resulted in a unique governance model, in which the national government played a distinct role.

In the early 1990s, 21 municipalities in the region decided to cooperate to counter the economic downturn. With support from Brussels, they created the Stimulus Programme, a fund aimed at strengthening the economic structure. Van Winden et al. (2014) offer a detailed account of the immediate cause for the collaboration and of how the motivation to improve the economic structure and growth brought together three key figures: the mayor of Eindhoven (Rein Welschen), the chairman of the Board of Governors of the Eindhoven University of Technology (Henk de Wilt) and the chairman of the Chamber of Commerce (Theo Hurks). Eventually, the 21 municipalities were ready for action. Policies were mainly geared towards achieving, and building on, Objective 2 status (a European structural strengthening fund) for the region. The programme proved to be successful. A regional fund served as a lever to access European funds and other national funds in the Netherlands. With a working capital of approximately 3 million euros (based on an amount of roughly 5 euros per regional inhabitant), the Stimulus Programme managed to obtain around 180 million euros in European subsidies. The most important gain of the programme was the creation of new networks. Companies and institutions had the possibility to form partnerships to submit projects and obtain subsidies. Mutual trust and cooperation increased exponentially. This resulted in 60 cluster projects and 400 other types of projects. In addition, funds from the Stimulus Programme were used to carry out large-scale refurbishing and development of industrial sites, and create 33,500 positions on training courses and 4,000 jobs (also see Fernandez Maldonado and Romein, 2009).

The contacts within the triangle of government, industry and knowledge institutions were intense and based on mutual trust. Companies had become aware of the vulnerability of the region and of the need to work together towards recovery and the creation of funds. Regional solidarity also formed the basis for the so-called *triple helix*, the cooperation between the regional authorities, the business world and the knowledge institutions.[22] Horlings (2010) characterises the contacts in this collaboration structure as informal, with negotiations being conducted behind the scenes. The main suggestion here is that these forms of collaboration do not involve the drawing up of complex contracts.

The creation of the High Tech Campus is partly the result of a public-private collaboration. According to Kantelberg (2013), there is a story that the Philips CEO, Cor Boonstra, and the Eindhoven city council made a deal in 1997: 'Philips moves its headquarters to Amsterdam, but to compensate it has to invest in a technological campus south of the city [...]. A clustering of those activities should result beneficial for Philips, while the municipality of Eindhoven would retain jobs in a field that offers many opportunities for further development'.

Combined with a more favourable economic situation and an optimistic business climate, the Stimulus Programme brought about new dynamism. The regional economy widened its scope. An influx of foreign companies started to occur. New growth sectors developed, including automotive, design and business services. At the same time, suppliers became less dependent on Philips and DAF as they entered new markets and developed new products. Finally, thanks to the development company NV Rede, many new small businesses were offered start-up opportunities in multi-tenant buildings.

The Stimulus Programme (1994)[23] was continued in the form of the Horizon Programme (2002) and eventually Brainport. In 2005, the Sistermans Commission published *Brainport Navigator 2013. Beyond Lisbon*, which constituted an integrated agenda that set basic conditions and included actions in fields such as Human Capital, Technology and Entrepreneurship. The Horizon Programme, a strategic action plan drawn up by the Eindhoven Regional Collaboration Association (SRE), was primarily aimed at the transition from industrial mainport to top technology region, and the Brainport programme was aimed at widening economic and social development of the region (Commissie-Sistermans, 2005). Brainport placed far more emphasis on developing the labour market, innovation through the marketing of applied knowledge, resilience to economic shocks (through diversification), and not

unimportantly, it also focused on strengthening international visibility and reputation and on creating an attractive business climate. The Brainport strategy was also much more of an effort towards creating a bridge to national initiatives.

Under the leadership of Rob van Gijzel, who became mayor of Eindhoven in 2008, the Brainport strategy was further developed into a strategy and implementation programme for the south-eastern Netherlands, the Brainport 2020 programme. This gave the triple helix collaboration structure an extra impulse, in the form of an innovation ecosystem[24] with collaboration taking place at all levels, in all sectors, and between companies, government authorities and knowledge institutions. Ambitions were heightened too: Brainport was to be one of the top 3 technology regions in Europe and one of the top 10 worldwide by 2020 (OECD, 2014). To achieve this, efforts were also made to reinforce cross-border cooperation with Leuven and Aachen and to increase public investments in the region, especially in R&D. Brainport 2020 encompasses a list of 70 actions that are linked to the 2020 objectives and cast into a monitoring system.

The triple helix collaboration of the Brainport region has attained international recognition, with Katz and Wagner (2014) and OECD (2013) offering detailed descriptions of the unique forms of collaboration found in the Eindhoven region.

The OECD (2013b) does no only refer to the regional structure and multi-level governance but devotes special attention to the cross-border cooperation that is taking place in the Brainport region: 'The Top Technology region/ Eindhoven-Leuven-Aachen triangle' (TTR-ELAt). For decades now, this programme has focused on stimulating cross-border activities, for instance by taking care of institutional and bureaucratic problems that hinder cooperation between countries or by increasing international attractiveness. The large number of cooperation projects in the three-nation area has contributed to defining TTR-ELAt as the most relevant cross-border functional cooperation structure supporting technology and innovation policies (Nauwelaers et al., 2013).

The role of the province

Over the past two decades, North Brabant province has been heavily involved in the economic development of the region, although formally the Dutch provinces have only been responsible for regional economic policies since 2011. In that year, it was agreed that the government would withdraw from the area of regional economic affairs. The arrangement was also ratified in an Administrative Agreement (Ministry of BZK, 2011). An analysis of North Brabant policy documents shows that the province was highly active in the field of economic development well before 2011.

In 2002, under the Brabant in Balans programme, this activity still mainly concerned facilitating new economic developments with regard to physical space[25], and particular attention had to be paid to 'ecological and socio-cultural aspects'. The main objective of the province's spatial planning policy was to use the available space more carefully. North Brabant was characterised as an attractive residential location 'between three metropolises': Randstad in the Netherlands, the Ruhr district in Germany and the Flemish Diamond in Belgium. The area around Eindhoven (regarded as '*the* centre for knowledge-intensive industry and services') received support from provincial policies particularly in the form of investments in accessibility. One example is the Westcorridor project, which has led to the emergence of new residential and working locations around the intersections of major arterials. The province also focused on reinforcing the position of Eindhoven Airport.

The Framework Memorandum Dynamics and Innovation was published in the same period, following its adoption by the Provincial Parliament in the spring of 2002. It named innovation as one of the focal points in the socio-economic policy for the years ahead. In 2003, the province formulated a policy line that was aimed mainly at strengthening Brabant as a top region for innovation: Brainport Brabant (Province of North Brabant, 2003). The province had the ambition to not only maintain its position as a European top region in the field of innovation, but also, insofar as possible, to further strengthen it. A sharp choice was made to use innovation and technology as a guiding reference for policy efforts in other areas. The province wanted to be, first and foremost, a source of inspiration, a stimulator and a coordinator, and wanted to ensure, within its capabilities, the most favourable climate for innovation possible (Province of North Brabant, 2003). To achieve this, the province set up the Brabant Innovation Council, which had 10 to 12 members and was chaired by Royal Commissioner Maij-Weggen.

Building on the Framework Memorandum Dynamics and Innovation, four main policy lines were identified as most promising and most essential for the development of North Brabant into a leading innovation region. These policies concerned strengthening the knowledge infrastructure, dealing with the pressure points in matching education and the labour market, stimulating innovation in companies, promoting new business activities, internationalising knowledge and building up an innovative business climate (Province of North Brabant, 2003). To finance the policies, the province used resources that were already available through the Economic Policy Implementation Programme and

appealed to the various European and national programmes targeting provinces. In total, the effort involved more than 400 million euros in additional investments (Province of North Brabant, 2003).

The administrative agreement for the 2007–2011 period, Trust in Brabant, was drawn up in 2007. The economy occupied an even more central position in provincial policies: 'In economic relationships, which are becoming increasingly global and competitive, the presence of strong regional infrastructure plays a crucial, and sometimes even decisive, role. The quality of this infrastructure is important for the question of whether it is possible to respond to new opportunities in sufficiently innovative and resilient ways' (Province of North Brabant, 2007). It should be noted that infrastructure had to be understood in a broad sense. 'In an economy in which every day more and more machines are being replaced by people and services, it is no longer just about physical things such as roads, canals and locations. Social, cultural and ecological qualities are also becoming more and more crucial. High-tech cannot do without a high 'touch', according to North Brabant province (Province of North Brabant, 2007).

Dynamic Brabant was the economic programme line in the Trust in Brabant administrative agreement. The programme focused, among other things, on stimulating innovative residential and business landscapes. The business climate was the central point ('Brabant, brimming over with energy') and it was in line with the national programme Peaks in the Delta. The ambition of the province was to secure, and maintain, a top position in Europe in innovative entrepreneurship, supported by a properly trained workforce–to be among the top 5 innovative European regions by 2011. For the period 2008–2011, a total of 27 million euros was allocated for the development of the labour potential, along with a further 7.8 million euros for investments in the quality of business locations and 12 million euros for efforts towards a clean, smart and competitive economy in Brabant. Using renewable energy, reducing energy consumption and strengthening the innovation capacity of small and medium-sized enterprises were seen as particularly interesting economic opportunities.

In the framework of the Dynamic Brabant policies, several multi-year programmes were developed, such as Endorsing Technology, which is intimately related to the high-tech cluster. The 2008 financial crisis forced the province to develop a new outlook, the Brabant Agenda. The province wanted to 'look beyond the crisis and take it as an opportunity'. The new circumstances required a new agenda, which was drawn up under the supervision of Royal Commissioner Van der Donk. But a new investment strategy was also needed. After all, even though substantial savings had to be made, resources were still being provided for investment. These investment plans were laid down in a separate policy document, the Brabant Invests in the Future Strategy (Province of North Brabant, 2010a).

Resources for the investment strategy came from the selling off of shares in the energy company Essent. Part of the capital was used for social investments. The amount available for investments in the future of North Brabant was approximately one billion euros (Province of North Brabant, 2010b). A separate investment fund was set up to focus on five investment domains and a related set of rules. The essay *Essence of Knowledge*, provides a description, from the perspective of competitiveness, of the province's vision of its future as a sustainable knowledge region. It includes express examinations of other regions that North Brabant is competing with, such as the Flemish Diamond, the Ruhr district, Munich, Helsinki and Stockholm. The investment strategy was based on four pillars: (1) knowledge, the application of knowledge, and innovation; (2) accessibility; (3) sustainable energy; (4) the physical environment, with special attention for sport and culture. One of the priorities in this investment strategy, was to reinforce public infrastructure. In Brabant, public investment in knowledge and innovation was lagging behind the financing of other projects linked to national and European objectives and ambitions.

As mentioned above, the investment agenda was positioned in the light of the Brabant Agenda. This involved long-term social investments to strengthen the structure of socio-cultural, ecological and economic capital. Agenda Brabant kept an eye on the Munich model (see Section 4.2): 'Since the early 1990s, the government of the federal state of Bavaria (Free State of Bavaria) has been very active in the development of knowledge-intensive business activities. Major efforts are also being made towards strengthening international economic relationships and creating clusters of new, sustainable technologies. In addition, there is attention for quality of life in the region' (Province of North Brabant, 2010c).

With the Brabant Agenda, North Brabant turned its sights on its south-eastern region (Brainport). It also recognised the importance of the BrabantCity partnership, in which it cooperates with five major cities in the province, including Eindhoven and Helmond.

Eventually, the investment strategies were further worked out into the Brabant 2020 Economic Programme (Province of North Brabant, 2012). It formed a continuation of the policy lines established in the Brabant Agenda and the Dynamic Brabant programme. The aim was still to reach a position among the five most innovative regions in Europe. The programme assigned prominent roles to six specific clusters: high-tech systems and materials (including automotive and solar), life sciences and health, food,

logistics, maintenance, and the biobased economy. Each cluster had its own specific action plan. The programme was also in line with existing nationwide programmes, such as the Top Sectors Policy and the regional agendas Brainport 2020 and BrabantCity partnership.

In the elaboration of its economic agenda, the province went for a model in which its regions and cities themselves are responsible for their own strategic agendas. The province took up the position of a partner, linking its own actions (especially with regard to the development of the economic clusters) to regional triple helix approaches. It was made clear that provincial and national borders were not sacred. The idea was to regularly look for the right scale–regional, supra-regional and international (Province of North Brabant, 2012). But the province did put a dot on the horizon: By 2020, Brabant will be one of the top five innovation regions and 'Europe's heart of smart solutions'.

The administrative agreement for the period 2012-2015 included a complementary intensification margin of 52.6 million euros for economic policies. This was dedicated mainly to continuing developments that had arisen from the Dynamic Brabant economic programme.

In 2013, North Brabant province set up four investment funds with a working capital of 475 million euros. They are meant to serve the energy (60M), innovation (125M), broadband (50M) and nature (240M) sectors. The working capital of three of these funds maintains its value for the province because it will recover its co-financing over time. This makes it possible to use public funds optimally while the province can keep on investing in various projects. Moreover, the selling off of Essent shares generated 1 billion euros, which were dedicated to further investments. The Brabant Development Agency (BOM) is the provincial administrative body that manages three of the four funds. The agency studies the business case of submitted applications to determine whether investments can be made and, following approval, which fund the investment should come from.

The role of the city Eindhoven

Eindhoven is located in the centre of the south-eastern part of North Brabant, and it also occupies a central position in terms of economic policies. For one thing, there are the policies developed in the municipality itself, but the city's policies also play a role in the Eindhoven Region Partnership (SRE) and, more recently, in the Eindhoven Metropolitan Region (MRE).[26] For a long period, the role of the city has had to do with the choice of Eindhoven as a *Leading in Technology* location and the central theme of municipal economic policy was the importance of knowledge, innovation, technology and creativity for the economic future of the region with Eindhoven as the central city. The primary task was the transition from industrial mainport to a leading technology and design region. The policy document Urban Outlook Eindhoven 2010 (which included the urban development programme for 1999–2003/2004) was particularly important for the direction of economic plans for the city (Municipality of Eindhoven, 1999). Follow-up documents were published in 2004, 2010 and 2011, culminating in Urban Outlook Eindhoven 2040 (Municipality of Eindhoven, 2011). The city's ambition (in line with the region) was to further develop into one of the high-tech regions around the world, among the top 3 in Europe and the top 10 worldwide.

The Urban Outlook policies dealt with strategic projects, such as the further development of the High Tech Campus Eindhoven, the reorganisation of the Strijp S district, the completion of the Flight Forum, the expansion of Eindhoven Airport and making the most of the possibilities in the Station district and the Emmasingel complex. In addition, the city centre was given priority. The Urban Outlooks also formed the basis for secondary memoranda on the catering industry, hotels, events, office space, business parks, retail trade, and tourism and recreation. Open innovation (see next section) played an important role both within and between various locations, such as the High Tech Campus, the TU/e campus, the city centre, the Strijp S district, the High Med Campus and the Automotive Campus.

4.3.5 Clusters

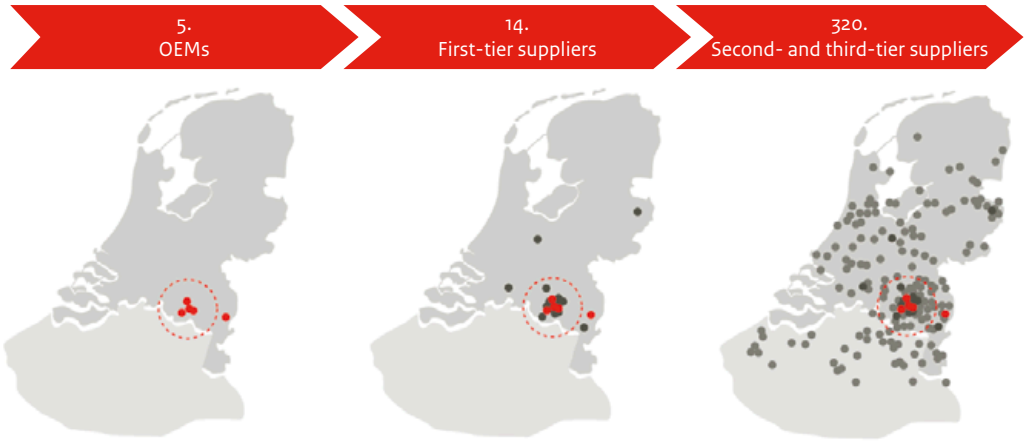
From company town to open innovation

Over a period of more than a century, Eindhoven developed from a company town into a cluster of knowledge-intensive activities. The city also underwent a transition from an 'entrepreneurial led to organised system of innovation' (Kesar, 2016). We have already made mention of the crucial role that Philips played in both transitions.

The cluster of high-tech activities largely explains the region's growth. It developed from a closed system (around a few large companies) into a system of open innovation. As mentioned in the previous section, the High Tech Campus is an example of this. The functioning of the campus is supported by its physical layout. It has a central area, the Strip, with conference halls, meeting rooms and catering facilities (the individual buildings do not have their own dining rooms). The aim is to share inputs–equipment, services and knowledge–as much as possible. An example is the joint use of specialist facilities, such as laboratories, test facilities and clean rooms (INBO, 2012, in Kesar, 2016).

Building on the knowledge base formed by Philips, a new generation of high-tech companies, such as ASML and NXP, has emerged over the years. Philips itself evolved into Philips Medical Systems. The city and the region have been

Figure 4.7
Original equipment manufacturers (OEMs) and first-, second-, and third-tier suppliers



Brainport < 40 km Eindhoven
80%

ASML
DAF
FEI Company
Océ Technologies
Philips Healthcare

Brainport < 40 km Eindhoven
71%

Participating in two or more chains:
Bosh Rexroth
GIS Europe
KMWE
Norma
Optiwa
Prodrive
VDL-ETG
Frencken Mechtronics
GL Group
Neways Electronics
NTS Group
Pezy
SKF
Wilvo

Brainport < 40 km Eindhoven
34%

Netherlands other	38%
Belgium	12%
Germany	7%
United States	4%
Rest of the world	5%

Source: brainport.nl

able to reinvent themselves, so to speak (Horsten, 2016; Kantelberg, 2013).

Although the Eindhoven high-tech cluster has developed from the power of proximity, a geographical analysis of the key businesses and their suppliers gives a good impression of the importance of the region for the Netherlands as a whole. Figure 4.7 (produced by Brainport Development) shows the key businesses, all so-called *Original Equipment Manufacturers* (OEMs): ASML, DAF, FEI, Océ and Philips. It also shows these businesses' most important first tier suppliers, which are also highly concentrated in the region. While it is clear that the second and third tier suppliers are spread all over the Netherlands, they are still located near the OEMs and the first-tier suppliers. The chain of major suppliers for the manufacturing of Brainport Eindhoven's key products shows a pattern of local embedding with links to other regions in the Netherlands.

4.3.6 Entrepreneurship

Stimulating entrepreneurship (new businesses, start-ups, new activities within existing clusters) was the region's policy focal point. This is expressed most manifestly in *Brainport Navigator 2013* (Commissie-Sistermans, 2005), which states that the region is striving to achieve an inspiring and result-oriented environment for start-ups and growth that also appeals to investors in high-risk projects requiring venture capital. The policy sees the government and major companies as launching customers–drivers of demand for the products of these start-ups. The philosophy is that it's not the end of the world if you go bankrupt in Eindhoven: failure may occur, or should occur, in order to learn from it. Legislation is to stimulate rather than interfere.

One of the aims was to promote entrepreneurial attitude: to have more new entrepreneurs and higher levels of entrepreneurship among employees. Investments were made in the Brabant Entrepreneurial School, the Entrepreneurship Incentive Programme, the coaching of entrepreneurs and improving access to investors. By now, entrepreneurship policies in Eindhoven focus strongly on start-ups. Within the region, there are various public and private initiatives to further stimulate start-ups in their growth. They involve the field of housing, acceleration programmes with their own networks (including BrightMove, High Tech XL, StartUp Weekend, Next OEM) and financing programmes (BrightMove, BOM Investment Fund). Eindhoven takes part in the national Startup Delta Programme. The business magazine Fortune ranked Eindhoven in the top 10 of the 'Best new global cities for start-ups'.

Though the municipality of Eindhoven has only recently adopted a specific entrepreneurship policy, other parties have been carrying out programmes for some time now. Eindhoven University of Technology (TU/e) has reported that it has been initiating and facilitating spin-offs for more than 30 years. This has led to the creation of more than 150 technology companies, including successful names such as Prodrive, Coosto, Xeltis, EmulTech and Flowid. In international rankings, TU/e is the worldwide leader in terms of cooperation between businesses and universities.

In 2013, the city laid down its ambitions with regard to entrepreneurship in the memorandum Running a Business 040, which builds on the principles of the outlook document Brainport 2020, mentioned earlier. The policy focuses mainly at supporting small and medium-sized enterprises.

4.3.7 Knowledge infrastructure

Eindhoven University of Technology

The choice for Eindhoven made by Philips was at the time crucial for subsequent economic development. The company is still of great importance to the current economy, but the same can be said of the establishment of the Eindhoven University of Technology (TU/e).

Only few regions have an institute of technology, and their presence is of great economic value. However, the decision to found the university in Eindhoven was not very clear-cut at the time. The citation below is from the *Commemorative Book Eindhoven University of Technology* (Bakker and Van Hooff, 1991), published on the occasion of the institution's 35th anniversary:

The decision to establish a new technical training institute and to choose a location for it was preceded by about 10 years of discussions at the national level... Especially the question of *where* a possible second University of Technology should be established proved to be a hard nut to crack for the committee (set up for that purpose). The members of the committee, including Frits Philips, were divided: a slim majority preferred Arnhem, with Eindhoven being the second choice. Earlier on, the Foundation for Higher Technical Education in the south of the Netherlands had compared the potential university cities of Maastricht, Weert, Eindhoven and Den Bosch, but instead of declaring itself in favour of any of those, it only expressed a rejection, with Weert as the victim. Politicians also took part in the bickering over the location. Finally, it was decided to carry out a study into Eindhoven as the place to establish the institute and in mid 1956 the resultant bill was adopted by the Senate.

Bakker and Van Hooff (1991) note that Frits Philips played a role in the definitive choice for Eindhoven. He had been deeply involved in the establishment of a second University of Technology in the south of the country. For example, during his period as deputy chairman of the Board of Directors at Philips, he was a member of the Foundation for Higher Technical Education in the south of the Netherlands, a private initiative that arose from consultations between industrialists in Brabant and Limburg on the expansion of higher education in the field of technology in the Netherlands. Frits Philips was also a member of the second Holst government commission, which was established in April 1947.

4.3.8 An attractive environment for working and living

In the description of the role of the province it was put forward several times that the physical environment in the region was an important policy focal point. This was, first of all, to avoid economic expansion from taking place at the expense of other natural values. In the second place, the aim was to create a pleasant and attractive environment to live in. As for the city of Eindhoven, the focus on creating an attractive environment for living and working is a more recent feature of policy memoranda, precisely with an eye on being able to develop the economy further. This in contrast, for example, to the city of Munich, which, at an earlier stage, already followed policies aimed at creating excellent facilities and an attractive climate for the economic development of the city

Initiatives to increase the quality of place of the city and the city centre in order to support the economy and culture, are particularly salient in the policy memoranda of the early 2000s. For example, the Arts and Culture department developed the concept of *laboratory city*, mainly to make disused buildings useful for start-up companies in the creative sector (Municipality of Eindhoven, 2004). Brainport Navigator 2013 (Commissie-Sistermans, 2005) also emphasises the importance of an environment for living and working that facilitates and stimulates (in areas such as housing, culture and accessibility), and that is able to form bonds between the region and young people from the Netherlands and abroad. In a knowledge economy, an attractive physical environment is seen as an important competitive factor.

In the continued economic development of Eindhoven, a great deal of attention has been paid to facilities, particularly in the past decade. According to Fernandez Maldonado and Romein (2009), this is due to a certain sense of urgency stemming from the observation that the city centre is not particularly alluring and that it lacks the 'buzz' and 'atmosphere' needed to attract highly qualified knowledge workers and foreign labour. On top of this, according to the authors, knowledge workers in Eindhoven only find relatively few homes attractive. The lack of a historical city centre (which was bombed during the Second World War) is an important factor here. Another

determinant is that, for a long time, Eindhoven did not distinguish itself from other cities in terms of culture. The city does have several distinctive sports facilities, including an indoor swimming pool and the PSV football stadium, but neither have a particularly clear link with the knowledge workers the city needs. An important fact in this context is that Eindhoven won the 2009 Knowledge District Competition, which resulted in the city being designated the national testing ground for broadband Internet, and high-speed (fibreglass) connections rapidly becoming available across its territory.

To make the city of Eindhoven more attractive, in 2007 the spatial planning programme The Brilliant Landscape was developed. The initiative was taken by the municipalities of Eindhoven and Helmond, and North Brabant province, and covers parks, culture, an attractive city centre and an international school (Huang, 2013). Urban Outlook Eindhoven 2010 (2005) is a programme for city development that makes mention of a cultural impulse. 'Eindhoven as a city with an attractive heart' has evolved into the recent conception of the development of the city (Municipality of Eindhoven, 2013).

4.3.9 Recent developments

The main purpose of the case study is to look into the exceptional economic growth of the south-eastern part of North Brabant in recent decades and describe the mechanisms behind it and the policies that supported it. In this concluding section, we outline a number of recent policy initiatives that are strongly linked to the historical 'Brainport story'.

In 2014, the area outlook Brainport City was drawn up within the framework of the Multiannual Programme for Infrastructure, Spatial Planning and Transport (MIRT) in which central government and regional and local authorities work together on spatial development projects and programmes. Brainport City was formally adopted in an MIRT Administrative Consultation meeting. With this area outlook, the municipality of Eindhoven has joined forces with the national government to define a future perspective that aims to strengthen the region's international competitiveness. Brainport City establishes a link with the urban culture of the city and describes ten related tasks, involving a series of quality carriers: international connectivity, the station area, the development of the city centre, the multimodal transfer site Acht, the connections between campus and city (brainport shuttle), the development and redevelopment of north-western Eindhoven, investments in the main road network, the scaling up of a high-quality public transport system, innovation, Smart City and smart mobility, the living lab and the landscape, urban greenery and water. In other words, it is mainly about the physical cogwheels in the engine of economic growth. Investments in these tasks have been expressed in the form of an adaptive programme and a development strategy (organisational proposal and funding strategy).

In 2015, the board of the Brainport Foundation set out a new strategy direction: Brainport Next Generation.[27] The core objective of this strategy is to strengthen the region's capacity to adapt. An important element is the development of the governance model from triple helix to multi-helix. Citizens, customers, consumers, investors, designers, artists and corporations are involved in the model for development. It serves to look for the connections between technology, design and social innovation, and the connections with other parts of the world, and with international knowledge regions that can strengthen the position of Brainport. In addition, there is a focus on major social issues in the fields of health, mobility, energy, food and safety. The idea is that Brainport turns the social challenges of today into the economic opportunities of tomorrow and contributes to a more sustainable, healthier and safer society.

Another important recent development is the Brainport Agenda for Action. At the end of 2016, the Minister of Economic Affairs promised to support the advancement of this agenda. This support results from resolutions passed by the Dutch parliament in which Eindhoven is recognised as a fully fledged 'mainport', along with Amsterdam Airport Schiphol and the port of Rotterdam (Letter to Parliament on Brainport Eindhoven, 2016[28]). Within that framework, the Brainport region submitted its ambitions to Members of Parliament in early 2017. The region demands additional support from the national government to reinforce its earning capacity and international competitiveness (Brainport, 2017), but the same document of aspirations also indicates how the region can contribute, in partnership with the national government, to the economic growth of the Netherlands and to solving societal challenges. In the period to come, the public partners and the region itself, the province of North Brabant and the national government are to develop a joint agenda for action.

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4.4 Milton Keynes

4.4.1 Outline

The Milton Keynes case study shows that regions with a small or medium-sized city and without high-tech clusters can also undergo exceptionally strong growth.[29] The explanation for the success of the city lies primarily in its location in the top economic region in the south-east of England, between London, Oxford and Cambridge. In addition, Milton Keynes was designated as a New Town at the end of the 1960s and as a Key Growth Area at the beginning of the 21st century to accommodate the population outflux from London. All the same, Milton Keynes is not a satellite city, but rather a central location with regard to surrounding towns such as Northampton, Aylesbury, Luton and Bedford. By now, the number of incoming commuters exceeds the number of outgoing commuters. The appeal of Milton Keynes to residents and businesses was not a matter of course. There was a large amount of competition with inner cities of nearby towns and other New Towns. But success can largely be attributed to spatial planning: the creation of urban qualities in a suburban setting that attracted both the middle class and the higher income groups.

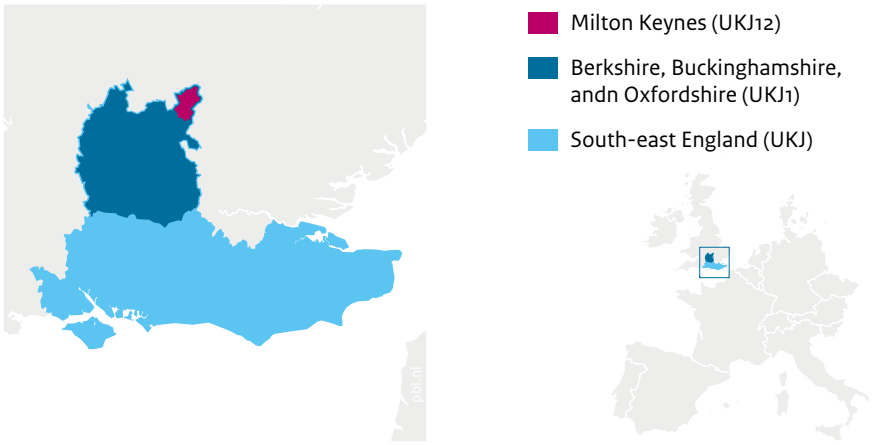
Milton Keynes combined its favourable location with investments in (C5) physical infrastructure (e.g. road and rail connections with London and surrounding cities), a high level of housing development and high-quality (C8) physical and residential environments: a high-quality built environment, low densities, proper accessibility by car within the city, a large amount of greenery and space for business activity *and* urban facilities. The urban character of the suburb and the affordable housing exerted a strong attraction on the middle class. And the presence of the middle class and the wide availability of space for businesses and offices in turn attracted knowledge-intensive services. In addition, the central location and urban character of Milton Keynes generated numerous jobs in retail and logistics. Important for the creation and maintenance of spatial quality is the city's competent (C7) governance, which comes to expression is its strong local institutions and public-private partnerships. They stem from the Milton Keynes Development Cooperation, which at the time of the city's creation was responsible for spatial development. The local institutions include Milton Keynes Park Trust, which uses revenue from property management to maintain the national parks and parkways it owns, Milton Keynes City Centre Management, which focuses on the management and development of the city centre, and Milton Keynes Development Partnership (MKDP), which, thanks to its land rights, has a major influence on spatial development. To give an example, MKDP recently introduced an Area Tariff that landowners and commercial property developers have to pay when they undertake site development. The revenue is used to maintain the level of public facilities.

At the same time, the exceptional growth Milton Keynes has experienced (along with the foreseen additional growth) may be an indication that a 'midlife crisis' is slowly but steadily building up. Is Milton Keynes a city or a suburb? Should it maintain the 'grid in the greenery' ideal or go for higher-density development? Other 'threats' linked to growth are the increasing congestion and rising house prices. However, Milton Keynes appears to be choosing growth, with its recent focus on strengthening the knowledge infrastructure so that it can grow into a fully fledged international knowledge city. Examples include the establishment of University Campus Milton Keynes and the University of Buckingham Medical School. Another example is the Smart City initiative that seeks to link the strengths of Milton Keynes in the field of spatial planning, smart systems and big data management to the reduction of CO_2 emissions–which are above average in Milton Keynes due to the low density and the related car dependence. This is done by making investments in education (in fields such as data science, sensor technology and smart city, urban planning), entrepreneurship (including the Urban Start Up Lab) and sites for experimentation (e.g. the Innovation and Incubation Centre and the Electric Vehicle Experience Centre). All of this, fits in with the slogan Milton Keynes has used from the early 1970s to the present day: 'The City that Thinks Differently Embraces Evolution and Champions Change'.

4.4.2 Geographic and administrative demarcation of the region

Milton Keynes (NUTS 3) falls within the statistical subdivisions of Berkshire, Buckinghamshire, and Oxfordshire (NUTS 2) and South-East England (NUTS 1). A map is presented in Figure 4.8. Only in the case of the city itself does the statistical subdivision follow the administrative boundary (Milton Keynes Unitary Authority). The south-east England region has not been an administrative unit since 2010. A group of three of counties forms another region: Berkshire (with Reading as the most important city, governed by local authority Reading Unitary Authority), Buckinghamshire (with Milton Keynes as the most important city, governed by Milton Keynes Unitary Authority) and Oxfordshire (with Oxford as the most important city). Some local authorities within the counties, often those of larger cities, have a unitary status, which means they can operate independently from the county. This is also the case of Milton Keynes but other parts of Buckinghamshire (South Bucks, Chiltern, Wycombe and Aylesbury Vale) fall under the jurisdiction of the county. The figures in the introduction to this chapter refer to the urban area of Milton Keynes (UKJ12). Our research focuses mainly on this area, but we will also provide detailed discussions of

Figure 4.8
Location of Milton Keynes city and the region of Berkshire, Buckinghamshire and Oxfordshire



Source: Eurostat, adaptation by PBL

the area's location in relation to London, Birmingham, Oxford and Cambridge, and in relation to places in the nearby ring of cities, such as Northampton, Aylesbury, Luton and Bedford.

4.4.3 Initial conditions

New Town and Growth Area in the top region of south-east England

Milton Keynes was designated as a New Town in 1967 to accommodate part of the population outflux from London. In 2003, the city was chosen to be one of the four growth areas in south-east England, along with the Thames Gateway, Ashford and the London-Stansted-Cambridge corridor.

Due to its New Town and Growth Area status and its location between several key regions and medium-sized cities, Milton Keynes is not simply a satellite city of London. It also fulfils a supra-regional function, with the number of incoming commuters now exceeding the number of outgoing commuters (Milton Keynes Council, 2016). In addition, 70% of its relatively young working population is employed in the city itself.

New Town Movement

Under the 1946 New Towns Act, 21 locations in England were designated to be a New Town. The measure entailed establishing, for each location, a temporary New Town Development Corporation, which was given responsibility to execute the national planning task. The New Towns can be subdivided into three generations. The first (1946–1951) was designed to deal with the housing shortage after the Second World War, especially in the green belt around London (and in the north east, in Newton Aycliffe, Peterlee). The second generation (1961–1964) also focused on the housing shortage, but this time around Liverpool (Runcorn and Skelmersdale), in the West Midlands Conurbation (Redditch and Telford) and in the area between Newcastle, Durham and Sunderland (Washington). The third generation (1961–1964) focused on enhancing growth around Liverpool and Manchester (Central Lancashire and Warrington) and London (Milton Keynes, Northampton and Peterborough).

Since Milton Keynes is a third-generation New Town, it was possible to apply lessons from the past in the design of the city layout. The first two generations, for example, were characterised by tight central control. The government (housing corporations) mainly built rental housing following strictly defined plans and, although the designs embodied many ideals, this often led to the emergence of a one-sided population structure and to a built environment of poor quality. Moreover, the arrival of new residents was not accompanied by an increase in job opportunities (Clapson, 2004).

The ideals of the first and second generations of New Towns

After the Second World War, large numbers of Londoners were encouraged to move from the city to a New Town. The Great London Plan of 1944, for example, was aimed at housing a fast-growing population and managing the return of residents who had fled the bombings. It recommended relocating no less than 1.5 million Londoners to the New Towns (Oxford Brooks University, 2006). The New Towns were seen as a panacea for London, which was crowded, dirty, humid and battered by the bombings. Ebenezer Howard's ideas about the garden city formed the basis for the plan: 'Town and country must be married, and out of this joyous union will jump a new hope, a new life, a new civilisation' (Howard, 1965: 48). In concrete terms, this meant a preference for Victorian style

homes with a garden, in low density settlements and with separate functions at the neighbourhood level. The New Towns were also meant to form a just society, ideally without class distinctions, private property or private schools (The Guardian, 2006).

The New Towns were not allowed to have more than 32,000 inhabitants and had to cover all day-to-day needs and provide cultural facilities and employment (Nio, 2017). In practice, it proved difficult to meet these requirements with such a limited population base. As a result, many critics denounced the lack of urban character in the design (Oxford Brooks University, 2006; Clapson, 2004). They also disapproved of the absence of a city heart: there was no clear facilities centre and during the day there was next to nothing to do (The Guardian, 2006). On top of that, the quality of the built environment was mediocre. All in all, the objections against the New Towns share similarities with the criticism of Le Corbusier-inspired urban developments in other parts of Europe, such as the Bijlmer district in Amsterdam, which is covered in the corresponding case study in this report (Clapson, 2004; Oxford Brooks University, 2006).

Later on, more and more variations arose on the rigid principles of the British garden cities. One example is the increasing level of building activity carried out by private developers. This occurred in part because home ownership increased in times of economic growth, but also because of the political shift from Labour to Conservative-Liberal from 1979 onwards under the Thatcher administration (Oxford Brookes University, 2006; Nio, 2017). In the 1970s and 1980s, the Right to Buy legislation was applied more and more, resulting in large numbers of rented houses being converted into private property. The deteriorated financial situation of those years also contributed to this shift: the fact that many New Towns had to write off debt was an important justification for undertaking more public-private developments. In urban planning too, attempts were made to achieve a closer integration of quality of the suburb with the diverse character of the city: 'A life that would enable residents to enjoy the best of both worlds: both urban qualities and modern accomplishments that make suburban living more comfortable, such as an own car and devices and appliances for the home' (Nio, 2017: 31). This suburban urbanity is an important element in the appeal of Milton Keynes.

4.4.4 The physical environment and the local residential environment

A different approach: suburban urbanity in public-private partnerships

As mentioned before, during the development of Milton Keynes, valuable lessons were learned from previous New Town developments. In Milton Keynes, for example, a great deal of public-private cooperation took place compared to earlier projects. Developers, architects and academics shaped the city together with a generation of official urban planners who were younger than those that had worked on previous New Towns. Development plans were more flexible and the aim was to achieve a 50:50 ratio of privately owned to rental housing (Oxford Brooks University, 2006). Private developers were given relative freedom to arrange the blocks within the grid structure according to their own judgement (Clapson, 2004).

Compared to many other grid cities of the period, Milton Keynes has a less strict design; the city layout follows the rolling, hilly lines of the landscape. The built environment is of high quality, with a substantial amount of greenery. Several green, linear parkways cut across the city, providing routes in and out of town, and following the floodplains of the Great Ouse and its tributaries. The concept of *Milton Keynes as a city in the forest* was part of the design (Nio, 2017: 38). Over the decades millions of trees were raised in the local Newlands nursery and planted throughout the region. Surveys conducted in 1980 (Bishop, 1986) and 2004 (MKLP, 2004) reveal that the residents highly value the greenery in Milton Keynes.

In the development of Milton Keynes, the aim was to build high-quality urban leisure facilities in the centre. The shopping centre, highly modern at the time, is quite extensive, covered and features large glass surfaces. Opened in 1979 by Prime Minister Margaret Thatcher, it was purposely used as an icon to get the city centre of Milton Keynes on the map (Clapson, 2004). An important part of city centre plan was the generous parking facilities and the boulevards lined with plane trees were another feature. The centre developed into a supra-regional hub that also attracted visitors from surrounding cities (MKC, 2016). In addition to the large-scale developments in the city centre, the plan also involved giving each grid square a number of shopping destinations, building several shopping centres outside the central area and distributing work destinations across the city. This was done to avoid over-concentration of activities and the related congestion on the roads leading into the city centre.

Building up urban character is an ongoing process. The absence of public facilities was a recurrent problem in the development of the New Towns, including Milton Keynes (MKLP, 2004; Oxford Brooks University, 2006). People spoke about the 'New Town Blues', in reference to the 'loneliness and boredom' the residents of the New Towns experienced (Nio, 2017: 113). Publications such as *Will Milton Keynes feel urban?* (in Walker, 1982), *What went wrong at Milton Keynes?* (Edwards, 2002) and *The struggle for the soul of Milton Keynes* (The Guardian, 2016) all point out that the emergence of a cultural and urban identity was not a matter of course. The city kept on feeling the need to further strengthen the university, the hospital, cultural

Building in the right place

The inadequate supply of housing in or near successful English cities means that not all preferences with regard to housing can be met and that residents have high housing costs (Centre for Cities, 2015). Even when correcting for the fact that the inhabitants of these successful places have higher average incomes, house prices are high there. In other words, they have a high housing ratio (housing costs expressed as a percentage of income). This situation has two disadvantages: not everyone can realise their housing preferences, which means that possibilities to make a match on the labour market are reduced (the potential is not fully exploited, which has a negative effect on productivity) and the inhabitants of these places are left with less to spend on other things than housing. Milton Keynes is an exception to this. Despite its location in the economically successful south-east England region, and particularly its proximity to London, Oxford and Cambridge, its housing costs are relatively low. In 2011, for example, wages in Milton Keynes were 15% lower than in London, but the price of housing there was half that in London (Centre for Cities, 2015). This is because, compared to other successful places in England, the production of housing fitted the pattern of demand relatively well, both quantitatively (according to Centre for Cities (2015), between 2001 and 2011 the population grew by 17% and the housing stock by 18%) and qualitatively (the quality of the housing is high and residents highly appreciate the low density in a green environment close to urban amenities). The Centre for Cities (2015) therefore comes to the conclusion that: 'as the Milton Keynes example shows, housing of the right type and quality, in the right place, can attract and retain residents, supporting jobs and the city economy'. Milton Keynes is currently facing a challenge because the affordability of its homes is no longer guaranteed. The Centre for Cities (2016) has found that over 2014 and 2015, house prices rose by 16%, compared to a 7% increase in London and 12% increase in Cambridge.

facilities, leisure centres and places for social interaction (MKCP, 2004).

Calls for a hospital were put forward as early as the 1970s. There was even a Hospital Action Group, whose campaign was named *Milton Keynes is Dying for a Hospital* (Clapson, 2004). It took until 1984 before the hospital was opened. In 2015, the hospital became part of the county's higher education facilities and the University of Buckingham Medical School became a reality. The other university (University Campus Milton Keynes, UCMK) opened its doors in the centre of Milton Keynes in 2008 with start-up funding from the Milton Keynes Partnership (MKP). The university is part of Milton Keynes College, which since 1982 had been providing secondary education but no higher education.

As for cultural facilities, the city opened The Stables concert centre in 1970 (renovated in 2000), the open-air entertainment and pop venue National Super Bowl in 1979 (taken over from Sony/Pace by English Partnerships in 2000), the Theatre District in Central Milton Keynes in the late 1990s, the Milton Keynes Art Gallery in 1999, and the football and rugby stadium MK1 in 2007. In the 1990s, the number of shops, restaurants, pubs, sports clubs and leisure centres grew substantially (Clapson, 2004). In 2000, Xcape was opened–England's first Indoor Ski Slope and first Multiplex Cinema, combined with a new shopping mall. Under the excuse of achieving urban compaction, Hub MK was also developed: a trade and business centre with apartments and two hotels. The area houses the tallest buildings in Milton Keynes.[30] Finally, the Milton Keynes Communities Strategy (2004) is worth mentioning here, because it clearly puts forward the argument in favour of increasing the city's urban character, without this affecting its low density in a green environment, something that is highly appreciated by the local residents (MKCP, 2004).

As a result of these developments, the level of facilities and employment in Milton Keynes was relatively high compared to that of other New Towns and people also referred to it as *New City*, rather than *New Town* (Clapson, 2004).[31] At present, 70% of the relatively young working population is employed in the city itself. And although many people make the daily commute to London for work (20% of commuters travel to the Greater London area), Milton Keynes has a positive commuting balance of 23% (Milton Keynes Council, 2016). Centrally located between London, Birmingham, Oxford and Cambridge, the city borders several regions. The largest part of the commuter traffic is that to and from London and places in the immediate vicinity of Milton Keynes, such as Northampton, Aylesbury, Luton and Bedford.

Its ability to attract middle class and higher income groups was important for the success of Milton Keynes. Although there was an overall housing shortage in the south-east England region, the arrival of people and businesses was not self-evident. Competition with existing city centres and other New Towns was fierce, particularly in the 1970s and the early 1980s. Significant levels of unemployment and high interest rates on loans meant there was a large supply of housing and put the financial position of the New Towns under pressure (Oxford Brooks University, 2006). Success in Milton Keynes was therefore not only the result

Physical infrastructure

The M1 is a major motorway that runs from London to Aberford via Luton, Milton Keynes and Northampton. Due to the large number of commuters there is a large amount of congestion between Milton Keynes and London. In 2009, the stretch between London and Milton Keynes was widened from two to four lanes (with work finished in 2012). It's about a 90-minute drive from Milton Keynes to London. Approval has also been given for the construction of an Expressway between Cambridge and Oxford via Milton Keynes and for improvements to the infrastructure around Luton airport. These two plans are part of a financing programme from the South East Midlands Local Enterprise Partnership (SEMLEP) and the associated nationwide Local Growth Deals.[32]

There is a good rail connection between London and Milton Keynes (West Coast Main Line). Since it was upgraded in 2008, the speed of trains has increased considerably. As a result, the journey to and from London takes only 40 minutes. There are plans for a high-speed rail connection between London and Birmingham (HS2) and work is underway on the stretch of the East West Rail between Oxford and Cambridge, which will also connect Aylesbury, Milton Keynes and Bedford (to be completed by 2024).

Finally, there is good international air connectivity via London Luton Airport (12.2 million passengers in 2015). The airport is located 2.3 kilometres from the M1 and can be reached from Milton Keynes by car in 35 minutes.

The economic growth of Milton Keynes means congestion is a serious threat. It is caused mainly by the number of motorists entering Milton Keynes every day to reach their place of work in the centre. Given the large population growth foreseen for Milton Keynes, congestion is expected to increase by a further 60% over the next 20 years, but the current infrastructure plans can only handle an increase of 25% (Centre for Cities, 2016).

of its location, but also of its spatial planning: building in the right place and creating dwellings and a residential environment of the right quality (see text box below).

Can Milton Keynes retain its qualities?

At present, a lively debate is going on about whether Milton Keynes will be able to maintain its suburban character because the housing shortage is forcing higher density building. The Milton Keynes Development Corporation recently introduced an Area Tariff for developers in order to finance public utilities, such as green spaces (to be discussed in more detail below), a move that may be a first response to this 'midlife crisis' (The Guardian, 2016).

Other recurring topics related to the low density of Milton Keynes are the deficiency of public transport and the high levels of CO_2 emissions and energy consumption. Milton Keynes is laid out in a grid structure with many roundabouts and few high-concentration spots that means the traffic flow is smooth. Milton Keynes is also known for its separate footpaths and bicycle paths, often crossing below or over the grid streets. At the same time, the fact that built-up areas are widely spread-out has always made public transport problematic (The Guardian, 2016). Consequently, average car ownership in Milton Keynes is above that of England (MKC, 2008). While car traffic within the city flows smoothly, urban growth and commuters to and from surrounding cities are causing more and more problems on the access roads (Centre for Cities, 2016; MKC, 2008). The textbox below provides more details.

4.4.5 Governance

Strong local institutions

The development of each New Town was tightly managed by its New Town Development Corporation. In Milton Keynes, the corporation was dissolved in 1992, after it had completed the most large-scale planning operations. Still, strong institutions arose from this move. Initially they were structured as local development companies owned by the nationally managed English Partnerships. They developed residential locations to meet the rapidly growing demand for housing (Cochrane, 2007). In 2004, the national government took the initiative to establish the Milton Keynes Partnership (MKP) that was to function as the executive body (local delivery vehicle) behind the National Sustainable Communities Plan (ODPM, 2003). This plan designated Milton Keynes as one of the four growth areas in south-east England, along with Thames Gateway, Ashford and the London-Stansted-Cambridge corridor. The Government Office Regions (GORs) were responsible for providing a regional translation of the Sustainable Communities Plan into Sub-Regional Strategies. In the case of Milton Keynes, this led to the Milton Keynes and the South Midlands Subregional Strategy (GOSE et al., 2004). From that point on, regional implementation was in the hands of the Regional Development Agencies. In the Growth Areas, this was the South East of England Development Agency (SEEDA).

At the local level, the Milton Keynes Partnership (MKP) was the party taking care of project implementation. Another body, the Milton Keynes Local Strategic Partnership (MKLSP), was created to mobilise local interests with regard to the further implementation of the national and regional growth agendas. The MKLSP managed to set up dialogues between other local strategic partnerships in order to work towards the Milton Keynes Community Strategy 2004–2034 (MKC, 2004). They covered fields such as health (Joint Health and Social Care Board), the economy (Milton Keynes Economy and Learning Partnership, MKELP) spatial planning (Centre Milton Keynes Partnership, CMK, and the Local Housing Strategic Partnership, LHSP) and the Milton Keynes Council (MKC).

As mentioned earlier, Milton Keynes has a unitary status, a prerogative for places or cities that are large enough to function independently from the county. The other four districts in the county of Buckinghamshire (South Bucks, Chiltern, Wycombe and Aylesbury Vale) are under the jurisdiction of the county. Therefore, the administrative structure is complex and cuts across several territorial borders. There is also a high level of what Alan and Cochrane (2007: 1170) call *cross-cutting membership*: 'Seven members of MKELP are also members of MKLSP, one of whom is also a member of MKP, while another is the English Partnerships Officer. GOSE is represented in some form on all three bodies and SEEDA on two. The cross-cutting memberships of these bodies ensure that they operate as forums for both informal and formal negotiations, where understandings are reached, even when they are not minuted or formally recorded'.

Several regional levels of government have since been phased out (GORs in 2010 and SEEDA in 2012) and competences have been decentralised to local authorities. This represented the end of regionally imposed tasks, which in turn were, to some degree, a rendering of national tasks, as laid down in the Milton Keynes and South Midlands Sub Regional Strategy (GOSE et al., 2004), the Regional Planning Guidance for the South East (GOSE et al., 2001) and the South East Plan (GOSE, 2009). Local authorities now have the possibility to take initiatives themselves towards pooling resources and interests in Local Enterprise Partnerships (LEPs), which are intended as collaboration structures for local actors to deal with tasks of regional importance. Milton Keynes is part of the Buckinghamshire Thames Valley Enterprise Partnership (BTVLEP), which was formed in 2012 and counts on the participation of all the other districts in Buckinghamshire. In 2012, the Plan for sustainable economic growth in the entrepreneurial heart of Britain 2012–2031 (BTVLEP, 2012) was published. It describes itself as a 'business-driven partnership of equals between the private sector and local government' (BTVLEP, 2012: 3) and focuses on areas such as start-ups, export promotion, innovation, labour force skills and related issues, including broadband Internet, network creation and the development of regional business parks.

Previously, in 2011, Milton Keynes had established the South East Midlands Local Enterprise Partnership (SEMLEP)[33] in collaboration with universities and colleges, local residents' associations, social organisations and the local authorities in Northamptonshire, Bedfordshire and Luton, Milton Keynes, Cherwell, Aylesbury and Dacorum. This partnership received government approval as a *functional economic area*, and focuses on the fields of transport, the housing market and the economy within a public-private context.[34] The Strategic Economic Plan (SEMLEP, 2015) was published in 2015. In addition to own (public and private) financing from within the LEPs, there have been three rounds of financing (in 2014, 2015 and 2016) from the Local Growth Deals managed by the national government. These Deals allocate financial resources to LEPs for projects that benefit the local economy.[35] The LEP Network[36] organises exchange and coordination between LEPs, such as that between SEMLEP, BTVLEP and Oxfordshire LEP (OLEP).

Although clear steps have been taken towards decentralisation and partnerships may change their objectives, names and composition, there is continuity in the many partnerships that are active in public-private contexts and at several scales, which are not necessarily territorially defined. They also operate quite often in the cross-cutting membership context mentioned earlier. The ideas of these partnerships are related to concepts such as *multi-level governance* and *multi-scalar governance* or, using the term preferred by Alan and Cochrane (2007: 1161), *politics of scale*: '…it is shown how a more diffuse form of governance has given rise to a spatially discontinuous region. This is grounded in an exposition of the political assemblage that is Milton Keynes today, with its provisional, cross-cutting mix of institutional agencies, partnerships, businesses and interest groupings engaged in a 'politics of scale' exercise to fix the region'.

The Milton Keynes Partnership was dissolved in 2011. The Milton Keynes Development Partnership (MKDP), established in 2013, is now the municipal development company in charge of carrying out projects for new areas together with developers and investors. Compared to the MKP, which had been set up at the initiative of the central government as a local delivery vehicle for the Sustainable Communities Plan (2003), the MKDP is independent of central and regional control. The MKDP owns large amounts of land and therefore has a large amount of influence. To ensure that the growth foreseen for the coming years in Milton Keynes will not take place at the expense of the quality of the physical environment, the MKDP recently introduced an Area Tariff that landowners and commercial developers are to pay when undertaking

site development. The revenue is used to maintain the level of public facilities. For each built dwelling, the landowner pays a fee of £18,500 and the developer pays £260,800 per hectare.[37] Other examples of strong institutions that have arisen as a legacy of the strong planning traditions of the New Town Development Agencies are the Milton Keynes Park Trust (MKPT) and Milton Keynes City Centre Management (MKCCM). The Park Trust uses revenue from the management of commercial real estate to maintain the numerous landscape parks and parkways it owns. Other partnerships, such as the Centre Milton Keynes Partnership (CMK) and the Economy and Learning Partnership (MKELP), have been renamed and restructured. The present-day Milton Keynes City Centre Management (MKCCM), exerts strict control over the management and further development of Milton Keynes City Centre.[38] And MK Business Leaders cooperates with Milton Keynes administrators and partners in SEMLEP on economic development of the region.[39] Finally, residents are now better represented in Community Action MK and Community Foundation. In addition, there is the Buckinghamshire and Milton Keynes Partnership, which is one of the Local Nature Partnerships operating throughout the whole of England.

4.4.6 Clusters

Following the thorough description of the urban planning policies adopted in Milton Keynes and of the related government structures (governance), we now turn to the policies aimed at strengthening the economic structure, discussing them in specific detail.

KIBS, retail and logistics

Milton Keynes has a heavy concentration of service activities: offices (services and education), retail, transport hubs and distribution centres. Particularly noteworthy is the number of Knowledge Intensive Business Services, or KIBS (Centre for Cities, 2016). Milton Keynes is therefore predominantly a services city. There are many jobs, both in absolute and in relative terms–compared to the national average–in computer programming, information services, telecommunication, corporate head offices, recruitment, financial services and education, but also in areas such as wholesale, distribution, transport, retail and repair (Milton Keynes Council, 2016). There are not only highly paid jobs, but also positions with relatively lower salaries in the administrative, sales and customer service professions. The future space requirements for business activities confirm this profile: for the period up to 2031, of a surface area of 124 hectares 17% has been allotted to offices, 76% to distribution activities and 7% to other industrial activities (Bilfinger GVA, 2015). These data also match the profile of University Campus Milton Keynes (see below). Milton Keynes is home to several corporate headquarters including Argos, Domino's Pizza, Marshall Amplification, Mercedes-Benz, Suzuki, Volkswagen, Santander, Yamaha Kemble, and to distribution centres such as those of John Lewis/Waitrose and River Island (MKC, 2016). The Red Bull Racing factory is also located in Milton Keynes. Other high-tech activities are concentrated primarily in surrounding areas, such as Aylesbury Vale (between Oxford, Luton and Milton Keynes), Silverstone Park (near the Formula 1 circuit), Westcott Venture Park and Arla/Woodlands.

Towards an international knowledge city

Milton Keynes gradually shifted its strategy focus from New Town to International City, with an eye on attracting knowledge-intensive business activity and highly qualified workers (MKLSP, 2004; MKC, 2013). According to Alan and Cochrane (2007), New Towns were first conceived mainly as overflow areas for overcrowded cities, while the international city strategy is aimed far more on attracting knowledge workers, who in turn attract knowledge-intensive businesses (also see Pike et al., 2006).

Since 2004, the drive for internationalisation has been accompanied by the branding slogan 'The City that Thinks Differently Embraces Evolution and Champions Change' (MKLSP, 2004), and by the Milton Keynes Council ambition 'to create an internationally recognised knowledge technology business cluster between Oxford and Cambridge' (DTZPieda, 2004: 29).

The Milton Keynes Economic Development Strategy 2011–2016 (MKC, 2011) clearly shows that the city has the ambition to further develop into an international knowledge city. The focal points are:

1. A diverse and competitive knowledge economy: achieve a more knowledge-driven economy, by stimulating innovation, entrepreneurship and the knowledge and skills of the population;
2. Economic restructuring: increase schooling and job opportunities, especially for those with lower levels of education;
3. Development of knowledge and skills: improve education opportunities for the population as a whole and ensure a better match between education and the local labour market;
4. Business support: promote innovation and the creation of start-ups by providing suitable business premises among other things;
5. Dissemination of what Milton Keynes has to offer: promote the city to attract investments and visitors;
6. Development of infrastructure: fulfil the demand for transport infrastructure and digital infrastructure.

In 2016, the Milton Keynes Skill Strategy (MKC, 2016b) was published. It formed the first step towards cooperation with the partnerships to improve the quality of education, increase education opportunities throughout workers' careers and achieve a better match of supply and demand on the labour market. The efforts towards improving knowledge and skills are also geared to those with lower

levels of education (see focal point 2, above). The income level in Milton Keynes is the same as the average for the United Kingdom and below the level of south-east England (MKC, 2016a). There is a relatively high number of jobs in lower paid service sectors, mainly retail, distribution and administrative work, and also a relatively high number of households on low incomes (Cochrane, 2007). Nio (2017: 84) concludes that there is a risk of a divide emerging in Milton Keynes, 'with the population in the outer edges being much more well-off than those living in the older neighbourhoods of the 1970s'.

As stated before, the hospital was founded in 2015, together with the University of Buckingham Medical School. The other university in Milton Keynes had opened its doors seven years earlier. It is part of Milton Keynes College that has been offering secondary education since 1982 but did not provide higher education until 2008. In 2012, this part of Milton Keynes College became a fully fledged department of the University of Bedfordshire (also present in Bedford, Luton and Aylesbury), which means it can now offer Bachelor's and Master's courses. A new campus was opened in 2013 and from that moment on, the name University Campus Milton Keynes (UCMK) has been used. There are also two small departments of the Open University (only for distance learning) and Cranfield University (only postgraduate studies). The UCMK profile can be conveyed through its list of disciplines: journalism, human resources, psychology and behavioural sciences, pedagogy, business and management studies, logistics and supply chain management, telecommunications, computer science and electronics, data science, sensor application, smart city studies and urban planning. Data science, sensoring and urban planning come together in the Milton Keynes Smart City initiative, which seeks to establish cooperation with the business world and citizens (see below for further details).

In addition to its site development policy to provide for the growth in companies, Milton Keynes cooperates with educational institutions, businesses and citizens to tackle a number of issues that arise from the challenges posed by the structure of its built-up areas. On the one hand, there are the low densities, high levels of energy consumption and strongly car-centred layout, and on the other there are economic opportunities in the fields of sustainability and technology. An example is the joint effort of the Higher Education Funding Council for England (HEFCE) and the Open University to set up the Smart City Initiative MK[40], which focuses on new technologies to facilitate growth in Milton Keynes without the need for additional infrastructures and without increasing CO_2 emissions (Caird et al., 2016). The key project of the initiative is MK Data Hub, which seeks to use big data methods to achieve smarter management of various urban systems, such as water supply, energy distribution and transport.[41] This involves the creation of special education programmes, but efforts are also being directed to cooperation with companies (at the Innovation and Incubation Centre at University Campus Milton Keynes), citizens (Citizen Lab) and start-ups (Urban Startup Lab).

These initiatives are in line with the progressive character that Milton Keynes wants to convey, as witnessed by the slogan that was coined in the early 1970s and is still used today: 'The City that Thinks Differently Embraces Evolution and Champions Change'. The aspiration is clearly expressed in the distinctive, modern spatial planning programmes and the many showcase projects for energy-efficient homes that have been presented over the years, such as Solar Home in 1973 and Home World Exhibition in 1981. The old slogan reappeared in the Low Carbon Living Strategy 2010 (NHBC Foundation, 2010)[42] and the Low Carbon Action Plan 2012 (MKC, 2012a), which expressed the ambition to reduce CO_2 emissions by 40% by 2020. The 2010 Low Carbon Living Strategy was updated in the form of the publication Imagine MK 2050 Strategy: A roadmap for a sustainable Milton Keynes (MKC, 2014)[43]. The Corporate Plan 2012–2016 (MKC, 2012b) also emphasises that Milton Keynes is a city 'where we think differently, create opportunity and believe in people'. The municipality uses the expression as it formulates a low-carbon agenda and aims to remain a leading, international model for innovation that provides new technologies with room for experimentation. Examples include the construction of a combined heat and power plant, a biogas plant based on household waste and the promotion of electric vehicles (NHBC Foundation, 2010).

This challenge is daunting because Milton Keynes was designed according to principles that involve a great deal of car use. Given that a fully fledged public transport system has always been something of a problem, Milton Keynes is now going for electric transport (EVs), in line with the sustainability and knowledge agenda mentioned above. The charging system is compatible with those used in London, Oxford and Cambridge, meaning electric driving between these Plugged-in Places is possible.[44] Milton Keynes has received funding through the UK government initiative Go Ultra Low City.[45] Electric driving is promoted by offering free parking for electric cars (Green Parking Permit), expansion of the charging infrastructure, allowing electric vehicles to use some bus lanes and the opening of an Electric Vehicle Experience Centre.[46]

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4.5 Dublin

4.5.1 Outline

When Irish independence took shape in 1921, the country was as rich as the United Kingdom. It was the start of a period during which Ireland pursued strict protectionist policies and waged an economic war with the United Kingdom. In addition, there existed a desire to turn Ireland into a self-sufficient welfare state. The resulting economic misery became particularly apparent in the 1950s: high taxes, national debt, inflation, unemployment, emigration and low growth. The economy relied heavily on the export of agricultural products. The situation improved with the opening up of the economy from 1959, the introduction of the zero-tax policy for foreign companies in the same year, investments in education from the 1960s and entry into the European Economic Community (EEC) in 1973. Ireland slowly transformed from a rural society into an industrial society with low-skilled labourers. However, the tide had not been stemmed entirely: the oil crises of the late 1970s and early 1980s, and the country's reactionary monetary and fiscal policies brought about a new period of economic decline. With the creation of the European single market in 1992 and the substantial economic growth taking place in the United States, foreign investment in the Dublin region increased dramatically in the 1990s. From 1994 onwards, the economy grew exponentially; Ireland, with Dublin at the forefront, is now classed as the *Celtic Tiger*.

In addition to the general tax benefits given to foreign companies (C6 financing), the Industrial Development Agency (IDA) focused specifically on attracting foreign investment. For a long time, policies were marked by the industrialisation of underdeveloped rural areas. However, foreign companies–also called industrial enclaves–were only interwoven with the national economy to a limited degree and that formed the reason for the launch of the Linkage Programme in 1985. It aimed to improve the integration of foreign companies into the domestic supply and labour markets. Also, a (C1) cluster strategy was chosen for the electrical, software, pharmaceutical and chemical sectors, dedicated to goods such as semiconductors, microprocessors, software, computers, printers, pharmaceutical products and medical technology. The IDA was also one of the first development companies in the world to concentrate on attracting services. In addition to financial and telecom services, the agency focused especially on the software sector.

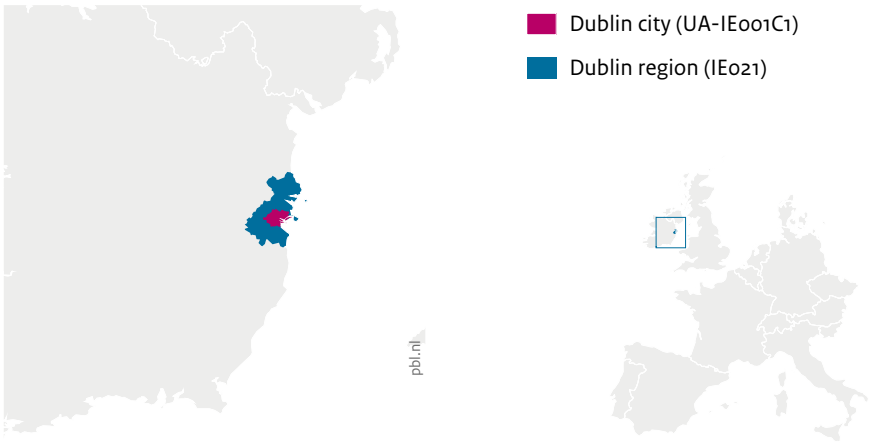
The *hub and spoke* model was a characteristic feature of the cluster strategy that involved attracting a few prominent companies (hubs) for national businesses and local employees to connect to (spokes). The presence of those leading companies has resulted in the present-day concentrations of business activity in the city of Dublin. Examples are Intel (Collinstown Industrial Park), Microsoft (Campus Sandyford), Hewlett Packard (Liffey Park Technology Campus), IBM (IBM Technology Campus, IDA Business Park and IBM House Shelbourne Road), Symantec and Oracle. Furthermore, a financial hub emerged in the Docklands, a development that was triggered by the opening of the International Financial Services Centre (IFSC) in 1987. The cluster strategy was characterised by the perfect match between efforts to attract specific companies and the development of (C4) knowledge infrastructure. For example, the universities produced large numbers of technicians and software developers (especially in the city of Dublin) and specific knowledge institutes were established with a direct connection to the focus areas mentioned above. Gradually, a highly qualified labour force developed that still benefits foreign companies, today (C3: human capital).

The Dublin economy also proved flexible. Industrial activities around hardware manufacturing were 'replaced' by service activities in the fields of software, sales, technical support, call centres and logistics. From the late 1990s onwards, there was a shift within the software sector from a focus on support services, which did not specifically require highly skilled software developers, to increasingly advanced activities.

From the mid 1980s onwards, the shift of attention towards more high-tech and service activities coincided with a shift in spatial planning, with dispersed expansion policies gradually giving way to measures aimed at strengthening urban regions. Cases in point are the redevelopment of the Docklands, the Temple Bar District and the Historic Area Rejuvenation Project in Dublin (C8: physical and residential environments). The redevelopment of the Docklands was intimately linked to foreign investments: the Financial Services Centre, which opened there in 1986, sparked the urban renewal of the entire area. The Temple Bar District is now well known for its cultural activities and nightlife, the Historic Area Rejuvenation Project is characterised by the Smithfields Public Area with its shopping centres and projects to preserve and give new use to historic buildings, such as the whisky distillery.

Finally, it should be noted that Ireland, and Dublin in particular, has been going through a severe crisis since 2007. Although many foreign companies are anchored in the regional economy, the low corporate tax rate also continues to attract a large volume of volatile capital. Added to that was the crisis created by the increase in domestic spending. A pro-cyclical fiscal policy (spending money in times of economic growth), a reduction in the tax on wages, the easy access to mortgages and political lobbying by construction companies all contributed to this. The result was a severe financial and property crisis.

Figure 4.9
Location of Dublin city and Dublin region



Source: Eurostat, adaptation by PBL

4.5.2 Geographic and administrative demarcation of the region

The statistical region of Dublin (NUTS IE021) covers all of County Dublin. It is not an administrative unit in itself but has been divided into four administrative areas since 1994: Dublin City, Dublin Fingal, South Dublin, Dun Laoghaire-Rathdown. The data in the introduction to this chapter correspond to the Dublin statistical region (IE021), which falls in the larger statistical region of southern and eastern Ireland (IE02). A map is presented in Figure 4.9. Around 30% of the 5 million Irish population live in the Dublin region (NUTS 3), and around 10% live in the city itself.

To assist local government across the country, eight Regional Authorities were established in 1994. They were dissolved in 2014 and replaced with three Regional Assemblies. The Dublin region is covered by the Eastern and Midland Regional Assembly (EMRA). Within EMRA, the Dublin region is a Strategic Planning Area (SPA); the two other ones are Eastern SPA and Midlands SPA. Until recently, control by the central government was rather strict, with local government (Dublin City) playing a minor role. It was not until the 1990s that local government was granted more competences, which increased the options to formulate bottom-up policies (Barley and Shine, 2005). Control by regional authorities is also a relatively recent phenomenon.

4.5.3 Initial conditions

When Irish independence[47] became a reality in 1921, the country was as rich as the United Kingdom (The Economist, 2004). It formed the start of a period that lasted until 1960 and that Bartley and Shine (2005: 147) call the 'era of nationalism and isolationism'. From the 1930s, the country enacted highly protectionist policies aimed at achieving self-sufficiency.[48] Moreover, public spending was excessively high because of the desire to transform Ireland into a welfare state. Due to the problematic economic situation, the country continued to run up debt. This major downturn became particularly evident in the 1950s through high taxes, public debt, inflation, unemployment, emigration and low growth. The economy relied heavily on the export of agricultural products to the United Kingdom and the fact that Ireland was engaged in an economic war with the United Kingdom did not do much to remedy the situation. The considerable economic growth that took place in large parts of Europe after the Second World War bypassed Ireland completely.

The period from 1960 to 1986 is dubbed by Bartley and Shine (2005: 147) as 'the era of internationalisation and modernisation'. The economic situation improved with the opening up of the economy from 1959, (with free trade with the United Kingdom being an important part of the measures)[49], the introduction of the zero-tax policy for foreign companies in the same year, investments in education from the 1960s (with free education for all introduced in 1967) and entry into the European Economic Community (EEC) in 1973. (The Economist, 2004). Ireland slowly transformed from a rural society into an industrial society with low-skilled labour. (Crossa et al., 2010). Membership of the EEC not only led to increased trade, but also gave the country access to European agricultural subsidies and infrastructure funds, a welcome extra in times of cutbacks in expenditure. But the oil crisis of the 1970s, the recession of the 1980s and the country's reactionary monetary and fiscal policies brought about high inflation (The Economist, 2004).[50] Emigration, especially of young people with higher levels of education, reached record highs in the 1980s. And the new outbreaks

The crisis years

Ireland, and Dublin in particular, attracted many foreign companies that were relatively footloose, which meant they could easily leave again if circumstances changed. This came to light during the financial crisis of 2008 and subsequent years. Part of the capital flows can also be linked to special-purpose entities (SPEs) and shadow banking. On the other hand, a significant proportion of the business concentrations did appear to be solidly anchored in Dublin. As Barry (2002) argues, the arrival of foreign companies was also important for enabling the breakaway from the single-track structure of the agricultural sector. O'Leary (2011) shares this opinion and states that up to about 2002, foreign investments were an important driver of the Celtic Tiger, which thrived thanks to the export-based growth in its foreign companies. But after that, growth was driven by domestic spending. According to O'Leary (2011), the rising wages (the result of reduced income tax) introduced under pressure from the trade unions, along with easy access to mortgages and lobbying from construction companies stimulated spending, which led to overheating of the economy. O'Leary notes that this pro-cyclical fiscal policy (spending money in times of economic growth) is characteristic of Ireland, because the same mistake had been made earlier, in the period between the two oil crises. Dellipane and Hardiman (2011) speak of a triple crisis: financial (due to the interconnectedness of the financial system and the real estate market, property developers, the building sector and politics), fiscal (due to the large gap between public spending and tax revenues, and to the reduced income tax rate), and a crisis in the field of competitiveness (the dramatic increase in the cost of doing business in Ireland that occurred during the boom years).

of the Protestant-Catholic conflict did not contribute to political stability and balanced economic growth at the time either.[51] The economic misery lasted until the end of the 1980s, after which a period of recovery began. It took Ireland a long time to catch up with the rest of Europe, but economic reform, investments in education and the zero-tax policy served to build an important foundation for the name Ireland would acquire in the mid 1990s: the *Celtic Tiger*. The city of Dublin was at the forefront of this transition.

From 1994 onwards, Dublin's economy grew exponentially. Growth was driven by financial and fiscal reforms that included reducing, at the national level, public spending, public debt and taxes (Baily et al., 2011). With the reduction of debt and, later on, the introduction of the euro, interest rates went down and investments increased. A reduction of the income tax rate in the 1990s led to an increase in spending that also greatly boosted the domestic market (The Economist, 2004). A financial hub developed in Dublin as a result of the zero-tax policy and the opening of the International Financial Services Centre (IFSC) in 1987 (Stewart, 2013).[52] Policies around foreign direct investment (FDI, see Section 4.5.4 for details) started to focus specifically on high-quality economic activities. Bartley and Shine (2005: 147) therefore describe the 1986–2001 period as that of the post-industrial strategy to attract only fast-growing high-tech industries and services. The partnerships between the government, employers and trade unions that were a part of the 1987 Programme for National Recovery, introduced wage restraints (in exchange for the reduction in income tax mentioned earlier) and stabilised labour market relationships, which has been cited as a positive factor in attracting foreign investment (Mugnano et al., 2010). Ireland was also doing well in demographic terms: the baby boom lasted longer than in Europe on average because the waves of emigration in the 1950s and 1060s meant that there were, in proportion, relatively few elderly people and many young people, and the negative migration balance turned positive (The Economist, 2004). Finally, the signing of the Belfast Agreement in 1998 ended the Protestant-Catholic conflict. The ICT crisis of the early 21st century caused a short break in the *Celtic Tiger* period, but growth picked up again after that and continued until the financial crisis of 2008. A crisis from which Dublin is still trying to recover (see text box below).

4.5.4 Irish FDI and industry policies

Opinions vary as to the structural contribution of Foreign Direct Investments (FDI) to the Irish economy. A frequently voiced piece of criticism is that a large part of the FDI impact is made up of money flows of P.O. Box companies[53], which generate relatively few jobs and little tax revenue[54] (think of the IFSC financial centre in Dublin, mentioned above). In addition, both P.O. Box companies and physically present foreign companies may be relatively footloose and not fully anchored in the Irish economy (Culliton, 1992; Gleeson et al., 2005). This means that they will quickly disappear when circumstances change, for example when taxes or wages go up or the company suffers economic setbacks. The Irish economy is sooner a case of a so-called separate system of national companies on the one hand and foreign companies on the other (Ugur and Ruane, 2004). Consequently, the Irish economy depends not only on the whims of foreign companies, but also on the foreign markets those companies operate on. The fact is that Ireland is used as a base for exports to other European countries and that makes it highly dependent on external demand. The financial centre is also particularly subject to the functioning of global financial markets.

European Union measures against Irish tax policy

Under pressure from the EU, Ireland changed its zero-tax policy in 1984 and set the corporate tax rate at 10%. The subsidy policy aimed at companies was also abandoned because it was considered a form of government support to private businesses. The EEC and later on also the European Commission wanted to do away with state aid because it spurs corruption and impedes the creation of a level playing field at the European level. In 2005, the corporate tax rate was further increased to 12.5%. Recently, controversy around the Irish tax policy has arisen again, mainly because of alleged tax evasion practices by US companies. This occurs when companies open an office in Ireland without actually relocating production or when they take over Irish businesses and then are able to enjoy the tax advantages by relocating the entire business to Ireland (The New York Times, 2016). In 2016, the United States announced that it would take measures and the news led to the suspension of an intended merger between the American pharmaceutical company Pfizer and the Irish Allergen (The New York Times, 2016). The European Commission also took further action in 2016 when it was revealed that Apple Sales International was effectively paying less than 1% tax in Ireland. The European Commission demanded that the Irish government force Apple to retroactively pay more than 13 billion euros in taxes because it saw the situation as a breach of EU rules on state aid to individual companies (European Commission, 2016). Ireland has appealed against the European decision.

The IFSC has also been linked to cases of shadow banking (The Irish Times, 2013; Stewart, 2013). This is a setup in which a bank only has a PO Box and a handful of directors who are also the 'directors' of many other companies, while the concrete banking operations are carried out in other countries. In addition, the actual amount of tax paid is said to be lower than 12.5%. This is possible thanks to crafty timing of transactions and extra benefits that are received for 'investments' in R&D. It also appears to be difficult to ensure these companies adhere to the financial rules.

Another instance of criticism focuses on competition between national and foreign companies: capital and labour used by foreign companies are 'lost' to national companies that are more structurally anchored and this would hamper structural domestic economic growth (The Economist, 2004). Finally, there is the question of how big the global social cost of 'tax evasion' is? Foreign businesses in Ireland pay less tax, or no tax at all but they *do* make use of public services, which have to be financed through other forms of taxation, such as citizens' income tax (Stewart, 2013). Moreover, the European Union had to put up bailout money during the 2008 financial crisis.[55]

In contrast, others argue that foreign investments in Ireland involved far more than volatile capital and volatile companies alone. This is illustrated by, for example, the historical description by Ruane and Buckly (2006) of the FDI policy that IDA has been pursuing since 1957.[56] As, at the end of the 1960s, spillover effects on domestic economic activity were minimal, in the 1970s IDA focused on a specific type of foreign companies: those that exported large volumes of goods to growing European markets and wanted production to take place in Europe. Ruane and Buckley (2006: 6) call this the *project approach*. It involves reaching an agreement on a package of mutual investments, with IDA also providing the necessary follow-up services, such as assistance in recruiting suitable workers. The FDI policies became increasingly selective as to the kinds of sectors: high-tech manufacturing, particularly in the fields of electrical, chemical and pharmaceutical goods. The companies they managed to attract in the 1970s include Polaroid, Digital Equipment and Gateway. Due to the shared language and the overseas relationship with the United States, Ireland, with its cheap labour force, was particularly popular with American manufacturing companies.

Many companies, including Polaroid, Digital Equipment and Gateway, turned out to be footloose and left the country in the 1990s (The Economist, 2004). Not only did the EU take measures against Ireland's tax policies (see text box below), but labour costs also rose sharply in the 1990s. Yet, this did not necessarily mean that policies had failed. A case in point is the fact in 1997, around 90% of the jobs at Apple were still industrial. Later, many of those positions were transferred to the Czech Republic and Taiwan due to rising labour costs but at the same time, Apple Ireland increased the number of activities with higher added value, such as software development and the Customer Support Centre. Therefore, while it was not so much a case of a decrease in the overall number of jobs, by 2004 the proportion of industrial jobs with regard to total employment had fallen to around 15% (The Economist, 2004). Barry and Egeraat (2008) also reached the conclusion that industrial activity in hardware manufacturing had been substituted by service activities in the fields of software, sales, technical support, call centres and logistics. In the late 1990s and the first years of the following decade, there was a job shift within the software sector itself from support services–which did not

require highly skilled software developers–to increasingly advanced activities (White, 2004).[57]

When the project approach came to an end, policy design shifted towards the formulation of strategies for economic clusters, a move that was in line with the shift in the economy towards more high-quality activities. In this regard, the experience IDA had gained with the project approach proved useful, as many of the companies that had already been attracted were active in the fields of software, semiconductors, computers, pharmaceuticals and medical devices (The Economist, 2004). Therefore, the idea was to establish the link between foreign investment and cluster policy in precisely those fields. (Ruane and Buckly, 2006). Ireland managed to attract several leading companies, including Wyeth (biopharma[58], Pfizer (pharmaceutical and biotech[59]), Dell (computer hardware[60]), and Lotus (software [61]), all in Dublin, and Apple (computer hardware) in Cork (The Economist, 2004; White, 2004). IDA was also one of the first development companies in the world to focus on attracting services, including financial and telecommunication services and giving special attention to services related to software activities. The experience IDA had built up in giving support to businesses was also put to good practice, for example in the form of consultation for organisations wanting to hire properly trained workers (Baily, 2011).

Cluster strategy

The aim of the cluster policy was to create linkages to national suppliers around the locations of leading companies. That would then enable a specialised labour market to arise (the *hub and spoke* model). In response to the limited level of interweaving of foreign and national companies, a National Linkage Programme was launched in 1985 (Lenihan and Sugden, 2008). The idea was that firmly rooted, foreign companies would create a cluster with unique regional competences (comparative advantages), which could be used to attract other companies. Examples of businesses that established themselves in the Dublin area are Intel (Collinstown Industrial Park[62]), Microsoft (Campus Sandyford[63]), Hewlett Packard (Liffey Park Technology Campus[64]), IBM (IBM Technology Campus, IDA Business Park and IBM House Shelbourne Road[65]), Symantec[66] and Oracle[67]. This led to the birth of an electronics *hub*, and soon *spokes* developed of small electronics companies that were eager to be connected to these giants. According to Krugman (1997) and Ruane and Buckly (2006), this success can be explained partly by pure luck, but also by the IDA policies (including consulting about recruitment and finding suppliers) and education policies (which involved offering specific lines of education that matched the cluster strategy). The universities in Dublin produced large numbers of engineers and software developers.

Knowledge infrastructure and clusters

The Irish government has been investing in secondary and higher education since the 1960s. In 1966, secondary education even became free of charge, and between 1995 and 2000 tuition fees were waived in higher education. The two largest universities are located in Dublin and other major ones are in Cork, Galway and Limerick. Dublin's universities are top institutions for IT and pharmaceutical and healthcare studies. For many foreign companies, this is an important quality (The Economist, 2004). To attract foreign companies, special educational programmes were developed that were in line with the economic focus areas, such as electrical engineering (Krugman, 1997) and software development (Glancy et al., 2001; White, 2004).

Before 2000, Ireland invested very little in science and technology. At the end of the 1990s, however, the Technology Forecast Group came to the conclusion that it was high time to increase financing and this led to the drawing up of the National Development Plan 2000–2006, which foresaw major investments. The National Development Plan 2007–2013, and, more particularly, the 2006 Strategy for Science and Technology, further boosted investment. In addition to general investments in research, R&D, higher education and business infrastructure, specific investments were made in the sectors of agrifood, energy, marine technology and geotechnics, healthcare and the environment (Cunningham and Golden, 2009).

In 1998, the Technology Forecast Group on possible technological development paths for the Irish economy published the report *Technological Foresight Study Ireland*. The group reached a series of conclusions that motivated a shift of focus towards ICT and biotechnology, and the report recommendations led to the establishment of the Science Foundation Ireland (SFI)[68] in 2000. This organisation concentrates on fundamental and applied science for the benefit of the technology industry and supports research groups working at the cutting edge of their fields. Since 2008 it has also directed attention to renewable energy and energy-efficient technology, and in 2013 activities were started in the field of fundamental research.

Since 2005, Enterprise Ireland[69] has been investing in Applied Research Enhancement Centres (ARECs), which are dedicated to developing specialist knowledge in and between universities and businesses. Here too, the focal areas mentioned above are strongly present: ICT and software, life sciences and pharma, and biomedical devices and materials. One example is the CREST institute, which is affiliated with the Dublin Institute of Technology and operates in the field of biomedical equipment and materials.

Foreign investments as a strategy for industrialisation

Above we noted that an industrialisation strategy based on attracting foreign companies can be vulnerable (Barry, 2002; Baily et al., 2011; Ruane, 2001). Yet, there are arguments in favour of an industrial policy tailored to businesses, sectors, clusters and education programmes that goes beyond offering generic tax breaks.

According to Barry (2002), Ireland's old one-track economic structure meant that standard financial and fiscal reforms only had a minor impact.[70] He argues that standard reforms may be necessary to enable a country to catch up but are not a sufficient condition for substantial economic recovery. In the case of Ireland, the specific focus on attracting foreign investment was needed to create an export base that did not hinge on agriculture and offered opportunities for other economic activities to gather around it. The measures went beyond textbook generic macroeconomic reform, because they formed a specifically tailored industrialisation strategy (Barry, 2002: 40). This vision fits in the product space framework formulated by Hidalgo et al. (2007), which holds that countries with a strongly unvaried focus on the production of a few low-grade products are unable to make 'big leaps' towards undertaking more sophisticated activities because they lack the knowledge and skills for the transformation. Irish initiatives that fit into this framework are the shift from hardware production to software development and the shift within the software industry towards higher quality activities (White, 2004) that both took place in parallel with the ongoing development of FDI policies, such as providing specific education programmes, creating knowledge institutes and implementing the hub and spoke model.

4.5.5 Agglomeration Dublin

While we observed earlier that industry policies had a strong national component, it is clear that many economic activities are physically concentrated in Dublin (Shahumyan and Williams, 2015). Important examples (with an intimate connection to FDI policies) are financial and business services, ICT, entertainment and the media (a crossover between ICT and the creative sectors), medical technology (also present in Galway), and chemistry and biopharmaceutical industry (also in Cork and Limerick). Further details can be found in Hazelkorn and Murphy (2008) and Williams et al. (2012). In the wider Dublin region, concentrations of specific activities are housed in the Docklands Area–a part of the Urban Development Project (UDP)[71] known for its transformation from industrial port to a high-tech services site–and, especially, Silicon Docks (high-tech companies) and the International Financial Services Centre (IFSC). Other locations are CityWest business park, home to Adobe and SAP, and The Digital Hub, which has a concentration of ICT and companies in the media sector.

Compared to other metropolitan agglomerations such as Munich, Madrid and Amsterdam, Dublin does not have a historic-cultural centre. Still, the city has been the economic, administrative and cultural heart of Ireland since independence in 1922 (Crossa et al., 2010), while also developing into a university city. Dublin never was a real industrial city, as industrialisation largely bypassed the country as a whole. As a result, the transformation efforts that industrial cities elsewhere in Europe were confronted with in the 1980s and 1990s were relatively insignificant in Dublin (Crossa et al., 2010).

Top-down policies and spatial distribution

Until the mid 1980s, local policies focused mainly on the implementation of centrally managed plans that foresaw nationwide, low-density suburban expansion outside existing cities (Bartley and Shine, 2005). This principle of spatial dispersal aimed to discourage agglomeration as much as possible. It was based on an ideal of a Catholic and rural Ireland. In addition, the economic hardship after the Second World War lasted until the 1960s and forced many Irish people, especially Dubliners, to emigrate. As a result, the population declined steadily between 1940 and 1960 (Hughes, 2010).

Industry policies pursued in the 1950s and 1960s under the Underdeveloped Areas Act concentrated on the industrialisation of underdeveloped rural areas (Crossa et al., 2010). In 1971, IDA presented its leading spatial planning document for the following 20 years (Hughes, 2010). The creation of 'industrial enclaves' was no exception in that period. Later on, it also spawned the Linkage programme (1985) and the cluster policies. The Irish Government's position is illustrated by its political rejection of the 1969 Buchanan Plan, a vision of urban development in Ireland commissioned by the United Nations. The government claimed that the plan was excessively based on concentration areas and stated that it did not believe in the supposed trickledown effect from these concentration areas to the rest of Ireland (Hughes, 2010).

Despite these policies, the population of Dublin grew during the later phase of industrialisation starting in the 1960s. Urban expansion consisted of low-density suburban residential areas outside the city's central district. The period witnessed the origin of the pattern of dispersed, low-density developments that still characterises the Dublin region today. Population growth came to a standstill during the oil crises of 1973 and 1979. Partly because of the urban spreading policies that paid little attention to urban development as whole, the central part of Dublin was in very bad condition by the mid 1980s (Hughes, 2010).

Bottom-up policies and urban renewal

In addition to macroeconomic policies (taxation, wages, investments in education) and the cluster and knowledge policies linked to FDI, from the mid 1980s onwards, the administration also focused on cities and urban renewal. According to Bartley and Shine (2005: 145–146), the *urban renaissance* policy was a response to the increasing global competition between cities to attract human capital and businesses. The policy was effective over a span of time that coincided partly with the 1986–2001 period marked by the post-industrial strategy to attract only fast-growing, high-tech industries and services, and partly with the *Celtic Tiger* period of explosive economic growth between 1994 and 2008, and the period of decentralisation that saw local government authorities being granted more competences.[72] As mentioned above, spatial planning in Ireland had until then been under strict central management and this new period was therefore characterised by decentralisation, increased flexibility and the involvement of public-private partnerships (Bartley and Shine, 2005: 155).

The new times started with the adoption of the Finance Act and the Urban Renewal Act in 1986 and the opening of the International Financial Services Centre (IFSC) in the Docklands in 1987. The Finance Act provided tax relief for private developers for investments in urban development in certain parts of the city. Under the Urban Renewal Act, the Urban Development Corporation (UDC) received special powers to start up urban regeneration within a certain area. A good example is the redevelopment of the Docklands. The opening of the IFSC in this central part of the city accelerated urban renewal in the area. In economic terms, the project was very successful, but there is often-voiced criticism about the mono-functionality of the area. Although the original plan foresaw multiple functions, the combination of the oil crisis and the vision of a financial centre meant that development mainly involved building office blocks for foreign companies operating in the financial and business services sector. In addition, the area has turned into a relatively isolated enclosure due to its security fences, a canal and a security wall (dubbed the *Berlin Wall*, by locals). Then developments have led to gentrification and a shortage of affordable housing in Dublin (Bartley and Shine, 2005). The low level of public participation was part of the problem and everything was made more difficult by the fact that the Urban Development Corporation was run by the national government, bypassing the local government. Still, despite the mono-functionality, the lack of social inclusion and the poor level of democracy in decision-making, foreign investments also actually served as a catalyst for urban redevelopment, if only because the IFSC opened its doors in 1986. Spatial planning in Ireland is therefore another area that cannot be viewed independently from FDI policies, which before 1986 were part of the Underdeveloped Areas Act, and subsequently functioned as a driver of urban renewal by shaping the Finance Act and the Urban Renewal Act and promoting the establishment of the IFSC.

Over time, the social and democratic dimension received more and more attention in Dublin's urban regeneration projects. In this regard, Bartley and Shine (2005) refer to four models (Marks), each characterised by a specific urban renewal project: the Docklands model (Mark 1), the Temple Bar model (Mark 2), the Historic Area Rejuvenation Project (Mark 3) and the New Docklands model (Mark 4).

When the demand for office space by financial companies fell during the recession of the late 1980s, the urban development focus shifted to cultural heritage and the local government was assigned a more prominent role. Together with the designated national authority (UDC), the local authorities drew up a Framework Plan for the Temple Bar district (Mark 2), which, compared to the Docklands model (Mark 1), was a more people-oriented project that matched the existing urban structure in an architectural and a planning sense. The Temple Bar district is now known for its cultural activities and its nightlife. It is also one of the few neighbourhoods that has preserved the medieval street pattern.

In the Historic Area Rejuvenation Project (Mark 3), which was initiated in 1994, the local government had full control with regard to both initiative and implementation and representatives of local resident groups were involved in the planning procedure. The area in question was characterised by disused buildings, unemployment and degradation because the traditional economic activities had disappeared. Distinctive elements of the revitalisation project are the viewpoint on the 185-metre-high chimney of an old whisky distillery and the Smithfield Public Area, Dublin's largest public space, featuring shopping malls and the Smithfield Plaza on the site of a former marketplace.

The New Docklands project (Mark 4) took shape in 1998, when the national government introduced the Integrated Area Plan (IAP). For an area to be designated as an IAP and qualify for national funding, local interests had to be safeguarded. Dublin's local government embraced the idea and the Dublin Docklands Development Authority laid down a provision in its master plan that on this occasion the key issue was the social, economic and 'holistic' regeneration of the area (Bartley and Shine, 2005: 158). Local residents' groups discussed the plans with the newly established Consultant Council and were represented in the Governing Board. However, the national government still exerted significant influence through the UDC and a struggle for power took place behind the scenes. This even led to the creation of a 'dual system' that gave private investors the option to operate via the national government or via the local government (Bartley and Shine, 2005).

A consistent vision on urban development

The first consistent spatial planning programme for Ireland was not published until 2002: the National Spatial Strategy 2002–2020 (Hughes, 2010). For the first time there was an integrated vision of the social, economic and physical development of the country. Also new was the identification of a number of Gateways (Dublin, Cork, Limerick/Shannon, Galway and Waterford) that were to be assessed in relation to nearby lower-order cities. The plan involved large-scale investments in infrastructures to improve their functioning. The Regional Planning Guidelines for the Greater Dublin Area, published in 1999, 2004 and 2010, also considered the urban network in its entirety following an approach that was summarised in the Compact Polycentric Settlement Strategy (Hughes, 2010). In 2007, the National Development Plan 2007–2013 was published, which, for the first time, made explicit reference to the regional planning guidelines and local plans that had been drawn up throughout the country.

A pattern of dispersed urbanisation

Dublin's rapid growth over the last 20 years has led to a rather dispersed form of urbanisation along with the expansion of the city itself. The Commuter Belt now runs from the city centre to 100 kilometres beyond the borders of Dublin. Places in the surrounding counties, such as Navan, Drogheda, Carlow, Naas, Rochfortbridge in Westmeath; Gorey and Bunclody in Wexford; and Castlecomer in Kilkenny, have grown dramatically thanks to the Dublin commuters who have taken up residence there (Williams and Shield, 2002). Even small villages have seen many new inhabitants arrive: Clonard, Stamullen, Enfield, Ratoath and Ballivor in County Meath; Carbury and Prosperous in County Kildare; Aughrim and Baltinglass in County Wicklow; Kinnegad in County Westmeath; and Collon in County Louth. Even though official plans kept urban development concentrated in specific locations and maintained the Strategic Green Belts as unbuilt areas, urbanisation has continued at a brisk pace. The new developments do not only include residential areas, but also business locations, especially for high-tech and service companies (Williams and Shield, 2002). Examples of such new decentralised locations are Leopardstown/Sandyford (transformation from industry to services and high-tech activities; f.i. Microsoft), Cherrywood Technological Park, Tallaght and Environs (Citywest Business Park, Baldonnel Business Park and Parkwest), western Dublin/Kildare North (Intel and Hewlett Packard, Liffey Valley Shopping Centre), Blanchardstown/Mulhuddart (retail and business services, including the IBM Complex), Dublin Airport/Swords (logistics and IT).

Infrastructure

Due to the dispersed nature of urbanisation and the concentration of traffic flows in the city centre, Dublin has a relatively large number of congestion problems. Public transport is therefore an important mode of transport. Dublin has an extensive rail network that connects the many suburbs with the centre and other parts of the city. Over the past 20 years, important investments have been made in the expansion and improvement of tracks and stations. In 2004, the LUAS light rail system was opened. In 2017, a plan was presented for an underground rail system with construction set to start in 2021. Considerable investments are also being made in road infrastructure. Examples of major road projects that have recently been completed are the Dublin-Belfast (M1/N1 in 2007), Dublin-Limerick (N7/M7 in 2010) and Dublin-Sligo-Galway motorways (M4/N4). Another project was the upgrading of the M50 ring road that included construction of a tunnel in the Docklands area.

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4.6 Madrid

4.6.1 Outline

Under Franco, Madrid became, even more than in the past, Spain's central hub where all roads and communication infrastructures converged on. Madrid also saw relatively large investments going into the state-run industries located there: Repsol (CAMPSA), Telefónica (an ICT state monopoly) and the telecom equipment manufacturer INTELSA, and also into the state-owned banks and National Institute of Industry (INI). The present-day aerospace technology cluster Aeroespacial de Madrid has its origins in the defence industry. The large-scale state projects attracted companies from other parts of Spain. The combination of administrative capital, large population base and hub function also had a powerful appeal: Madrid acts as a magnet for people, companies and investors, both national and foreign. The attraction effect was first felt during the gradual opening up of the economy from the 1960s onwards, and also in the late 1970s, which were marked by post-Franco liberalisation, democratisation and decentralisation, and following Spain's entry into the EU in 1983. In the 1990s, foreign migration and investment, mainly from Latin America, also increased rapidly. The presence of a large supply of labour made up of flexibly employable, relatively cheap, young and well-educated workers subsequently attracted new economic activities.

After the Franco regime, the Madrid region invested heavily in the restoration of residential areas, its cultural heritage and the organisation of cultural events (C8: conditions of the physical and residential environments). These investments were necessary after the years of neglect the city had suffered. They were a reaction to Franco's highly centralist and repressive regime, which had had no room for regional cultures and traditions. Since the beginning of the 1990s, Madrid has attempted to find a place among the leading cities in the international field of urban influence, particularly Paris and London, the two largest agglomerations in Europe (OECD, 2007: 16). In a relatively short period of time, substantial investments were made in (C5) physical infrastructure, including the metro system, a high-speed rail network, the airport and ring roads. Financing also went to cultural amenities, for example the simultaneous expansions of the Prado, Thyssen and Reina Sofía museums. The great population influx and the heavy flows of foreign investments that started in the mid 1990s fuelled the setting up of large and costly building projects, some of which were only partly executed. The financial crisis that erupted in 2008 led to the burst of the real estate bubble.

After a period of economic growth driven largely by the opening up of the economy, institutional reform and physical investments, Madrid now faces the challenge of diversifying into a more knowledge-intensive economy with high-value, regionally anchored functions. In addition, the cheap labour and the many temporary contracts lead to low labour productivity and a low willingness to invest in employee training. As a result, workers find themselves in a vulnerable position. There is also a mismatch on the labour market, which has brought about high youth unemployment among highly educated people. All in all, it can be concluded that Madrid has invested too much in physical infrastructure and too little in knowledge infrastructure and human capital.

4.6.2 Geographic and administrative demarcation of the region

The administrative borders of the city and the region coincide with the statistical divisions for the city (UA-ES001C1) and the region (NUTS ES30)[73] shown in Figure 4.10. The Madrid region (Comunidad de Madrid) has 6.5 million inhabitants and comprises 179 municipalities, of which the city of Madrid (Ciudad de Madrid), with 3.2 million inhabitants, is the most important.[74] Unlike in many other regions in Europe, the borders of the Madrid region coincide largely with the borders of the daily urban system (OECD, 2007). The 17 Spanish regions enjoy a high degree of autonomy, with a president heading a democratically elected parliament. The city of Madrid also has an elected parliament (the city council), headed by a mayor. The growth figures presented in the introduction to this chapter correspond to the Madrid region. Throughout the case study, we will frequently distinguish between the region and the city.

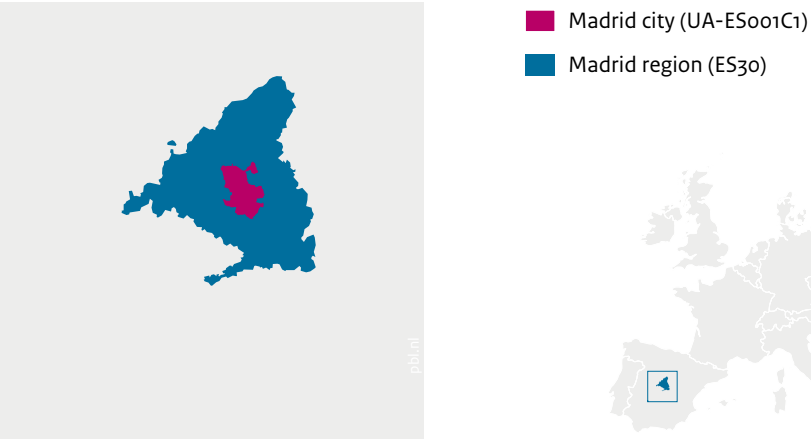
4.6.3 Initial conditions

The end of the autarky

After the bloody political purges of the Spanish Civil War (1936–1939), Franco founded a dictatorship that would hold Spain in its grip until his death, in 1975. The regime pursued a strongly nationalist, centralist, repressive, autocratic and autarkic policy from Madrid. It involved, among many other things, a situation of ceaseless conflict and oppression. Another point in question was that the European allies did not allow Spain to join NATO, not to mention the European Economic Community (EEC). With only Ireland and Italy maintaining close contact with the regime, Spain was economically isolated.

Nevertheless, the country experienced remarkable economic progress in the 1960s. Called *the Spanish Miracle*, it was a period in which the ideas of relatively liberal technocrats were given more room for manoeuvre (Solsten and Meditz, 1988). This meant dismissing many autarkic ideas and implementing several economic programmes including the Stabilisation Plan (1959) and Development Plans I (1964–1967), II (1968–1971) and III (1972–1975). These involved investments in infrastructure, the development of (partly state-run) industrial estates,

Figure 4.10
Location of Madrid city and Madrid region



Source: Eurostat, adaptation PBL

reducing state intervention and encouraging competition, international opening and, above all, attracting foreign investors to enable the financing of plans (OECD, 2007; Solsten and Meditz, 1988; The New York Times, 1964). The measures led to a wave of dynamic, Fordist industrialisation and the flourishing of the tourist industry. Emigration to economically prosperous countries also got under way, which brought about a heavy flow of remittances and a reduction in unemployment.

Rural exodus

The two largest metropolitan regions in Spain, Madrid with 6.3 million inhabitants and Barcelona with 5.2 million, have played leading roles in the various waves of urbanisation that have taken place in Spain over the past 50 years (Arias and Borja, 2007). In terms of population, other metropolitan areas in Spain follow at quite a distance. Valencia has a population of 1.8 million, Seville has 1.5 million inhabitants and Bilbao, Malaga and Zaragoza have 1 million each[75]. A round of Fordist industrialisation led to a first wave of urbanisation between 1950 and 1975, occurring mainly in Madrid and Barcelona (Arias and Borja, 2007). The big city offered economies of scale and, for the industrial sector, proximity to markets, labour and infrastructure. A rural exodus took place as many rural workers moved to the city to find jobs in industry. The population increased both in the city itself and in the ring around the city, within the region of Madrid. The period saw industrial estates concentrating and migrants settling in the southern suburbs of Madrid and in other places further south in the wider region of Madrid, such as Getafe, Leganés and Móstoles. By 1970, the region was already home to some 4 million people, while it had only 1 million inhabitants in 1930 and 1.5 million in 1950.

Path dependence and agglomeration

Madrid and Barcelona have traditionally always been at the top of the urban hierarchy in Spain. Barcelona benefited from its port and Madrid became Franco's administrative capital. Franco also invested relatively large amounts in large-scale, state-run industrial businesses in Barcelona (the SEAT works for example), and particularly in Madrid, which was home to companies such as Repsol (CAMPSA), Telefónica (ICT monopoly) and INTELSA electronics as well as the National Institute of Industry (INI). Aeroespacial de Madrid is the present-day aerospace technology cluster that has its origins in the defence industry. The large-scale state projects attracted other companies that advanced Madrid's central position in Spain. Madrid was, literally and figuratively, a central hub where all road and communication infrastructures converged on (Stapell, 2010). Consequently, the agglomeration process that took place during the wave of industrialisation of the 1960s was particularly pronounced in Madrid. In addition to industrial and state-owned telecom companies, the capital also housed the state-run banks, which adopted a more market-oriented, international strategy when deregulation was introduced. Altogether, it is not surprising that the financial and ICT clusters arose in the capital. In addition, both the government and private companies invested heavily in Madrid. Later, government investments were initially directed to post-Franco reconstruction and then to efforts to acquire a position at the top of the international urban hierarchy: Madrid as a magnet for foreign investments and international knowledge workers, a transport hub, a capital city showcase, a globally relevant congress centre and an attractive destination for business and tourist travel.

End of the Franco era and the emergence of regionalism

The Franco regime hoped that liberalisation and economic development would temper the dissatisfaction among the population, but something quite the opposite happened. The developments had led to the emergence of a middle class of mainly industrial workers living in cities who were becoming increasingly well-organised (Solsten and Meditz, 1988). At universities too, organised opposition was on the increase. Moreover, the great wave of industrialisation came to an end in the mid 1970s, and the oil crisis led to economic stagnation, which served to step up the demand for reform even further. Especially in the southern parts of the Madrid region, social problems came up due to deindustrialisation in the post-Fordist period (OECD, 2007). After Franco's death in 1975, it was therefore not long before the constitution was promulgated (1978), a democratically elected president took office (1979) and municipal elections were held (also in 1979).

The new constitution also made it possible to carry out a first wave of decentralisation in Spain (1978–1983). Within the framework of the first round of *Pactos Autonómicos* (autonomy deals), seventeen regional *Comunidades* with a parliamentary-democratic system were created, including the *Comunidad de Madrid* in 1983 (OECD, 2007). The pace of decentralisation varied greatly from one region to another. For example, regions with an originally strong 'national identity'–Andalusia, the Basque Country, Catalonia and Galicia–were granted the special status of 'fast track' region, while the others were supposed to take the 'slow track', consequently enjoying far less autonomy for a long time (Perrado, 2004). In 1992, under the second round of autonomy deals, all 'slow track' regions were brought up to the same level as their 'fast track' counterparts. This enabled regions to draw up their own autonomous laws within the framework of the national constitution, thereby becoming more flexible in terms of administration. As a result, day-to-day management and relationships with the province, the state and municipalities can differ across regions (Agranoff, 1994).

The decentralisation of competences was a gradual and uneven process. It is still ongoing, mostly towards greater decentralisation, although some regions, including Madrid, have recently considered returning powers (in the fields of education, justice and care services for example) to the central government. This was after they had been hit hard by the crisis that started in 2008.[76] The Madrid region is characterised by the fact that its borders coincide with those of the daily urban system and that there are no tiers of government between the region and the municipality (as is the case in other regions such as Catalonia). This is considered to be beneficial for the region's readiness compared to many other European and Spanish regions (OECD, 2007).

The Spanish regions clearly have a high degree of autonomy. This partly has its origins in the traditionally strong 'nationalities' of Andalusia, the Basque Country, Catalonia and Galicia. However, other regions, including Madrid, also pressed for a high degree of autonomy after the Franco era. According to Stapell (2010), this was a reaction to the repression suffered under the dictatorship. Throughout the regime, everything had to epitomise a common Spanish identity, in which there was no room for local autonomy and tradition. The repressive and centralist policies enforced from Madrid had the effect of nationalism being linked to autocracy, and regionalism to democracy. According to Stapell (2010), there was no shared Spanish identity. In Andalusia, the Basque Country, Catalonia and Galicia, identity lay in a common regional history but in Madrid, which lacked this common history, a search was made for what Stapell (2010: 10) calls a geographically shared 'civic identity of sense of place', in order to distance itself from the dictatorial past.

4.6.4 After Franco: investing in the quality of the physical and the residential environments

By the mid 1970s, with rehabilitation work long overdue, Madrid had fallen into disrepair. Moreover, the damage caused by the Civil War (1936–1939), which had raged on mainly in Madrid, had never been repaired (Stapell, 2010). It was not just the city itself that was lagging behind. The expansion of the metropolitan area (see text box below) had produced partially self-built neighbourhoods that were of abominable quality (Arias and Borja, 2007; Stapell 2010). As deindustrialisation set in, social problems arose, particularly in the southern parts of the region. All infrastructure investments had been car-oriented and based on a monocentric city: the motorways led mainly to the urban centre (OECD, 2007). The second wave of urbanisation, the post-Fordist period, took place between 1975 and 2000 and was characterised by the levelling off of growth in the Madrid region accompanied by sprawl that was even greater than that of the previous period (Arias and Borja, 2007). As in many other western cities, the Madrid population underwent a decline until the end of the 1990s (Arias and Borja, 2007).

The big clean up

In the 1979–1986 period, Madrid invested heavily in urban renewal (civic identity) and cultural facilities (a sense of place). The common denominator *Revitalising Madrid* covered a range of projects: leisure centres, clinics, cultural centres, libraries and museums were renovated or newly built; public parks[77], monuments, rivers and historical buildings[78] were given a facelift and renovated; railway and bus stations were connected to the metro network; and the metro lines themselves were modernised and expanded. Investments were not only made in the centre. Conscious efforts were made to

Sprawl, spreading out like an oil slick

Urban sprawl is massive in Madrid. The city is spreading like an oil slick in so-called *metropolitan rings*, which has resulted in a sharp decrease in the average density in the region over the past 50 years (Arias and Borja, 2007). The trend is structural despite processes initiated in the early 1970s to bring about concentration. Important causes are the facts that from the 1960s urban development was mostly uncontrolled and that from the 1990s many Spaniards prefer to own a house in the suburbs (OECD, 2007).

Arias and Borja (2007) give seven reasons for the sprawl trend: (1) poor spatial planning; (2) the shift from economies of scale to economies of scope, which resulted in industries spreading more widely than before; (3) an increase in car use; (4) the construction of infrastructure by the government in order to make a profit when selling off land–a phenomenon that was fuelled by corruption; (5) a preference for a suburban lifestyle: a detached or semi-detached home with a car in the driveway; (6) the abundance of financial resources; and (7) low interest rates that have encouraged private home ownership since the mid 1990s.

involve, insofar as possible, the entire metropolitan region and its inhabitants, including the suburbs (Stapell, 2010). Outside the centre, for instance, there was a focus on improving the existing residential environment, that is, refurbishment without demolishing large parts of the city. This occurred in districts such as Fuencarral, Carabanchel Bajo, Carabanchel Alto, Vicálvaro, Villa de Vallecas and Hortaleza.

In the field of culture (sense of place), investments were made in informal education programmes that brought local residents into contact with the historical buildings and the culture and history of Madrid.[79] These programmes were extended to the regional level, so that the investments were not limited to the centre, but also shared with the suburbs. In addition, numerous street festivals and exhibitions were organised. The initiatives aimed to align themselves with *La Movida Madrileña*–the Madrid Scene that developed between 1978 and 1983. This counterculture movement was characterised by freedom of expression in the public sphere, in contrast to the restrictions of the Franco period, its breaking free from taboos and the emancipation of the working class (visible in the adoption and adaptation of the Madrid jargon *cheli* by the younger generations). Madrid developed from a late 1970s ruin into the cultural capital of Europe in 1992.

One step further: towards the international top

In the 1990s, attention shifted more and more towards developing the city's international profile (Stapell, 2010). Early in the decade, the desire arose in Madrid to find a place among the leading cities in the international field of urban influence, particularly Paris and London, the two largest agglomerations in Europe (OECD, 2007: 16). First expressed in the city's 1993 PROMADRID strategy, the ambition was consolidated in the Regional Urban Plan of 1997. New areas were developed to house business activity, the historic city centre was further renovated and iconic building projects and large-scale infrastructure projects were started up (Fernández-Güell, 2014).

The 2003 Pro-Growth strategy was also used by the city of Madrid to adopt a marketing plan to attract international investors and tourists from Japan, China, India and the United States; Latin America was already prominently present (OECD, 2007). Another initiative was the city's Olympic bid for the 2012 and 2016 Olympic Games. The strategy was developed in collaboration with regional partners such as the Chamber of Commerce, trade unions and Real Madrid football club. In a relatively short period of time, investments were also made in the metro system, a high-speed rail network, the airport, the ring roads and cultural amenities. The simultaneous expansions of the Prado, Thyssen and Reina Sofía museums is an example of such efforts (Perrado, 2004).

Madrid is known as a destination where many business trips are combined with culture and entertainment. Its numerous restaurants, lively streets and nightlife, its UNESCO heritage and the wide range of cultural activities, such as the Gallery Route, El Prado and the Thyssen museum, all contribute to this. The city invested in conference and exhibition centres that advance its international visibility and consequently ended up in the top 10 of conference destinations (OECD, 2007).

The third wave of urbanisation

From the late 1990s to 2007, a third wave of urbanisation took place in Madrid. The population in the region grew explosively. In addition to expansions to urban settlements throughout the region, which was mainly driven by immigration, the population in the centre of the city also increased as a result of a revaluation of the central environment by knowledge-intensive services and the accompanying body of young knowledge workers. The development was reinforced by public investment in the centre. The trend of simultaneous deconcentration and recentralisation (city of Madrid) fits in with the description of many cities in that period: '…from the initial concentration to suburbanisation and dispersal, thence to return to the re-urbanisation of the urban centres' (Arias and Borja, 2007: 175).

Financial and real estate crisis

From the mid 1990s onwards, building activity in Madrid was spurred by the fact that mortgage loans were easy to obtain and came with tax advantages. This led to a rise in the influx of people and to economic growth. Since creating space for more inhabitants also means more money is spent in the city (thanks to the loans, people have more purchasing power), the construction business grew into one of the largest sectors in Madrid. Along with huge government investments, which were largely financed through real estate loans, and foreign investments in urban real estate projects, this led to the creation of a real estate bubble in which the government, the financial cluster and the construction sector had become closely interwoven. Fernández-Güell (2014) gives a series of examples: the extension of the motorway network (a radio-concentric model); the extension of Barajas Airport (Terminal 4, completed in 2006); the extension of the high-speed rail system; the upgrading of the public transport system (the regional railway network and metro system); the Madrid-Rio project, which involved building the stretch of the M-30 ring road along the Manzanares River underground and laying out a new park on the surface (completed in 2011, with a large amount of residual debt); the new business centre that acts as an extension of Castellana Avenue (four 58-storey skyscrapers have been waiting for a new growth period since 2009); the rehabilitation of 17th and 18th century neighbourhoods; the 20th century Gran Via district (which is now the entertainment district of Madrid); traffic calming and renovation projects in centrally located residential areas (which brings about high levels of gentrification). To top this all off, there are the more than half a million homes that were built in the period 2003–2011. While these large-scale investments were being made, Madrid climbed positions in all sorts of rankings. Until the crisis erupted in 2008. From that moment on, per capita income fell, unemployment rose to 19%, passenger numbers at Barajas Airport dwindled (Terminal 4 is heavily underused), public debt per capita in Madrid was the highest in Spain and property prices dropped by 30%. As a result, there are many unfinished works and empty plots in the city. Projects such as Operación Chamartín and Operación Campamento are still on hold. It is also estimated that a stock of 70,000 homes remained unsold in 2011 (Leal and Sorando, 2016). Finally, corruption scandals involving the government, financial institutions and building companies were exposed. City of Madrid 2020 and the new Internationalisation Strategy (2012–2015) are more recent plans that advance a different, more sustainable and socially inclusive development strategy (Fernández-Güell, 2014). An Office has also recently been established to combat fraud and corruption.[80] Nevertheless, a required first step is reducing the debt burden.[81]

As mentioned earlier, the government invested heavily in urban megaprojects in this period. Fuelled by the huge population influx and the large flows of foreign investments that started in the mid 1990s, large and costly projects were set up and fully or partly executed under the political leadership of Ruiz-Gallardón, President of the Madrid Region from 1995 to 2003 and Mayor of the City of Madrid from 2003 to 2011. With the onset of the 2008 financial crisis, the whole system fell apart (see text box below).

4.6.5 After Franco: the path towards the strong economic growth of the 1990s

Catching up with Europe

Spain's economy continued to grow after the Franco era, as a result of liberalisation, democratisation and decentralisation, and eventually also its entry into the EEC in 1986 (OECD, 2007). Efforts to catch-up with the rest of Europe continued to concentrate on the two largest urban areas of Spain: Madrid and Barcelona. The industry with its Fordist character made way for a knowledge-based economy with more high-tech activities and services. It also meant that after the period of deconcentration, physical proximity became more important again. Following a short recession in the early 1990s caused by the worldwide stock market crash (Black Monday in 1987) and the liberalisation of the telecommunications sector, which until then had been a monopoly, the economy grew exponentially from the mid 1990s onwards.

Agglomeration of human and financial capital

Along with the increase in reform initiatives and economic growth, foreign migration also grew enormously in the 1990s. This created a large supply of labour made up of flexibly employable (temporary work contracts), relatively cheap, young and well-educated workers. Combined with a vast and growing Spanish market, this subsequently attracted new economic activities and foreign direct investment grew particularly rapidly in the late 1990s. The most important flows of human and financial capital came from Latin America and were driven primarily by the shared language and the historically developed trade relationships (OECD, 2007).

Foreign direct investments went to industry, especially the chemical sector, to commercial and financial services, and to transport and communication. Madrid formed a large potential market, had good communication and transport infrastructure, a large supply of relatively cheap, properly trained labourers, and there was a large stock of commercial and office space (OECD, 2007).

Outgoing foreign direct investments were mainly made by businesses providing services (financial institutions and telecom companies) and by the more traditional and medium- and high-tech industrial sector, as their domestic markets were becoming saturated. The Latin American market was a major recipient of Madrid investments. Here too, banks and telecommunications companies played a prominent role, with the latter assaulting the South American market (OECD, 2007; Baklanoff, 1996; The Economist, 1995).

Clusters

After deregulation, the state-run banking system, which had traditionally been present in Madrid, developed into a financial hub for both national (domestic savings) and international (FDI) capital. Industrial growth gradually gave way to growth in financial and creative services, in fields such as ICT, the media, real estate, accounting and headquarters for companies in general. Another important sector was logistics: Madrid's central location and modern communication and transport infrastructure were attractive to logistics companies. ICT was important–both as a sector providing services and as input for the electrical industry–in the fields of telecom equipment and software, but also other kinds of consumer and industrial electronics, industrial equipment and components (Rama et al., 2003). ICT, the telecom branch in particular, and electronics were greatly interwoven. The medium-tech industries, including electrical engineering and also many traditional industries such as chemicals, paper and food (Moral et al., 2009), diversified into high-tech industries only to a limited extent (OECD, 2007). Within this development, space travel and the life sciences were important focal points.

The telecommunications sector was able to adapt to the new market conditions that arose after the rounds of deregulation and privatisation in the 1990s. Telefónica, originally a state-controlled monopoly, managed to change course in time and went on to become a world leader in telecommunications services and equipment.
As far back as 1987, and with an eye on the imminent liberalisation, the company formulated an international strategy. It obtained capital through an international stock market launch and opened branches in several countries, with those in Latin America becoming the most important (Rama and Ferguson, 2007). Its experience with large-scale communication and infrastructure projects in Spain served the company well in the huge Latin America region. According to Rama and Ferguson (2007), the fact that production and technology development were interwoven with the wider electronics sector in the Madrid region was also important. These links meant that production could be adapted to the specific conditions of foreign markets quickly and at a relatively low cost. This also brought about a learning effect for smaller companies involved in production: they learned how to successfully enter international markets on their own account. In other words, Telefónica exported the project and the process, and the suppliers exported the products (Rama and Ferguson, 2007). This resulted in Telefónica focusing entirely on services and, instead of outsourcing part of its production, it entrusted all production activities to its suppliers. These were mainly the existing suppliers located in the Madrid region, but there were also new, foreign suppliers such as Ericsson, Nokia and Alcatel (Rama et al., 2003). All in all, after the period of deregulation and privatisation, there was more room for new companies and modern forms of management.

4.6.6 Knowledge infrastructure

Of the eleven universities in Madrid, four are listed in the yearly QS world university rankings: Universidad Autónoma (186); Universidad Complutense (239); Universidad Carlos III (280); Universidad Politécnica (551).[82] Therefore, none are among the top 100 universities in the world. There are also several important educational institutions in the creative sector, such as the Escuela de Bellas Artes (School of Fine Arts) and IE (Architecture and Design) and centres offering part-time courses including Islas Filipinas, La Paloma, Puerta Bonita, Salesianos, La Salle and Tajamar (OECD, 2007). Seven Centres for Advanced Studies were founded between 2006 and 2008 in the fields of water, food, energy, materials, nanotechnology and software. There is also a new network institute that is part of PRICIT IV, one of a series of five regional plans for science and technology (listed below in Table 4.3) that the Madrid region has been implementing since 1990. With four rounds already finalised, the currently running plan is PRICIT V (2016–2020).[83]

A failing innovation system

A feature of the Madrid economy is the hub-and-spoke model of large companies, consisting mainly of their regional, national or international headquarters, with a network extending across regional and national borders. There is little interaction with and between SMEs in the region (OECD, 2007; Markusen, 1999).[84] The level of interaction between the business world and the academic world is also qualified as low. One of the recommendations of the OECD (2007) was therefore to increase the interconnections between companies and between companies and knowledge institutions, in order to strengthen the innovation system. This was deemed necessary because innovation and investments in research and development were lagging behind the efforts being made in other urban regions in Europe (OECD, 2007).
In addition, between 2000 and 2005, the contribution of the high-tech sector to total industrial production also decreased, whereas that of the medium-high and medium-low sectors went up (OECD, 2007). After a period of growth that was advanced by the opening up of the economy, institutional reform and physical investments, Madrid was facing the challenge of diversifying into a place with more knowledge-intensive, high-quality and region-based activities (OECD, 2007: 20).

Table 4.3
PRICIT Regional innovation programmes

1990–1993	PRICIT I - 19M euros
1994–1997	PRICIT II - 100M euros
2000–2004	PRICIT III - 202M euros
2005–2008	PRICIT IV - 225M euros
2016–2020	PRICIT V - 420M euros

This upgrade only got underway to a limited extent, despite reforms of the university system from 2007 and policy efforts by the regional development company IMADE[85], the regional programme for science, technology and innovation Madri+d[86] and the municipal development company Madrid Emprende[87] (OECD, 2007). Investments have been made in the space travel, biotechnology and life sciences sectors, and in incubators for start-ups and numerous science parks, such as the Madrid Science Park that concentrates on ICT. According to estimates by the OECD (2007), the programmes had a limited impact by 2007. The main obstacles were the fragmentation of research funds and programmes, the deficient vertical coordination between government levels, corruption, the inadequate integration of universities with the local economy and low labour mobility between universities.

Another example of reform towards knowledge-intensive activities is the Industrial Observatory established by the city of Madrid. By performing economic monitoring, the city tried to improve its control of the economy and devise better strategies. The OECD (2007) has recommended further expanding this institute and ensuring greater involvement of companies, so that a diversification strategy may emerge with a higher level of regional support. Getting companies anchored in the region and interconnecting large companies, SMEs and universities should play an important role in this effort. In addition, an institute of this kind could contribute to streamlining local, regional and national government objectives, such as the restructuring of industrial sectors that are falling behind. Such networking efforts can reinforce the innovation system and contribute to an upgrade of the sectoral mix (OECD, 2007).

4.6.7 Human Capital

Mismatch on the labour market

The Madrid economy is vulnerable due to the presence of numerous large foreign companies with limited anchoring in the local economy and the related poor innovation system, and also because of the fact that many of its inhabitants, especially the migrants, depend on jobs in locally oriented consumer services, the construction sector and industry (Leal and Sorando, 2016). These are the sectors that were hit hardest during the last financial crisis, starting in 2008. It was due to the vicious circle that had arisen: intense builiding activity–based on mortgages and real estate loans–attracted new residents and workers who contributed to the increase in spending in the region, mainly in day-to-day consumption and housing. But the boom in building also attracted investments in industry due to the availability of cheap labour. But when the financial crisis erupted, industrial and construction output fell, unemployment rose, spending and tax revenue decreased and applications for social security benefits increased (Fernández-Güell, 2014).

But even before the crisis, the OECD (2007) had already pointed to the vulnerability of a situation marked by many temporary employment contracts and a low level of investment in employees. It led to low productivity: cheap labour and flexible contracts tempted businesses into creating many jobs with low added value and lowered their readiness to invest in the training of their employees. A mismatch on the labour market also led to a devaluation of higher education diplomas.

With regard to job opportunities and levels of pay, a wide gap has opened up between, on the one hand, the younger generations in the labour force (including the highly educated) and the lower ranks of the working class and, on the other hand, the older generations of the middle class (who have more work experience) and the upper class (businesspeople, directors and managers). Young people are the victims of this situation, as evidenced by their low wages and the more recent phenomenon of high youth unemployment. As a result, since the onset of the crisis, income inequality has increased much faster in Madrid than in other European cities (Leal and Sorando, 2016).

4.6.8 Conclusion

All in all, Madrid has invested a large amount, if not too much, in physical megaprojects and too little in furthering people's knowledge and skills. Though investments *have* been made in knowledge institutes and science parks, little has been done to achieve interweaving of the knowledge infrastructures with the regional economy. The result is an inadequate diversification of the economy towards high-value activities.

In addition, the OECD (2007) has been pressing for greater involvement of the city and its actors in regional decision-making. Fernández-Güell also underlines the need for a more advanced system of governance based on cooperation, transparency, participation and innovation. A great deal of these recommendations has been incorporated in the new City of Madrid 2020 strategy and the 2012-2015 Internationalisation Strategy (Fernández-Güell, 2014). The number of training programmes for specific target groups is also increasing (EIM, 2012) and a dedicated office has been set up to tackle fraud and corruption.[89] With a large stock of real estate projects,

Migration

Migration is an important basic factor in the exponential population growth in Madrid. Until the 1970s, this almost exclusively concerned internal migration (OECD, 2007). After further economic reform and the ensuing growth, foreign immigration–especially from north African countries and Morocco in particular–started to intensify in the 1990s. From the late 1990s onwards, foreign migration increased even faster, especially from Latin America. This was to a large extent based on the shared language and the many cross-Atlantic business relationships. Migrants from central and eastern Europe, Africa and the EU15 followed at a distance. Madrid receives the largest number of immigrants in Spain and by now, almost 20% of the city's population is made up of migrants (this figure includes the nationalised migrants; without them it stands at 15%; see Leal and Sorando, 2016). For many young immigrants, an alluring picture is painted by the opportunities for education and employment in an environment where the cost of living is relatively low compared to that of other European cities (OECD, 2007). The young, educated labour force that has arisen from both internal and foreign migration means there is a massive, and therefore relatively cheap, labour potential. This has a strong appeal for businesses and investments.

Consequently, housing construction has increased sharply. Between 2003 and 2011, more than half a million dwellings were built, which represents a 20% increase in the total stock (Leal and Sorando, 2016). Housing construction was fuelled by attractive tax advantages in the mortgage market. The proportion of mortgaged owner-occupied houses grew from 30% in 2001 to 38% in 2011. The rental market also grew due to the influx of migrants: 65% of the migrants rented a home in 2011, compared to 10% of the native population.

During the financial crisis (2007–2014), unemployment grew dramatically and there was even a decrease in population (Economic Observatory, 2012). In 2012, the economy started to pick up a bit, but unemployment only recovered very slowly and the region was still waiting for the trend in population figures to reverse.[88]

unsold homes, unused infrastructure and a focus on more sustainable and inclusive economic policies, Madrid may soon recover its spectacular growth path.

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4.7 Amsterdam

4.7.1 Outline

In recent decades, the city of Amsterdam has directed its policy efforts mainly to the development and redevelopment of attractive residential and working environments aiming to further its economy. This was done by means of urban planning and spatial planning. In the first stages, up to the 1960s, policies intended to accommodate growth and later they focused mainly on halting the downward spirals of the population exodus (caused by high levels of suburbanisation between 1960 and 1970) and economic unrest in the early 1970s. Over the years, policies directed towards achieving (C8) attractive residential and working environments maintained a close relationship with nearby settlements in the Amsterdam region. The relationship was initially mainly functional (the other municipalities were overspill areas), but later it gained importance due to efforts to position the city and the region as attractive locations in the international economy. The vision formulated in the 1986 strategy plan *De stad centraal* (A focus on the city) was of great importance. With this plan, the city made a commitment mainly to itself, and put in efforts towards the creation of cosmopolitan environments to live and work in. Linked to this are the massive investments in the Eastern Docklands (part of the IJ banks areas) and other parts of the city, and also the later development of the Zuidas business district. In a more recent stage, the strategy plan was connected far more closely to the metropolitan region.

That is how the Amsterdam region has developed into an international service economy, with important pillars in financing, business, the creative sector and logistics. Amsterdam Airport Schiphol, and therefore also the national government's mainport policy, played an important role in these developments. The pillars of the service economy have a basis that goes far back in time. From 1500 to 1800, Amsterdam was already one of the most important trade and cultural centres in the world. Various levels of the administration have made important contributions to the developments described in this case study: the municipality of Amsterdam, the surrounding municipalities in the metropolitan region, the province (especially with regard to the formulation of the outlook for the entire North Sea Canal area), and the national government (which has been involved in important key projects and in the development of Amsterdam Airport Schiphol).

Another important aspect is the joint strategy of the actors involved in developing the Amsterdam region into a location with a high-quality international business climate. The strategy was partly related to city marketing (the *I Amsterdam* campaign) and to attracting foreign companies and knowledge workers. More recently, over the last five to ten years, the policy has been enriched with initiatives in the fields of the Amsterdam innovation system and entrepreneurship. Even though (C4) knowledge infrastructure and (C2) entrepreneurial dynamics have historically been strong, cohesion and cooperation in the innovation system were too limited and their benefits were not sufficiently exploited.

The economic strength of the Amsterdam region stems largely from its position in the international trade and knowledge networks and its high level of international connectivity thanks to Amsterdam Airport Schiphol. But it is also supported by cultural thickness–the concentration of cultural heritage, cultural institutions, and creative professions. Accompanying this is the region's diverse economic structure, marked by the presence of various strong sectors, companies that have dominant positions in international markets, and small-scale businesses that prosper in Amsterdam's breeding grounds. Amsterdam has fully benefited from the transition in its economy towards activities that are more intensely focused on services, creativity and innovation.

4.7.2 Demarcation of the region

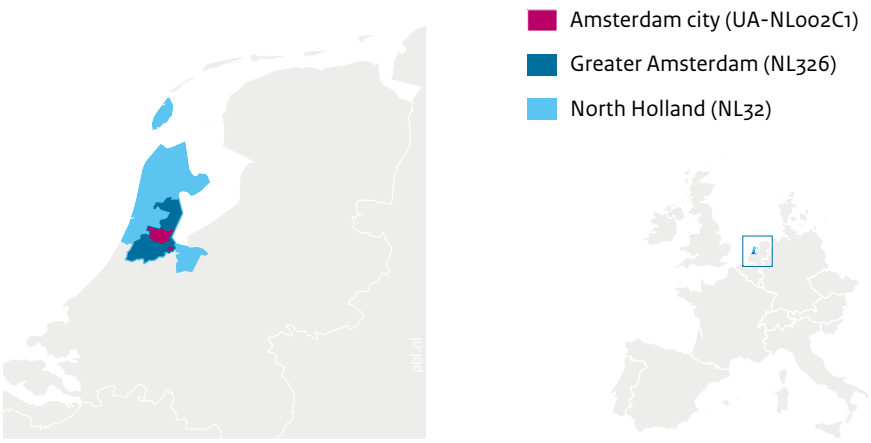
The Greater Amsterdam area covers the municipality of Amsterdam and places to the south, such as Haarlemmermeer (which includes Amsterdam Airport Schiphol) and Aalsmeer and, to the north, Purmerend and Volendam.[90] Greater Amsterdam is part of North Holland province (NUTS 2). In administrative terms, we can distinguish the city of Amsterdam, the province of North Holland and the Greater Amsterdam region, which can be subdivided into various forms of cooperation, which have been subject to change over time (see Section 4.7.9). The Amsterdam Metropolitan Region (MRA) is the most recent partnership. It is a collaboration structure for the northern part of the Randstad conurbation, formed by the provinces of North Holland and Flevoland, 33 municipalities and one transport region.[91]

4.7.3 Initial conditions

Internationale trade and open-mindedness

Amsterdam has a long tradition of international trade, which goes back to the 16th century and maybe even further (Von Streit et al., 2010). When the dominant port city of Antwerp was occupied by the Spaniards, the Dutch made a countermove by blocking it and many wealthy traders moved from Antwerp to Amsterdam. In the period of colonial expansion (1500–1800), the city grew into one of the most important trade centres in the world. In this process, trade and finance were inextricably linked. In 1602, for example, the United East India Company (VOC) established the world's first stock exchange, the Amsterdam *beurs*. In the 17th century, Amsterdam evolved further into the world centre of trade and capital provision and it became *the* meeting place for traders.[94]

Figure 4.11
Location of Amsterdam city, Greater Amsterdam region and Province of North Holland



Source: Eurostat, adaptation by PBL

Compared to its Europeans peers, its population of around 850,000 means Amsterdam is a relatively small capital city.92 Greater Amsterdam (COROP/ NUTS 3) has approximately 1.3 million inhabitants and the Amsterdam Metropolitan Region 2.5 million.93

This globally relevant centre function turned Amsterdam into a leader in the fields of innovative financial and insurance activities, industry, and port and transport activities (Bontje et al., 2011; Oevering, 2014). By the end of the 17th century Amsterdam had over 220,000 inhabitants and was the fourth largest city in Europe, after London, Paris and Naples.[95] The canals lined with mansions for the wealthy merchants and the workers' houses in the Jordaan neighbourhood date from that time (Bontje et al., 2011). But in recent decades–characterised by an intensively globalising economy–the city has also benefited from its position in international networks. Amsterdam is still one of the world's major financial centres thanks to the trading of securities and options, first on the Amsterdam Exchanges (founded in 1997) and at present, following the merger with the Brussels and Paris exchanges in 2000, on the Euronext stock exchange.

Because of its international orientation throughout history, its open-mindedness and tolerance, Amsterdam has always been a place with a large influx of people from elsewhere. This began as early as the 16th century with the arrival of rich traders, mostly Portuguese Jews, from Antwerp (Bontje et al., 2010). In later centuries too, Amsterdam continued to attract migrants from different backgrounds, including the large groups of international knowledge workers (see below) of more recent times. In this regard, Janssen-Jansen (2011: 260) uses the term *social thickness*. Two reasons are given for the emergence of a tolerant climate in Amsterdam: the international connections established through trade and its governance model of stadholders with a high level of local autonomy (within the Republic of the United Netherlands). The model contrasts with other government forms such as the absolute monarchies in other European countries (Roegholt, 1997; Mak, 2005).

Amsterdam's economic position has had its ups and downs throughout the centuries, and the city has had to work hard to maintain its position. In the 18th century, the economic boom came to an end and the Netherlands lost its standing as a world power to England and France (Von Streit et al., 2010). This adversely affected Amsterdam's trading position. But other reasons are also cited for the city's dwindling position, such as the want for administrative renewal, the power struggle between local and national administrations, the deficient accessibility of the port from sea and the lack of an economically vibrant hinterland compared to cities such as London and Hamburg (Mak, 2005). The first industrial revolution of the 18th century bypassed the Netherlands almost completely.

Von Streit et al. (2010) noted that it would take until the end of the 19th century for Amsterdam to begin its Second Golden Age. The impulse came from the privatisation of the Dutch West India Company, the opening of the Suez Canal, the heightened exploitation of the colonies and German unification (the German Empire arose from the association of fragmented principalities). During this period, a large number of small-scale industries emerged in the Amsterdam region, while large-scale industry was much more oriented towards the Rotterdam region.

At the end of the 19th century, space was made available for expansion of the city. Initially, this occurred in an unplanned fashion, but later proper planning procedures

were followed. Apart from the interruption caused by the Second World War, growth, in terms of both inhabitants and jobs, continued until the 1960s (Von Streit et al., 2010). The wave of suburbanisation that followed led to a population decrease of 200,000 inhabitants between 1960 and 1985. Suburbanisation was further reinforced by the deconcentration policy of the national government that aimed at building in surrounding overspill towns and centres (see Section 4.7.4).

The international connectedness of the Amsterdam economy meant that international dynamics and economic transitions, such as the emergence of the knowledge and creative industries, including ICT applications, made themselves felt intensely in the city. Partly due to the appearance of service sectors and ICT, Amsterdam started to experience a revival in the late 1980s. In line with previous growth periods, this was also referred to as a possible Third Golden Age. For other industrial cities in the Netherlands with a more traditional character, such as Rotterdam (and also Eindhoven, see Section 4.3), it was more difficult to take advantage of the emergence of new service sectors than for Amsterdam (Van der Wouden, 2015).

The arts, culture and science

During the Golden Age, the arts, culture and science also flourished in Amsterdam (Von Streit et al., 2010). Many artists received commissions from wealthy traders and merchants. The Athenaeum Illustre, the present-day University of Amsterdam (UvA), was founded by the municipality of Amsterdam in 1632 and the rich and influential families that were educated there also gave considerable financial support to the institution. Von Streit et al. (2010) conclude that the rise of creative professions and science was closely related to the world of trade and financial services, because wealthy merchants invested in art and science.

A development that was related to the second boom in trade mentioned above (the Second Golden Age) is the renewed specialisation in financial services, business services and logistics (Wagenaar, 2003) and also in culture. The new buildings of the Rijksmuseum, the Stedelijk Museum and the Concertgebouw date from that time. The period also saw the establishment of the VU University Amsterdam, the city's second university (Von Streit, 2011).

From the 1980s, during the third growth period, the focus of attention was mainly on the creative professions. Kloosterman (2004) has shown that, compared to other Dutch cities, Amsterdam was leading the way in initiatives around the clustering and growth in the creative professions. For example, the city experienced a substantial increase in the number of publishing houses, architectural firms, advertising agencies, film and video production companies and the performing arts. Therefore, it seems that there is continuity in the concentration of the arts, culture and the creative industry in the city. In this regard, Janssen-Jansen (2011: 260) refer to Amsterdam's *cultural thickness*. According to Hutton (2007), the concept is related to the diversity in the background of the population.

Cultural thickness is therefore an idea that relates both to the people and to their professions, but it also has to do with the cultural and recreational facilities that make Amsterdam an attractive place to live in, work in or visit. In a few words, the economic specialisation of the Amsterdam region in trade, logistics, financial and business services, and creative services is intimately linked to developments that took place decades and even centuries ago.

4.7.4 Attractive physical and residential environments

In recent decades Amsterdam has pursued spatial and urban planning policies to accommodate economic growth and to become an attractive city to live and work in. Building on the initial conditions in the city, the policies are formulated in Structural Plans and are expressly granted their own dynamics (see text box below on Structural Plans).

Around 1960, the city of Amsterdam had 870,000 inhabitants, the highest number it has ever reached (Janssen-Jansen, 2011). In those years, plans were made to demolish part of the historic city centre and fill in part of the canals to facilitate large-scale high-rise building projects. (Grünfeld, 2010). However, the local population mounted stiff resistance to the proposals and as a result those plans were not implemented. Given the present-day cultural and economic value of the historic city centre, this was a positive turn of events. But it was also positive in view of the fact that, shortly after, a large-scale wave of suburbanisation took place in the Netherlands, which also had a strong impact in Amsterdam.

Between 1960 and 1970, the population of Amsterdam decreased to 680,000 (Janssen-Jansen, 2011). This meant the city lost roughly 200,000 inhabitants in about ten years, while the surrounding municipalities were growing. Suburbanisation was in some measure the result of the desire of residents to live outside the city, something that was partly motivated by the possibilities offered by the private car (mobility) and the favourable price-quality ratio of suburban homes.[96] But the trend was also partly due to the fact that the national government was following a decentralisation policy, and the municipality of Amsterdam too was focusing on urbanisation outside the city itself (Janssen-Jansen, 2011; Van der Wouden, 2015). The national government concentrated on the distribution of people and jobs in overspill towns. The Netherlands Scientific Council for Government Policy has reached the conclusion that in that period, compared to other countries, the orientation

towards the large cities as essential links in the national economy, was minimal or non-existent, both within the cities themselves and in the national government (WRR, 1990). Around Amsterdam, several centres (such as Purmerend) grew strongly and plans were made to build new cities in the Flevopolder, to absorb the population growth, which was definitely a reality.

The 1974 Structural Plan of the Municipality of Amsterdam focused predominantly on urbanisation policies in a few places outside the city, while paying attention to the relationship between Amsterdam as the central city, the periphery of the city and the region (see text box below on Structural Plans). In this period, the Bijlmer district was built to provide housing in the city for middle-class families (Pethe et al., 2010).

Around 1975, the problems of the large cities emerged. An example is employment, with Amsterdam and The Hague experiencing only trivial increases, and Rotterdam even a decline (Van Duijn et al., 1983; Bartels, 1980). In reaction to its loss of population, which was partly a consequence of the polycentric urbanisation policy, in the 1980s the city of Amsterdam strongly emphasised city-centre development and the mixing of functions. The 1986 Structural Plan, *De stad centraal* (Municipality of Amsterdam, 1986), marks the change of direction. Grünfeld (2010) describes how the municipality of Amsterdam regretted the policies it had previously pursued–the creation of an urban region proved to pose a threat to the position of the city. The support for a range of facilities was under pressure, due to the spread of functions and the willingness not to build nearby, in the open landscape around the city. In addition, unemployment was still high. The city focused on a compact and mixed urban structure. Amsterdam had to recover its position as a 'leading economic and cultural centre' (Municipality of Amsterdam, 1986: 26). Urban compaction and the redevelopment of brownfield land and disused port areas (e.g. those along the IJ banks) were to provide room for this. But the policies also foresaw new urbanisation, such as the city expansion projects in the northern and western districts. The 1986 Structure Memorandum reflected the decision, contrasting with previous memoranda, to develop new business hubs as well as the centre of Amsterdam. All of this meant the overspill areas around Amsterdam had to continue developing on their own account, independently of Amsterdam (Grünfeld, 2010). This initially led to a tussle between Amsterdam and the surrounding municipalities: In reaction to the policy of spreading, Amsterdam now dedicated its attention entirely to itself. This initially led to a tussle between Amsterdam and the surrounding municipalities, who feared a loss of standing in the region.

However, from the 1990s onwards, a more balanced cooperation between the city and the region arose (see text box Structural Plans and Section 4.7.9).

An important factor in the change of direction was the advisory report published by the Andriessen Commission in the early 1980s, 'Strengths must be exploited', which dealt with the need to reinforce the city's economy (Commissie Andriessen, 1980). By acting on this advice, Amsterdam placed itself at the forefront of urban development within the Netherlands (WRR, 1990). The commission made recommendations for the local economy as a whole, by city districts and sectors of the economy, and put forward proposals for the improvement of physical conditions (new business parks, new infrastructures and upgrades to existing areas), and for new growth sectors, such as information technology and biotechnology, which were to be further developed in Amsterdam. In addition, the report included recommendations that were aimed specifically at stimulating small, innovative start-ups and strengthening the labour market (through steps such as training). Finally, the advice referred to improving the positive attitude of the city council towards city promotion initiatives and towards the business community, for example by reducing and relaxing regulations. All in all, the advice contained an integrated vision of the economic power of the city.

Hoppenbrouwer and Louw (2005) pointed out that an important policy line to reverse negative trends was the aspiration to have high-quality housing, combined with small-scale (service providing) businesses, while providing space for large-scale office occupation. The idea was for the post-industrial city to generate revenue through the provision of services and through knowledge and creativity and, more and more also, through recreational and consumer functions: a city where people want to live or which people want to visit because of its cultural offerings and options for entertainment (Van der Wouden, 2015). With its historic city centre, universities and its centres for culture and services created in the past, Amsterdam had been dealt a good hand (Janssen-Jansen, 2011; Engelsdorp-Gastelaars and Hamers, 2006). As for the transition to a knowledge-intensive and creative economy, the city was also doing very well. But this did not mean that the city could sit back and relax. In the words of Marlet (in: SER, 2015): 'While you need the circumstances to be favourable, as a government, you must also make it possible for things to happen and give dynamics a free rein'. The policy in Amsterdam was primarily aimed at redeveloping obsolete areas into high-quality, mixed-function urban environments in order to attract new residents and business activities (Van der Wouden, 2015). In addition, direct investments in culture and entertainment played a role. This involved museums, meeting places, events and the performing arts.

In the following sections, we will discuss these two policy efforts more specifically. But not without first noting that Amsterdam is now considered to be one of the most attractive cities in the world. In this regard, Gilderbloom et al. (2009) call Amsterdam: 'the world's greatest city'.

Structural Plans, guiding principles for city development

In all, Amsterdam has published six Structural Plans over the past few decades. In this exercise, which is based on the work of Grünfeld (2010), we summarise the main policy efforts that were put forward, and highlight turning points.

The 1968 Structure Memorandum was in line with the ideas of post-war spatial planning: the promotion of large-scale office functions in the city centre (creating a business district), combined with large infrastructure projects. There were even plans to fill in a substantial part of the canals and develop large-scale high-rise projects. After running into resistance put up by local residents, the city chose to preserve the historic city centre with its unique ring of canals. The Memorandum did not make it past the stage of a draft.

As a result of this choice, the new Structural Plan of 1974 focused on the city as a whole (not just the city centre, since that had to be preserved), in conjunction with the surrounding areas. But a requirement was that the city of Amsterdam be the absolute top spot and the centre of the region. Grünfeld (2010) describes how the development of 'the fourth lobe' in south-east Amsterdam meant that the city was reaching completion. At least, that was the understanding. Outside the city, the urbanisation policy focused on developing a few centres, in an urban-region model that foresaw a strong connection between the functions of living and working among those places.

Based on this functional unity of the city and the surrounding centres, the 1981 Structural Plan (formally, Part C of the previous Structural Plan) concentrated mainly on the local economy and on employment. In that period Amsterdam was not doing well economically. An important policy objective was strengthening the competitive position of the city and achieving a critical mass of properly trained workers needed to function as an internationally relevant centre. A second issue highlighted in the Plan was limiting commuting. The cities of Almere and Purmerend were recognised as places where the economy was allowed to grow, but Haarlemmermeer was not.

The following Structural Plan was published in 1986: *De stad centraal* (A focus on the city). This probably represented one of the most important turning points for the city (see main text). The region ceased to be the centre of attraction, and efforts were directed to the position of Amsterdam as an economic and cultural centre.

The compact city policy was continued in the Structural Plan of 1992 but at the same time, more attention was being paid to the importance of the region. According to Grünfeld (2010), It was recognised that the city goes beyond the municipal boundary and that the region is of vital importance to the economic and international position of Amsterdam.

The 1997 Structural Plan, *Open stad* (Open city), recognised the importance of the region even more. It was understood that relationships with the region are of great importance to the functioning of the city. Amsterdam wanted to be open. Based on the competitive position of the city, integrated plans for accessibility and mobility were formulated. In addition to the Zuidas business district, an attractive city centre continued to be an important issue. The development of areas along the IJ banks and a possible rail connection across the IJ to Almere were intended to safeguard the position of the centre of Amsterdam for the future (Grünfeld, 2010).

The subsequent Structural Plan was published in 2003 under the title *Kiezen voor stedelijkheid* (Going for urban character). The idea was for Amsterdam to stand out within the network city thanks to its urban functions and qualities. Grünfeld (2010) describes how the region (and regional cooperation) has been given a prominent place following the realisation that Amsterdam is increasingly part of the network city. The development of the network city was irreversible, and as a result it became the basis for urbanisation policies. But the various towns had to specialise and achieving differentiation of residential environments between locations was part of the effort. The plan included the observation that the decision to build outside Amsterdam was also related to the enormous quantitative challenge the city was facing.

The last Plan to be published, in 2011, was the Amsterdam 2040 structural outlook: *Economisch sterk en duurzaam* (Economically strong and sustainable). The city continued with its ambition to add housing through 'compaction' and 'transformation' in order to make better use of the existing urban land or to intensify its use (Municipality of Amsterdam, 2016a). This is discussed in more detail in Section 4.7.10.

The IJ banks

The redevelopment of the Eastern Docklands was a key project in Amsterdam covering several neighbourhoods in which over 8,000 housing units were built. The development areas include: Cruquius-Zeeburgerpad (also strongly geared towards businesses), the Veemarkt and Abattoir sites (both carried out in the 1980s, with important objectives in the field of social housing objectives), KNSM Island (1990–1995), Java Island (1994–2010), Borneo-Sporenburg (1997–2002) and Rietlanden-Oostelijke Handelskade. All these projects were specifically designed to be in line with the Structural Plan *De stad centraal* (Municipality of Amsterdam, 1986) and the Fourth Memorandum on Spatial Planning of 1988. These neighbourhoods are representative of the shift towards higher-quality, mixed residential environments (Van der Wouden, 2015).[97] Bit by bit, specific separate plans were also made for Oosterdok, Zeeheldenbuurt-Houthaven (Westerdok, Silodam) and Buiksloterham (Overhoeks, NDSM).

One of the important elements in the IJ banks development projects was the assigning of new functions to some of the historic buildings in the area. Former warehouses were transformed into shopping centres (the *Brazilië* warehouse), residential complexes (the *Zondag tot en met Zaterdag* and *Wilhelmina* warehouses, and the *Quarantaine* building), business locations (*Azië*[98] and the 'studio-warehouse' *Wilhelmina*). Others were converted into hotels, cafeterias and restaurants, including the restaurants in the *KHL-koffiehuis*, the *Quarantaine* building, the former premises of the steam shipping company *De Oceaan* and the *Azië* warehouse (Jamie Oliver), and the combined Panama club-restaurant in the *Panama* warehouse. The old passenger terminal of the KNSM shipping company was restored in 1997 and since then it has been home to *Loods 6*, a cluster of spaces for artists, entrepreneurs and shopkeepers, along with an exhibition and presentation hall (the former luggage hall) and the *Kompaszaal* event hall with a cafeteria and restaurant. The renovation of the *de Zwijger* warehouse was completed in 2006 and now serves as an independent platform for debate on complex urban tasks and as business space for companies related to the platform.

Iconic historical buildings on the Oostelijke Handelskade, such as the warehouses *de Zwijger*, *Amsterdam*, *Wilhelmina*, *the Lloydhotel* and *Panama*, have been revitalised and alternate with emblematic modern buildings such as *Muziekgebouw aan 't IJ* (concert halls built in 2005), *Passenger Terminal Amsterdam* (PTA), *Mövenpick Hotel* and the *EYE* film museum (opened in 2012 in the Overhoeks neighbourhood). Various river cruise ships and naval ships dock at the Passenger Terminal and a new port has been built for tour boats and water taxis at the *Zouthaven*. To preserve monumental buildings, the municipality of Amsterdam incurred costs and was willing to accept reduced revenue from the selling off of land (Ministry of IenM, 2009).

Giving space to urban diversity

The revival of the cities and the focus on higher quality for business locations, especially in the Randstad conurbation and the central Netherlands 'ring of cities', were also present–in the form of the *compact city* concept–in the 1988 national-level Fourth Memorandum on Spatial Planning (Van der Wouden, 2015). The national government's key-projects policy to support this development was implemented for the very first time in Amsterdam with the restructuring of the *Oostelijk Havengebied*, the Eastern Docklands area.[99] The project can be seen as a turning point in the urban development of the city, finding its expression in the quality of the buildings, the mixing of functions, the large share of privately owned housing and private rentals, and also in the preservation of the historic buildings (Hoppenbrouwer and Louw, 2004). These key projects were also the first initiatives in which public-private partnerships assumed a major role (Van der Wouden et al., 2015).

Public-private cooperation and the relationship with the national government through the key-area policy were important in making it possible to literally bring about a reversal in the urban development of Amsterdam. But these structures of cooperation also had their own dynamics. For example, the ING bank, the largest private party, withdrew from the Amsterdam Waterfront Financing Corporation (the public-private structure for the IJ banks projects), which meant the IJ banks were no longer in their entirety designated as a national key area. The most important reason for ING to withdraw was the doubt it felt about the attractiveness of the IJ waterfront for large-scale office developments (Van der Wouden et al., 2015). At the same time, the competing Zuidas site *was* considered suitable, due to its better accessibility and favourable location close to the airport (see *Zuidas district* in Section 4.7.7 for further details). As a result, the development of areas along the IJ banks continued in a more gradual fashion, without being governed by a large master plan (Aardse and Van der Werf, 2016). Development focused more on establishing a mix of housing, small-scale businesses, offices and cultural amenities (see text box below). In the already existing parts of the city too, the focus was on revitalisation, preservation of cultural

heritage and urban diversity. Examples are the projects for the Olympic Stadium, the large public space of Museumplein, the Westergasfabriek site with its concentration of mixed functions and facilities, and the Red Light Fashion district.

The construction of mixed-function, high-quality urban residential environments suitable for young households and families started in the late 1980s and helped the city to retain its groups of highly educated inhabitants. Van Dam and De Groot (2017) show that young couples and families already had a strong preference for a highly urban environment in the early 1980s, but that they probably could not realise their housing aspirations, because in those years single-family houses were mainly built in the surrounding overspill towns. Now Amsterdam was meeting their housing wish. In addition, the migration of young single persons to the city produced a volume effect.

The new segmentation was deemed necessary because in the past Amsterdam had mainly built social rental housing. The city of Amsterdam still has a relatively high proportion of social rental homes (about 60% as compared to the national average of 30%)[100], while this is quite the opposite in the surrounding regions that have a large share of home ownership. Janssen-Jansen (2011) and Salet et al. (2003) observe that this policy has had the effect of, on the one hand, ensuring that the social mix is maintained, and on the other hand, of making it difficult for middle-income groups to improve their position on the Amsterdam housing market or to establish themselves in Amsterdam. Incidentally, many social housing units are occupied by people (mainly from the higher income groups) who do not belong to the housing target group.[101]

Investing in culture and entertainment

In addition to investments in urban redevelopment aimed at new, lively residential and working areas, the municipality of Amsterdam also allocated resources directly to culture and entertainment. In line with the task of urban renewal, this involves projects such as *Muziekgebouw aan 't IJ*, *de Zwijger* warehouse and the *EYE* film museum.

But the focus on culture has a longer history. According to Hoog and Vermeulen (2011: 7), 1975 was the year that marked the 'breakthrough of modern urban tourism' and the related investments in events and cultural attractions.[102] From that time on, the city also invested in a series of cultural buildings that led to new openings, new locations and renovations. Examples include the Amsterdam Historical Museum, the Rembrandt House, the Jewish Historical Museum, the Allard Pierson Museum, De Nieuwe Kerk and Beurs van Berlage.

Culture was also an important question for Amsterdam when it came to structuring urban developments. An example is the renewed layout of the public space Museumplein[103] that was linked to the renovations of the Royal Concertgebouw (1985–1988), the Rijksmuseum (2003–2013), the Stedelijk Museum (2007–2012) and the Van Gogh Museum (2011–2013). Work on the square itself started at the end of the 1990s with the construction of an underground car park and the subsequent remodelling of the physical space. Amsterdam is also where the highest investments are made in the performing arts in the Netherlands (Marlet, 2009).

In the 1990s, the number of international visitors to the city grew rapidly. The opening of the Passenger Terminal in 2000 meant Amsterdam achieved a position on the cruise market. Since 2000, the number of visitors has increased so much that there was a shortage of hotels. According to Hoog and Vermeulen (2011), the occupancy rate of hotels in Amsterdam in 2005 was the second highest in Europe, after London.[104]

To sum up, we can conclude that the combination of Amsterdam's adoption of *a focus on the city* in the mid 1980s and the national *compact city and key area* policy has meant that the city is doing very well economically. New residential environments have been developed and existing dwellings have been modernised. The city has been able to entice young city dwellers again. And investments in culture and entertainment have contributed to the liveliness, and thereby the attractiveness, of the city.

Various studies have shown that the broad offer of culture and entertainment is an important factor in the attractiveness of the city for knowledge workers and visitors, and by extension, in the city's success (Marlet, 2009; De Groot et al., 2010). The metropolitan region as a whole has grown strongly (SEO, 2000) and the growth pattern has become balanced. The most recent insights into this matter can be found in the Economic Explorations of the Amsterdam Metropolitan Region (Municipality of Amsterdam, 2017; and several other volumes).

4.7.5 Knowledge infrastructure: towards an innovation system

The city of Amsterdam has a solid knowledge infrastructure, in which important positions are held by two universities, the institutes affiliated with them, and other knowledge and educational institutions. As mentioned earlier, the University of Amsterdam and later also the VU University Amsterdam have always been closely linked to economic developments in the city and its international profile.

BiGGAR Economics (2014) has recently calculated the economic impact of the Amsterdam universities and the University Medical Centres (UMCs). They conclude that those institutions make a substantial economic contribution to the city of Amsterdam, its Metropolitan

Examples of partnerships in the innovation system

Amsterdam Science Park

The Amsterdam Science Park is a joint venture between the University of Amsterdam, the city of Amsterdam, and the Netherlands Organisation for Scientific Research (NWO). It is one of Europe's largest centres for commercialisation of information technology, the life sciences, advanced technology and sustainability (Science Park Amsterdam, 2017). In 1996, the Municipality of Amsterdam designated a location for the Science Park and anchored it in a strategy aimed at further developing the city as a knowledge-intensive location. It houses 130 companies and several agencies that connect science and companies, such as financing firms and business incubators. Among these are ACE Venturelab Amsterdam, Amsterdam Innovation Exhange (IXA), Innovation Lab Chemistry Amsterdam, and Life Sciences Center Amsterdam.[105] NWO has 800 staff working at the Science Park and the other institutions and companies employ more than 800. The University of Amsterdam has 1,500 employees stationed there and in all, almost 7,000 students receive education at the Park.[106]

Duisenberg School of Finance

In 2008, given the good health of the financial services sector in Amsterdam, the Dutch financial sector and several Dutch universities decided to establish the Duisenberg School of Finance (DSF).[107] The aim was to develop a series of high-quality university programmes. The founders of the institution are ING, Aegon, Fortis, APG, NYSE Euronext, SNS Reaal, the Dutch Central Bank, and the academic institutions University of Amsterdam, VU University Amsterdam, Tilburg University, Erasmus University Rotterdam and the Tinbergen Institute. The Duisenberg School of Finance was closed on 1 September 2015, because it did not attract enough students. However, the University of Amsterdam and the VU University Amsterdam continued to offer several of their courses under the name Duisenberg Honours Programme.

Amsterdam Institute for Advanced Metropolitan Solutions (AMS)[108]

AMS was founded in 2013 with the aim of developing knowledge on metropolitan developments. The institute has a public-private structure in which science, education, the government, companies and social organisations work closely together. Several companies (TNO, KPN, Accenture, Alliander, IBM, Cisco, ESA, Shell, Waternet) and social organisations (Amsterdam Smart City, the city of Boston and Waag Society) are involved in activities conducted by the academic partners Delft University of Technology, Wageningen University & Research and the Massachusetts Institute of Technology.

Amsterdam Centre for Entrepreneurship

The Amsterdam Centre for Entrepreneurship was formally established in 2010, when the University of Amsterdam, the VU University Amsterdam and the Amsterdam University of Applied Sciences decided to merge their entrepreneurship centres. The Amsterdam School of Arts joined the structure in 2013. ACE counts on support from the municipality of Amsterdam and the Ministry of Economic Affairs.

Collaboration efforts[109]

In the period 2000–2016, the University of Amsterdam worked closely together with the Amsterdam University of Applied Sciences and from 2003, they even had a joint executive board. However, collaboration was terminated in 2017 because it did not yield enough benefits. For some time now, the University of Amsterdam and the VU University Amsterdam have also been discussing options for collaboration (e.g. the Amsterdam Academic Alliance) and a possible merger. In this regard, the two universities have agreed on six so-called *joint degrees* (agreements). There was also a plan to house the beta faculties in a single location, but it was recently decided not to go through with the idea.

Region (MRA), and to the Dutch economy as a whole. BiGGAR took a broad approach, looking at direct and indirect effects, and estimates the impact at approximately 13 billion euros in added value, with a total of more than 135,000 jobs throughout the Netherlands. The city of Amsterdam and the Amsterdam Metropolitan Region together account for more than 60% of these positions.

Despite its strong knowledge base, it was not until relatively recent times that Amsterdam started with policy-based support and investments in the regional innovation system (SEO, 2009). Since 2005, there has been cooperation between knowledge institutions, regional authorities and various intermediary organisations of the business world, including the Chamber of Commerce and the precursor of today's Amsterdam Economic Board.

A review of the functioning of the Amsterdam knowledge economy, states that although the importance of higher education and knowledge institutions is recognised in the field of policy-making, the related economic benefits are not optimally exploited (SEO, 2009). The review recommends ensuring that knowledge policies have a sharper focus and developing a specific common goal in order to give more weight to the innovation system. That would require drawing up a shared agenda first (which did not exist at the time the review was published). In its review of Amsterdam's education policy, the OECD (2010) also concluded that a shared vision between knowledge institutions is lacking.

An important second pillar to strengthen the innovation system is attracting more R&D investments and taking scientific knowledge (which is strongly present in the region) to the market (SEO, 2009). In an earlier stage, Van den Berg et al. (2001) had already noted that in Amsterdam the relationship between academic knowledge and the knowledge that regional clusters of companies need is relatively weak. These relationships require further development of the networks between knowledge institutions, educational institutions and the business world. SEO (2009) indicates that more needs to be done to stimulate innovative capacity and that the situation calls for stronger, demand-driven stimuli for research and education. Examples that reveal that the collaboration between knowledge and the business world is getting more intense include recently established facilities such as the Technology Transfer Office (TTO), Science Park Amsterdam, and also partnerships such as the Amsterdam BioMed cluster, the Duisenberg School of Finance, and the Amsterdam Institute for Advanced Metropolitan Solutions (AMS). The text box below provides more details. Another recently established organisation is the Amsterdam Centre for Entrepreneurship (ACE).

4.7.6 Amsterdam city marketing

In addition to the policies for urban planning (to enhance the physical and working environments) and the more recent policies focused on the innovation system (to generate economic growth from the knowledge infrastructure), initiatives in the field of international profiling also play an important role in Amsterdam. Early in the 21st century, Amsterdam acknowledged that there was increasing competition between cities as to attracting knowledge, talent, companies and visitors, and that a city marketing policy could make an important difference (Hoog and Vermeulen, 2011; Municipality of Amsterdam, 2004a). The core values that the city wanted to transmit were: creativity, innovation and entrepreneurial spirit. In 2004, Amsterdam adopted its very own motto: *I Amsterdam* (Municipality of Amsterdam, 2004a).

Amsterdam Top City

Government, public institutions and the business world promote the core values and the Amsterdam brand in a joint effort. The initiative came from the city of Amsterdam, which meant that the city marketing offensive was strongly anchored in the broader context of the Amsterdam Top City programme, the economic agenda of the city council policy for the period 2006–2010. The central idea of this programme was the improvement of the business climate following five lines of action: (1) nurturing, attracting and exploiting talent; (2) stimulating entrepreneurship from business inception to growth; (3) creating an open and welcoming atmosphere for people and businesses, (4) physically offering space for creativity and entrepreneurship, and (5) creating a clear-cut image of what Amsterdam stands for in the Netherlands and abroad (Municipality of Amsterdam, 2006b). Up to 2010, the city invested approximately 50 million euros under the programme Top City, of which 9.4 million euros were allocated to events, 4.3 million euros to city marketing, 6.5 million euros to the life sciences, 6.2 million euros to top education, 4.1 million euros to the creative sector and 4 million euros to expats (Bontje et al., 2011).

The ambitions of this programme included ensuring national and international companies became rooted in the region–to keep them from relocating–and to encourage them to invest in the Amsterdam region (the Investor Development Programme). The city also tried to promote the interests of the 300 most important foreign companies and the 50 most important national companies in more direct ways (SEO, 2009).

The Top City programme and the close bond around *I Amsterdam* gave rise to the Amsterdam Partners covenant. It is the umbrella organisation for all kinds of partnerships that are relevant for reinforcing the business climate. Examples of participating partners are Amsterdam Airport Area (AAA), Amsterdam Uitburo (AUB), Amsterdam Tourism and Congress Office (ATCB), Architecture Centre Amsterdam (ARCAM), Topsport Amsterdam, KennisKring Amsterdam, Amports and Amsterdam Cruiseport (ACP). In addition to the municipality, many organisations, companies and cultural and knowledge institutions have subscribed to a joint marketing strategy.

The Amsterdam business world is deeply involved in the strategy. This includes seven large (multi)national companies–ABN AMRO, Heineken, ING, KLM, Nuon, Philips and Amsterdam Airport Schiphol–and also a fair amount of smaller companies in the fields of business services, legal affairs, real estate and the hotel business that make content-related contributions, carry out checks and give advice. They also took part in the one-off impulse to launch the brand and they make yearly financial contributions.

In 2013, the new city marketing organisation Amsterdam Marketing (AM) was established. It is the result of the unification of Amsterdam Partners (see above), Amsterdam Business, Amsterdam Tourism and Congress Bureau (ATBC) and Amsterdam Uitburo. Amsterdam Marketing has taken over the core values of creativity, innovation and entrepreneurial spirit.

The period of the Top City programme also saw the establishment of the programme agency Creative Cities Amsterdam Area (CCAA). From 2007 until its termination on 1 August 2013, it focused on stimulating and strengthening the creative industry, and on promoting entrepreneurship in the sector, in seven cities in the northern half of the Randstad conurbation (Almere, Amsterdam, Zaanstad, Utrecht, Amersfoort, Hilversum and Haarlem). The national government, regional authorities, two chambers of commerce and several development organisations took part in the programme (SEO, 2009).

Foreign companies and expats

Earlier we described how Amsterdam has always been a central place for foreign companies and workers to move to. A publication by PBL Netherlands Environmental Assessment Agency shows that the Amsterdam region tops the ranking of Dutch regions for attracting foreign companies and international workers and talent (PBL, 2011, 2014).

The municipality also follows active policies in this field. An example is the foreign investment agency Amsterdam in Business[110]. Aimed at attracting foreign companies, Amsterdam in Business operates in the Amsterdam region, Amstelveen, Almere and Haarlemmermeer. The city also has an expat centre, IN Amsterdam[111], which aims to attract and assist international newcomers. Its services include assistance with residence and work permits, start-up visas, registration with municipal institutions, and tax regulations.

Since 2012, Amsterdam has also been pursuing a European strategy (Municipality of Amsterdam, 2012) that is geared towards the positioning of the city and the realisation of its ambition to become a global business hub. With this initiative, the city wishes to remain among the top five economic and knowledge regions of Europe. The strategy involves focusing on doubling its R&D efforts, investing in spin-offs from knowledge institutions and setting up four leading educational programmes. Furthermore, the strategy links these economic objectives to targets for sustainable urban development that include a 40% reduction in CO_2 emissions by 2025, compared to 1990 levels. Amsterdam wants to play a leading role in the field of sustainability and spatial development, and become internationally known as a smart city.

4.7.7 Entrepreneurship and clusters

In earlier sections it became clear that the Amsterdam economy traditionally has had important specialisations in trade, logistics, and financial, business and creative services. These specialisations are also characteristic of the city's entrepreneurial spirit and dynamism. In this section we describe the various cluster concentration locations in the city, while paying specific attention to the role of the government in their development.

Incubators

As mentioned in Section 4.7.2, Amsterdam has a rich history in the field of the creative sectors and professions, which are strongly present in the economic structure. The creative sector of the Amsterdam economy encompasses a few large and many small and medium-sized businesses. To further their situation, the municipality has an incubator programme, which offers entrepreneurs affordable business space and other facilities. The programme arose at the end of the 1990s as a result of the redevelopment of the IJ banks. The agency, Bureau Broedplaatsen, is part of the municipal organisation and its activities include producing multi-user business sites with studios and workshops, together with users, housing corporations, project developers and banks. Between 2000 and 2010, around 40 incubators were developed that received 49 million euros in investments. (Haselbach et al., 2010). Several examples are described in the text box below.

In addition to the incubators, the city also has many coworking offices. Before 2015, these were subsidised by the government, but with the arrival of commercial operators such as Regus, Seats2Meet, The Hub, Spaces and We Work, coworking centres have largely become a commercial activity (Municipality of Amsterdam, 2015).

Apart from the incubator policy and the more general policies aimed at mixing urban functions, Amsterdam also concentrates intensely on economic diversity. The policies are mainly designed to maintain and further develop the city's varied economic structure, rather than opting for only one or a few sectors. Diversity is seen as a strength because it can lead to new combinations. Moreover, it keeps the economy from becoming too vulnerable when specific sectors experience setbacks, because economic downturns in one sector can be compensated for by other sectors (Bontje et al., 2011). In the 2002–2006 period, policy programmes were therefore formulated in a very wide sense around issues such as the business climate, the strengthening of the diversity of the sector structure, and improvement of the organisational strength of the city and region. In the HERMES programme, Amsterdam cooperated with the business world, mainly on strengthening the diversity of the economy by drawing up strategies and financing projects. The HERMES programme (EZ, 2002, 2005) directed its attention to specific branches of the creative sector, such as ICT and the

Incubators

Incubators have been built on several locations, such as the IJ banks. Examples are: *Kunstfabriek* in the de Zwijger warehouse, the former *Shell Lab* (33 lab rooms that house 300 media and technology companies), *Concertgemaal* (stage for classical music), *Cruquiusgilde* (workshops and a machine shop), *Cleantech Playground De Ceuvel* in the former De Ceuvel shipyard (sixteen studio boats and one restaurant boat), Studio-warehouse *Wilhelmina*, and the incubators in the *Azië* and *de Zwerver* warehouses. Throughout the metropolitan region too, more and more attention is being paid to incubators, such as *Honigfabriek* in Zaanstad and *Domijn* in Weesp (Municipality of Amsterdam, 2015).

media cluster, but did not pursue an explicit policy dedicated to a range of sectors.

The municipality also outlined a perspective on the internationally competitive and creative knowledge city in its Social Structure Plan (Municipality of Amsterdam, 2005), which foresaw investments in urban dynamics and in the education of its citizens. According to the plan, creative cities should, above all, be able to adapt quickly to new markets and trends (Bontje et al., 2011). Points of particular interest are the mismatch on the labour market, a shortage of housing and working space, congestion and the preservation of Amsterdam's image as a tolerant city.

In short, diversity and creativity are important pillars of the Amsterdam economy. They have been stimulated by the incubator policy, among other things. But the city and the region also have a wide range of other economic activities, related to the seaport and the airport.

Seaport

Due to its function as a powerful trade centre, the Amsterdam seaport has traditionally been important. In recent decades, policies have been marked by developments in the entire North Sea Canal Area (NZKG). A recommendation offered by a commission chaired by former Dutch politician Andriessen, *Working together to create space for economic growth*, played an important role in defining the policies. The commission emphasised that a strong port function is required to be able to achieve economic growth and attract new companies (Commissie-Andriessen, 1995). The recommendation sees the port as an engine for economic growth and employment in the North Sea Canal Area and as an integral part of the logistic-industrial complex. The commission also recommended that efforts not be limited to attracting high-quality industrial and distribution activities, and that the Canal Area do everything that is in its power to make additional industrial sites available, particularly for wet activities (Commissie-Andriessen, 1995). This meant that, in parallel with the revitalisation of existing sites, other projects were also carried out, such as the construction of Afrikahaven in the early 2000s, the Third Harbour of IJmuiden and the development of Wijkermeer and Hofambacht. At the time, the commission did not see any direct reason for the construction of a second lock at the Noordersluis site. The commission also observed that the level of education of the workforce should be continually adapted to the changing requirements of each sector, by offering retraining programmes and refresher courses.

The port area of Amsterdam (which includes the ports of Zaanstad, Beverwijk and Velsen/IJmuiden) is, in terms of transshipment, the fourth largest port in Europe, and it has a market share of 8% (2013 figures). The port area provides more than 67,000 jobs (2015) and it generates an added value of 7 billion euros (2015), which is of great importance to the Amsterdam Metropolitan Area (Port of Amsterdam, 2017).[112]

The municipality of Amsterdam has always been strongly involved in the development of the ports. The Port Authority, Havenbedrijf Amsterdam NV, is the company that has been assigned responsibility for management, operation and development of the port of Amsterdam. Since 2013, the Port Authority has been an independent, unlisted public limited company with the municipality of Amsterdam as its sole shareholder, while the administrative platform for the North Sea Canal Area (BPF) has been responsible for the implementation of the 2040 North Sea Canal Outlook. The main objective of the Outlook is to enhance the contribution of the North Sea Canal Area to the Amsterdam Metropolitan Region and its international competitive position. Within this Outlook, the port of Amsterdam aspires to develop further and be able to handle a maximum cargo tonnage of 125 million tonnes by 2030. The plans include the opening of a new sea lock at IJmuiden, which is to become operational in 2019. The Port Authority highlights that under the 2014 Outlook, the port will be more than just a transshipment location: it will be a dynamic metropolitan port that combines the power of the logistics hub with a high-quality industrial sector and a multifaceted services sector.

Airport

Amsterdam and Amsterdam Airport Schiphol have been closely linked for decades. The Munich case study points out that that city did not have a new international airport until 1992–which further improved the region's position in an international network–while Amsterdam has

obtained value from the international connectivity that Amsterdam Airport Schiphol offers for much longer.[113] However, when, in 1916, Amsterdam Airport Schiphol was established in Haarlemmermeer at an appropriate distance, at that time, from Amsterdam's built-up area, it was not anticipated that the airport would experience such enormous growth. Nor was it foreseen that the surrounding urban area would expand so greatly (Ministry of Infrastructure and the Environment, 2016). Particularly since the 1960s, developments have been taking place very rapidly. Passenger volume grew from less than 1.4 million in 1960, to approximately 40 million in 2000 (Ministry of Infrastructure and the Environment, 2016). With more than 60 million passengers in 2016[114], Amsterdam Airport Schiphol is the third-busiest airport in Europe.

Hakfoort et al. (2001) showed that direct employment at Amsterdam Airport Schiphol also experienced a strong increase. In 1976, there were almost 24,000 direct jobs, and 20 years later, in 1996, almost 45,000.[115] Moreover, indirect employment was just as high as direct employment (Hakfoort et al., 2001). A more recent study by Decisio (2015) reveals that airport activity and the related jobs provide work for 65,000 people at Amsterdam Airport Schiphol and for a further 50,000 elsewhere in the Netherlands, the majority in the Amsterdam Metropolitan Region (Decisio, 2015). This volume of employment represents 9 billion euros in added value.

In addition, Decisio (2015) shows that further benefits are produced by another indirect effect, related to the relationship between, on the one hand, network quality and airport size and, on the other hand, economic development of a region. It is difficult to determine the extent of this broader economic interest, but it definitely plays a role. This has to do with the presence of European head offices (which provide almost 9,000 jobs), distribution centres (7,500 jobs) and the international conference sector in the Amsterdam region and North Holland province. Without international connectivity, they would all find themselves in a less attractive location.

Over the years, Amsterdam Airport Schiphol has developed from an airport into an Airport City (Von Streit et al., 2010)—an airport that functions as a city, with meeting places, shops, hotels, casinos and the World Trade Center (WTC). Consequently, Amsterdam Airport Schiphol has become more and more attractive for transfer passengers, but also as a meeting place for people who are not travelling anywhere by aeroplane. Critical in this development was the decision, made in the mid 1980s, to turn Amsterdam Airport Schiphol into a mainport: one of Europe's most important air travel hubs.[116]

Zuidas District

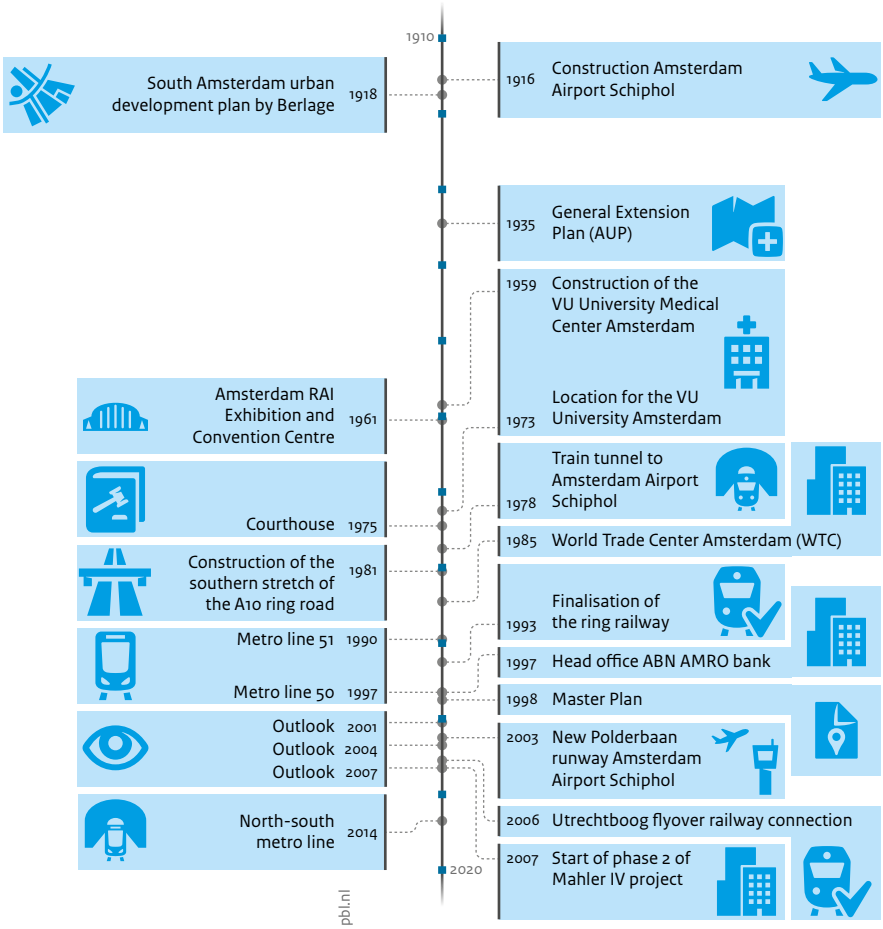
In the last few years, the *Zuidas*, located along the stretch of the A10 ring road in the southern part of the city, has developed into a site with a high concentration of financial and business services (PBL, 2016). Until 1998, planning was largely based on pragmatic case-by-case decisions whether a proposed building project could go ahead (Municipality of Amsterdam, 2004b). But the Zuidas was seen as an interesting business location due to its location near Amsterdam Airport Schiphol and its good accessibility by road and rail (Amsterdam Zuid railway station). Figure 4.12 provides a timeline of decisive developments that have contributed to the prominent position of the location. As more and more companies wanted to establish themselves on the Zuidas, the municipality determined in its 1994 Programme Agreement that an integrated plan for the area had to be drawn up: the 1998 Master Plan (Municipality of Amsterdam, 2004b).

One of the main reasons for the design of an integrated plan was the decision made by the ABN AMRO bank to locate its head office in the Zuidas area. This went against the wishes of the municipality, which had foreseen most large-scale office development, including business premises for ABN AMRO, to take place on the IJ banks (see text box on Structural Plans). However, the bank considered the Zuidas to have more potential as an office area and settled there. The decision eventually proved to accelerate subsequent development of the Zuidas.

A second factor that sped up development was the 1997 designation by the national government of the Zuidas as a New Key Project. The aim was to for the Zuid/WTC station to grow into the second railway station in Amsterdam. Partly because of the planned development of the Zuidas, Zuid/WTC went on to become a multimodal transport hub (Municipality of Amsterdam, 2004b). Nevertheless, as the municipality itself concludes, the Zuidas earned development mainly on its own merits (Municipality of Amsterdam, 2007c).

Over the years, a series of outlooks for the area has been drawn up, all of which mark important moments in the development of the Zuidas. For example, the Zuidas Outlook (2001) gave the area an impulse from the field of urban planning: the area was to be transformed from a mono-functional office location into an urban environment with mixed-functions, including offices, homes and facilities. The objective was to develop the Zuidas into an outright and compact city centre, where living, working and facilities are in proportion to each other (Municipality of Amsterdam, 2004b). In the same period, a subsequent process was started up towards establishing public-private partnership. In response, the municipality, the national government and the Amsterdam Regional Council (ROA) reached an administrative agreement in 2006. The 2007 Outlook marked an important moment in the further development of the area with the establishment of the Zuidas Amsterdam Enterprise and the participation of private

Figure 4.12
Important milestones in the development of the Zuidas district



Source: Gemeente Amsterdam 2007

parties (Municipality of Amsterdam, 2007c). The transition from a location that had already become a successful business hub into an urban centre with a mixed programme was emphasised most heavily in the 2009 Outlook (Municipality of Amsterdam, 2016a). Housing projects and functions serving the general public went on to occupy a more central position. The aim was to complete more than 7,000 housing units for 13,000 to 15,000 people by 2030. More residents would mean having a broader base for various facilities, including shops and schools (Municipality of Amsterdam, 2016c). In addition, the space earmarked for green areas, sport, play and education was to increase the quality of the physical and residential environments.

The 2016 Outlook in turn came with a number of changes in urban planning with regard to previous versions, such as the decision to build only the motorways underground and to keep the railway tracks above the surface. The Outlook focuses even more on the development of the Amsterdam Zuid railway station and the use of bicycles and public transport (aiming to reduce the proportion of car use). A great deal of attention is paid to realising an attractive residential area and to achieving integration of the Zuidas into the wider surroundings. The municipality points out that the focus is not only on the final result, but very particularly also on the path towards that: 'What do we have to do to keep the Zuidas attractive, especially during the construction phase? (Municipality of Amsterdam, 2016c: 13). Finally, this Outlook sees the development of the Zuidas as a joint task: developers, builders, investors, the authorities and residents, institutions and entrepreneurs need to shape the Zuidas in a combined effort (Municipality of Amsterdam, 2016c).

According to Major (2008), the development of the Zuidas is characterised by the adaptive capacity of the planners (the municipality of Amsterdam) and by the public-private partnerships that have been set up to facilitate the participation of the national government, the banking world, the Dutch railway company NS, the VU University Amsterdam and private parties.

4.7.8 Physical infrastructure

The previous sections have already highlighted that the Amsterdam region has made many spatial infrastructural investments in programmes such as the seaport, Amsterdam Airport Schiphol, the Zuidas district and other urban development projects. A large number of these investments are related to accessibility from outside and mobility within the city and the region, with money being put into tram connections, stations and related facilities. Much of this has already been discussed, and here we limit ourselves to noting that accessibility of the city was, and still is, one of the central points of interest within urban and provincial policies.

4.7.9 Governance: city and region

Several public and public-private partnerships in Greater Amsterdam were dealt with in the previous sections (e.g. those under the headings of Amsterdam Marketing, IJ-oevers, Zuidas and Amsterdam Airport Schiphol). In this section we discuss governance from the point of view of regional administrative cooperation transcending the level of the city of Amsterdam. We will look at cooperation in the fields of the housing market, infrastructure and the economy.

The Amsterdam region has a long tradition of regional administrative cooperation. A great deal of administrative complexity lies hidden behind this tradition. In the 1960s, for example, there was the Agglomeration Board for Greater Amsterdam, in the 1970s the Informal Agglomeration Council, and since 1985 the Regional Council for Amsterdam (ROA) has served as a cooperation structure for various municipalities. In the early stages, cooperation was informal, in the sense that it was not subject to legal administrative frameworks. The bodies involved exchanged information on tasks related to public housing, traffic and transport, and explored common interests. In 1992, the national government conferred formal status to the ROA, endowing it with its own staff and assigning it a range of responsibilities. Its main tasks were to prepare for the creation of a new urban province (see the text box below on the Common Regulations Act) and to draw up a strategy for regional-economic development.

Regional cooperation came to a dead end after the 1995 referendum in which the citizens of Amsterdam rejected the idea of an urban province (Van der Lans, 2006).[117] After carefully considering the situation, the ROA made a fresh start in 1997 (Van der Lans, 2006). The move was in part formal, falling in the context of the Framework Act (see text box on the Common Regulations Act), but it mostly had an informal character, and included the possibility to adapt forms of cooperation and consultation to the issues that had to be tackled (Van der Lans, 2006). The initiative was taken by Regional Cooperation Amsterdam (RSA), a lightweight cooperation body for the northern half of the Randstad conurbation.[118] Several collaborations have been set up this way since 1997, including the Northern Randstad Council and the joint initiatives around developments in air traffic (Amsterdam Airport Schiphol), the regional economy and the North Sea Canal Area. These informal partnerships developed outlooks and plans and facilitated information exchange. When necessary, they represented the regional interests before the national government. However, the RSA did not take any formal decisions (Van der Lans, 2006).

Eventually the ROA was converted into City Region Amsterdam, an administrative partnership of fifteen municipalities in the Amsterdam region (WGRplus, see text box on the Common Regulation Act). In operation between 2006 and 2016, this body was responsible for statutory regional tasks in the fields of traffic and transport, economy and tourism, the regional housing market and youth care. On 1 January 2017, City Region Amsterdam transformed into Amsterdam Transport Region to continue performing tasks related to regional traffic and transport. Responsibilities with regard to the economy are now assigned to the Amsterdam Metropolitan Region and housing is assigned to the sub-regions of Amstelland-Meerlanden, Zaanstreek-Waterland and Amsterdam. Amsterdam Metropolitan Region operates in the northern part of the Randstad conurbation as the cooperation body for the provinces of North Holland and Flevoland, 33 municipalities and one transport region.[119]

From this brief description of the governance in the city and the region it is clear that Amsterdam actively looks for adequate forms of cooperation. Informal collaborations have always provided an important basis and attempts at formal cooperation, imposed from above, have proved to be less stable. In the end, it is once again the informal constructions that form the basis for cooperation today.

Government memoranda

Amsterdam has always had a prominent position in national memoranda. In this regard, the Fourth Memorandum on Spatial Planning (1988) and the Fourth Memorandum on Spatial Planning Extra (1991) are important because they mark a shift from policies based on spreading to an approach based on the notion of 'regions under their own steam' and they have a strong orientation towards economic growth and competitiveness, and therefore towards the economic strength of Amsterdam. We have already described the key projects in Amsterdam (Eastern Docklands in the late 1980s and the Zuidas in the late 1990s) with which the government committed itself to developments in Amsterdam. Stimulating the economy was an important objective in the projects, but the policy memoranda by the Ministry of Economic Affairs are also noteworthy. Raspe and Van Oort (2007) provide a description of the most decisive memoranda on regional-economic and industrial

Common Regulation Act (WGR)

The national government was also an important party in the governance of the Amsterdam region. In 1977, it took the initiative to formalise regional cooperation and drafted a proposal to transform the 12 provinces in the Netherlands into 22 mini-provinces (Smallenbroek and Spit, 1992). The proposal sprang from the debate on the Common Regulations Act of 1950 (WGR), which had not proven to bring about preparedness in the regions and granted decision-making power to regional bodies that were not democratically elected. In the 1983 Memorandum on Administrative Organisation issued by the Ministry of the Interior and Kingdom Relations, the proposal for a new tier of government in the form of 22 mini-provinces was converted into a proposal for 'extended local government'. A new Common Regulation Act was written in 1984, which went further in terms of assigning powers than the 1950 Act, allowed for more variation in forms of cooperation and also made it possible for the municipal and provincial authorities to have a larger say.

However, this still did not go far enough, especially for the larger Dutch cities with complex problems (Ministry of the Interior, 1988). The idea for a new level of government arose once again, this time in the form of so-called *urban provinces*. In 1992, the government took the initiative to formalise the Regional Council for Amsterdam (ROA). But in 1996, after further formalisation efforts towards urban provinces failed, the Common Regulations Act *Plus* (WGR-plus) was added to the existing Act. It was a dramatic variation on the general WGR regulations. Municipalities could legally be forced to participate in a WGR-plus and there were statutory tasks, such as the periodic design of a regional-economic development strategy, decisions on regional business locations, supra-local land policy, and promotion and acquisition aimed at businesses and tourism. In addition, common tasks were formulated in the areas of the housing market, traffic and transport, and youth care. Until 2007, the fifteen municipalities in the Amsterdam region officially operated under the name Regional Council for Amsterdam (ROA) through the Framework Act for Governance in Change and, from 2007 onwards, through WGR-plus, they continued as City Region Amsterdam.[120]

The government also took the initiative in the informal Noordvleugel Consultation (cooperation body for the northern half of the Randstad conurbation), by entrusting the region with the task of building 150,000 dwellings by 2030. Although the initiative was informal, it acquired such standing that the government went on to make investments in the Noordvleugel programme: it put up 8 billion euros for infrastructure, housing, nature and the economy. When this plan was formally almost completed, the government changed hands in 2007 (Balkenende IV Government) and the emphasis shifted to the level of the Randstad conurbation. The Noordvleugel programme was cancelled and the Randstad Urgency Programme (URP) was created to take its place. It encompassed 33 projects, such as an exploration of the viability of having a single public transport authority in the Randstad, developments in the Markermeer-IJmeer area (TMIJ), the radical upscaling plan Almere 2030 (60,000 dwellings and infrastructure), 't Gooi and Utrecht (AGU), developments at Amsterdam Airport Schiphol, Lelystad, and the National Structural Outlook Amsterdam-Almere-Markermeer (RAAM).

WGR-plus was repealed in 2015. The government put the emphasis on voluntary cooperation and a restrained, strictly task-oriented approach. The only exception involved the tasks in the field of traffic and transport for which transport regions were to be established (VOA in the case of Amsterdam).[121] Also, in 2008, the new Spatial Planning Act (WRO) meant that part of the spatial planning tasks, such as the drawing up of spatial development strategies, were transferred to the province.

policies in the 1950–2007 period. In these, Amsterdam had a prominent position, particularly in cases where the emphasis was on stimulating growth (rather than evening out differences in growth). The 2004 memorandum Peaks in the Delta is illustrative of this: Amsterdam (with the Zuidas and Amsterdam Airport Schiphol developments) was given national priority. This concerned, for example, national policies on the restructuring of business parks, accessibility of the city and mainport Amsterdam Airport Schiphol, and stimulating innovation and the urban economy.

4.7.10 Recent developments

In the past decades (and particularly since the mid 1980s), the policy efforts in Amsterdam that aimed at keeping the economic engine running have concentrated predominantly on creating high-quality and attractive physical and residential environments and on the use of public-private partnerships to develop physical space in order to promote economic dynamics (e.g. Amsterdam Airport Schiphol, Zuidas and small-scale businesses in the city). The Structure Outlook Amsterdam 2040 (2011) maintains this policy line. The ambition continues to be

adding homes through compaction and transformation, thereby making better and more intensive use of the existing urban area (Municipality of Amsterdam, 2016a).

Heading towards 2025

Heading towards 2025 is a strategy document for city development until 2025 that operationalises the 2040 Structure Outlook and the ambition to build 50,000 housing units (Municipality of Amsterdam, 2016a). In addition to accommodating growth, the municipality wants to add quality to the city with this strategy, working under the basic assumptions that business activity can change character quickly as it increases, and that the knowledge-intensive and creative economy prefers to establish itself in the heart of the city, among the residents and places of entertainment. It is therefore becoming less and less easy to maintain the classic separation between residential and business activities. Amsterdam is also facing an enormous challenge with regard to sustainability. Heading towards 2025 considers that urban environments that are mixed, in terms of both functions and population composition, are best able to accommodate these developments (Municipality of Amsterdam, 2016a).

Amsterdam applies the principle that the strategy for urban development needs to be flexible, that is, it should be able to adapt readily to economic developments (Municipality of Amsterdam, 2016a). To ensure this flexibility, the coordination and attuning of new projects are carried out by the new Space for the City Team. This administrative unit includes the most heavily involved aldermen and has an official steering committee that focuses mainly on the strategic considerations of where and how to permit further development of the city (Municipality of Amsterdam, 2016a).

Amsterdam is aware of the fact that the continuity of its economic strength depends on its capacity to keep on innovating economically and to stay in touch with the international flows of individuals and trade. For this reason, the city cooperates with companies, knowledge institutions and other authorities in the metropolitan area to: attract international business activity, stimulate the development and application of knowledge and innovation, improve the concordance between education and the needs of the labour market, maintain and strengthen international connections through the port and the airport, and employ the Expatcenter to facilitate the growing stream of foreign people who want to settle in the city and the region (Municipality of Amsterdam, 2016a).

Amsterdam Economic Board

The Amsterdam Economic Board (AEB) was set up in 2010 to strengthen the regional economy in sustainable ways.[122] It is an organisation for cooperation whose 25 members include administrators of knowledge institutions and companies, and aldermen and mayors from the Amsterdam Metropolitan Region. Together they draw up the strategy for the Metropolitan Region. The AEB evolved from the Amsterdam Knowledge Circle Foundation (established in 1994 for the development of the regional knowledge infrastructure) and the Amsterdam Innovation Motor (established in 2006 as an independent organisation).

The AEB promotes innovation and cooperation between the business world, knowledge institutes and the public administration. Cooperation is streamlined around five metropolitan challenges (with the following goals for 2025)[123]:

- Circular Economy: the Amsterdam Metropolitan Region is to be a leader in smart solutions for the more efficient use of raw materials.
- Digital Connectivity: the Amsterdam Metropolitan Region is to be the most important location in Europe for data-driven innovation.
- Health: the residents of Amsterdam Metropolitan Region will have gained two extra years of healthy life.
- Mobility: all urban journeys within the Amsterdam Metropolitan Region will be emission-free.
- Talent for the Future: the Amsterdam Metropolitan Region will be the most successful region in terms of exploiting, retaining and attracting talent.

To reinforce the international competitiveness of Amsterdam Metropolitan Region, the AEB has also identified eight economic clusters:

- Creative Industry;
- ICT/e-Science;
- Life Sciences and Health;
- Financial and Business Services;
- Tourism and Conferences;
- Logistics;
- Market gardening and Agri-food;
- High-tech Materials.

The Board has formulated a strategy for each cluster. The implementation of a strategy involves close cooperation between the Amsterdam Chamber of Commerce, Syntens Innovation Centre, Amsterdam Inbusiness, the local universities and colleges of higher education and the business world.[124]

Startup Amsterdam

In recent years, Amsterdam has been pursuing numerous policies to support start-ups, focusing on both new companies, and existing businesses that have the possibility to grow and enter international markets. In 2015, the municipality of Amsterdam, along with 250 partners, founded StartupAmsterdam: an outlook and an action programme, fed by the entire start-up ecosystem in Amsterdam, which is to be in operation for four years (2015–2018). The ambition is to turn Amsterdam into *the* place in Europe for start-ups.

With StartupAmsterdam, Amsterdam is making an effort to create an image among international start-up teams, technical talents, investors and fast-growing companies: Amsterdam as the city where start-ups have access to growth capital, where large organisations can readily be approached as test clients, where experienced start-up mentors are widely available, and where there is a wide range of inspiring start-up events in a setting that combines an entrepreneurial mindset with global growth ambitions (Municipality of Amsterdam, 2015). The aim is to attract (fast-growing) foreign start-ups. Amsterdam start-ups should also be able to more easily attract staff with relevant expertise and be better positioned in the foreign technology clusters. Foreign investments in Amsterdam should be boosted. In addition, Dutch financial parties (such as those at the Zuidas) need to be mobilised and concentrate on promoting cooperation between public and private knowledge (Municipality of Amsterdam, 2015).

With these initiatives, StartupAmsterdam is aiming to achieve, throughout the entire start-up ecosystem, powerful collaborations that have a clear focus and are coherent and transparent. Rather than going for specific sectors or clusters, the use of crossovers between sectors or technologies is seen as a relevant approach and areas such as gaming, dance, the media, advertising, the sharing economy and food are the centre of attention. The idea is also that start-ups look for locations where other companies share their ambitions and targets instead of joining a specific industry or cluster.

The circular economy

The pillar of the sustainability agenda of the municipality of Amsterdam is the circular economy. This concerns both achieving the sustainability targets and exploiting the economic potential of the circular economy (Municipality of Amsterdam, 2015b). In 2015, the city presented an outlook for the city and the region, including an agenda for action, or roadmap. The outlook incorporates the city's desire to significantly reduce the generation of waste by ensuring all materials are included in technical or biological usage cycles, for example by generating all energy from renewable sources.

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4.8 Conclusion: a region-specific policy mix

Each region has its own policy mix, as becomes clear from the descriptions of the six case studies. In each case, some of the cogwheels in the engine of the economy are emphasised more, and others less, and often they are treated as a connected whole. The regional policy mix is specified according to the regional structure and the resulting priorities correspond to the profiles of the urban regions that we outlined in Section 3.5.

Examples of how the regional is structure is reflected in the setting of priorities in regional policies are the choice for high tech and innovation in Eindhoven and Munich (private R&D, patents, clustering of high-tech industry, quality education and a young, highly skilled workforce). Amsterdam and Milton Keynes opted for creating appealing facilities and residential environments to attract highly qualified employees (quality of housing and the residential environment, young and highly educated labour force, educational opportunities and public R&D). In Dublin, the focus was on attracting foreign capital and companies, mainly with the aim of achieving a transformation towards higher value activities (electrical industry, software, pharmaceuticals and chemicals) within its own economic structure (specialisation in chemistry and clustering of business services, as well as specialisation of the region in general). Madrid mostly had an autonomous agglomeration process in which more weight was given to physical projects in urban renovation, urban expansion and, in a later stage, urban megaprojects.

To illustrate this, Table 4.4 summarises the priorities that were set in each region. The cogwheels in the engine of economic growth are the centre of attention here, but the summary cannot reflect all the nuances that have been described in the individual case studies in this chapter. For example, the dynamics of policies over time is not visible. The table is simply a brief overview of the policy priorities that were found to be predominant over the entire period studied, spanning several decades. The policies are sorted into the categories: top priority, very important, important and less important. Another thing to consider is that the initial situations differed from one region to another. In some regions, for example, many policy efforts were needed with regard to a certain factor because it had been seriously neglected, while other regions were performing well in that field, meaning that no policy priorities were required there. The individual regions are displayed in the columns in Table 4.4. Some caution is required when comparing the information in the columns. Moreover, the intensity of the policy does not fully correspond to the breadth of the deployed resources, which varied from region to region.

Table 4.4 shows that in the Munich region all eight factors of the growth engine were given priority and considered very important in terms of policy efforts. Munich gave preference to strengthening clusters by promoting their development (economic structure), the quality of human capital, knowledge infrastructure, and the necessary financing. We have already described this as a *coherent innovation system*. Through the governance of the system, strong policies were followed on these fields (and as a result all involved in the Munich region became like-minded and pursued a joint strategy), complemented by an intensive entrepreneurship policy. Other important policy areas were physical infrastructure (accessibility) and the quality of the physical and local residential environments.

In Brainport Eindhoven, the emphasis was mainly on clusters, knowledge infrastructure and governance of innovation: a triple helix structure in which government, businesses and knowledge institutions work in close collaboration. The case study also reveals that entrepreneurship, financing (venture capital) and the quality of the physical and local residential environments, despite being considered important, received less intense policy attention.

In the Milton Keynes region, priority was given mainly to the physical and local residential environments and to the facilities that contribute to creating an attractive location to live and work in. Policies in the physical domain and governance in development projects and public-private partnerships were very important in this regard. The region focused far less on entrepreneurship and specific clusters but did embrace the smart-city idea as a concept with links to economic activities. Human capital was important but was attracted mainly through the physical and local residential environments. In the field of knowledge infrastructure, the case study shows that from the start the region has enjoyed many advantages because of its location close to the leading universities and knowledge clusters in Oxford, Cambridge and London. Policymakers were very much aware of this unique location, and of the required physical infrastructures to ensure proper connections with these core areas.

In the Dublin region, high priority was placed on attracting foreign investments. Human capital policies put the emphasis on giving Irish workers the skills that matched the demand of foreign businesses. The aim was to ensure these businesses became an intrinsic part of the regional structure. But priority was also given to the further development of the clusters that needed new and different forms of knowledge, making policies aimed at the required knowledge infrastructure and cluster development highly important. Although especially relevant, entrepreneurship and the quality of the physical and local residential environments were given less policy priority in Dublin. Governance was important, but efforts

Table 4.4
Policy priorities in the six regions marked by growth

Policies aimed at:	Munich	Eindhoven	Milton Keynes	Dublin	Madrid	Amsterdam
1. Clusters						
2. Entrepreneurship						
3. Human capital						
4. Knowledge infrastructure						
5. Physical infrastructure						
6. Financing						
7. Residential amenities						
8. Governance						

	Top policy priority
	Very important in policies
	Important in policies
	Less important in policies

were mainly related to the interaction between national policies and the region.

Madrid assigned top priority to physical infrastructures and major projects corresponding to the development of a large agglomeration. The quality of the physical and local residential environments was also important. Since the city of Madrid dominates the region and living and working are concentrated there in the functional region, other policies, such as those for cluster development, were less prominent. Large, leading companies would be establishing themselves in the city anyway, partly because several authorities, including the national government, had interests in clusters such as those belonging to the telecom and energy sectors.

In Amsterdam, policy priority was given to the quality of the physical and local residential environments. In the earlier stages this was done to make the city an attractive place to live in, and later to facilitate growth towards a creative knowledge economy. Policies in the physical domain were important, and strongly related to the sectors (clusters) of logistics and financial and business services. Examples are the development of the Zuidas district and the upgrade projects for Amsterdam Airport Schiphol. The other policy areas were also important, but somewhat less dominant.

Table 4.4 shows that in the examined regions priorities exist in several policy areas. These growth regions often determine the priorities in a coherent policy mix.

What attracts the attention in the case studies is that regional authorities, besides establishing priorities for policy, also contributed to making economic renewal possible in a timely fashion. They enabled regions to literally reinvent themselves by creating critical mass around new and promising economic activities that were emerging in the region and by stimulating innovation in sectors that had a strong presence in the region and were in danger of entering a phase of decline.

The case studies also show that each region made efforts towards creating good physical infrastructure and attractive environments to live and work in. While these policy areas are, at first sight, generic, the regions often worked them out in more detail according to their own specific profiles, outlined above. Take, for example, the extensive renovations of old city centres and the associated cultural facilities in Amsterdam (in the mid 1980s), Munich (after the Second World War) and Madrid (after Franco's death in 1975); the values related to nature that were seen as a factor of attraction in Munich ('compact, urban and green') and Milton Keynes ('the forest city'); the specific working environments for high-tech knowledge workers in Munich (former military sites used as 'areas for the new economy') and in Eindhoven (the Strijp S district as the creative centre of the city) that were linked to the Future Bavaria Initiative and the Brainport Strategy, respectively; the coupling of the inflow of foreign investments to the redevelopment of the Docklands Area in Dublin; and the way Milton Keynes managed to secure human capital through its suburban residential environments equipped with urban facilities.

Notes

1 What makes Bavaria unique is the fact that, unlike the government districts, its *Bezirke* have an elected parliament

(*Bezirkstag*) which functions independently from the federal state. Their boundaries coincide with those of the government districts: Upper Bavaria is therefore not only a government district (an extension of the federal state of Bavaria) but also a *Bezirk* (with an autonomously functioning and elected administrative body).

2 Population data from the Bayerisches Landesamt für Statistik (Statistics Office of Bavaria): https://www.statistikdaten.bayern.de/.

3 Fraunhofer institutes and units in the city of Munich: Micro Mechatronic Centre; Microsystems and Solid State Technologies; Fraunhofer headquarters; Embedded Systems and Communication Technologies; Applied and Integrated Security; Electrochemical Storage. Others in the Munich region: Building Physics (Oberlaindern Valley); Competence Center Building Technology (Rosenheim); Verkehr, Mobilität und Umwelt des Fraunhofer (Prien am Chiemsee); Institute for Industrial Engineering (Garmisch-Partenkirchen). www.standortkarte.fraunhofer.de/main.jsp?lang=en&debug=false&topic=institut&topicvalue=null&focus=base&focusvalue=806&t=1315392609639.

4 Astrophysics; Biochemistry; Innovation and competition; Social law and public finance; Tax law and public law; Neurobiology; Ornithology; Extraterrestrial physics; Physics; Science of light; Plasma physics; Psychiatry; Quantum optics. https://www.mpg.de/institutes_map?region=BY.

5 https://www.research-in-germany.org/en/research-landscape/research-organisations/networks-and-clusters/the-leading-edge-cluster-competition.html.

6 http://industrie4.0.gtai.de/INDUSTRIE40/Navigation/EN/Topics/Why-germany/why-germany-policy,t=smart-data,did=1191584.html.

7 http://www.clusterplattform.de/CLUSTER/Navigation/Karte/SiteGlobals/Forms/Formulare/EN/karte-formular.html.

8 http://bayernkapital.de/financing-innovation/.

9 http://www.lfa.de/website/downloads/broschueren/b_english/b_english.pdf.

10 Bayern Innovativ was founded in 1995 and counted on an investment budget of 50 million euros, which was related to the OZB funds. It is the most important communication platform for all high-tech initiatives that are subsidised by the federal state. It is jointly managed by public, private and intermediary research agencies. The objective is to promote technology transfer for both researchers and businesses, particularly SMEs.

11 http://www.lfa.de/website/downloads/broschueren/b_english/b_english.pdf.

12 The Bavarian International Technology Forum was established in 1995 to promote exchanges between the academic world and the industrial sector. The body focuses on supporting SMEs seeking to increase their exports or expand across borders. Invest in Bavaria is an organisation dedicated to profiling Bavaria as a location for foreign investments. A global network has been created of 22 Bavarian representatives operating abroad to facilitate the participation of SMEs in international trade fairs (Rode et al. 2010).

13 https://www.muenchen.de/rathaus/home_en/Department-of-Labor-and-Economic-Development/labormarket-policy.html.

14 See also: http://www.clusterobservatory.eu.

15 https://www.energie-innovativ.de/.

16 https://www.stmwi.bayern.de/service/foerderprogramme/energiefoerderung/

17 https://www.umweltpakt.bayern.de/ueber_uns/index.htm

18 http://www.klimawandel-meistern.bayern.de/#Allianz

19 For a more detailed description, see for example http://www.brainport.nl/over-brainport/het-verhaal-van-brainport/brainport-in-de-tijd.

20 During its period of development in the region, Philips created an entire 'city', including facilities and social infrastructure. The company built houses (the Philipsdorp and Drents Dorp neighbourhoods), schools, a library and cultural facilities, sponsored sports clubs and also set up a pharmacy, currently operating under the name ETOS (Kesar 2016).

21 At the time, the Physics Laboratory (Natlab) was the first modern research centre to operate within the walls of a private company, eventually growing into the largest R&D lab in the world (Van Winden et al. 2014). Around 1975, Natlab employed about 2,000 people, including approximately 600 researchers with a university education (https://nl.wikipedia.org/wiki/Philips_Natuurkundig_Laboratorium). Natlab was at the time larger than any Dutch university lab (Kesar 2016).

22 Another feature of the region with regard to solidarity was that businesses themselves were very concerned about the issues. One example (in addition to Philips) is DAF, which created the dedicated DAF Support Fund and organised meetings for companies that were looking for new customers and markets.

23 As mentioned above, the Stimulus Programme started as the executive body of the SRE municipalities (the cooperation association between 21 municipalities in the south-eastern part of North Brabant) and the province of North Brabant with the aim of ensuring proper management and implementation of the first Stimulus Programme (1994-1996) for the Eindhoven region. This was followed by the management of the second Stimulus Programme (1997-1999). After that, starting with the EPD 2000-2006, management of the Stimulus Programme developed from an organisation for the south-eastern part of North Brabant into an executive organisation for the allocation of resources of the Regional Structural Fund from within the European Regional Development Fund for the whole of the southern Netherlands. The execution of the Regional Structural Fund programmes is formally the responsibility of the Managing Authority (MA), North Brabant province. The MA has delegated this task to the Stimulus Programme management, which is therefore the executive body in charge of day-to-day programme management for the provinces of North Brabant, Zeeland

and Limburg. Stimulus Programme management is operationally and functionally directed by the province of North Brabant. The management body is part of North Brabant province, which deals with the execution of a number of European subsidy programmes for the provinces of North Brabant, Limburg and Zeeland on behalf of the European Commission and the national government. Stimulus manages a number of subsidy programmes and facilitates application procedures for subsidies. Stimulus operates from Eindhoven as the programme's secretarial department for OPZuid, OP-Zuid and in the near future also POP3 Brabant. Source: https://www.stimulus.nl/over-stimulus/.

24 http://www.brainport.nl/over-brainport/het-verhaal-van-brainport/brainport-in-de-tijd.

25 The main principles of spatial policy were formulated in *Brabant aligned* (2000). They were the result of the interactive trajectory *Talking about space* (1998a), started up in 1998. The main idea of *Brabant aligned* was to give the (economic) dynamics sufficient margin for it to contribute to preserving and reinforcing ecological quality and spatial diversity. *Talking about space* also presented an anthology of opinions on the use of space - Brabant in plain terms (1998b) - which subsequently were analysed in *Brabant in plain terms on schedule* (1999a). This material went on to become an important source of inspiration for the formulation of the debate vision *Brabant full of contrast* (1999b). Provincial policies also focused on proper spatial (and ecological) management of the economy in *Strategic Agenda for the environment, the economy and spatial planning* (2000).

26 Eindhoven Metropolitan Region is an administrative collaboration body formed by 21 municipalities in the south-eastern part of North Brabant province, which was formally launched in February 2015. It is successor to the Eindhoven Region Partnership (SRE).

27 Zie ook https://www.brainport.nl/over-brainport/brainport-strategie.

28 Ministerie van Economische Zaken (2016), Brainport Eindhoven, brief van minister Kamp aan de Tweede Kamer, DGBI / 16179263.

29 Nathan (2007: 18) expresses the growth of this kind of English cities in the following terms: 'relatively homogenous, uncreative, medium density locations have seen the biggest growth in high-end financial and business service jobs–jobs which Florida suggests should gravitate to the big creative cores.'

30 Compaction in the centre is seen as a strongly market-led development, which, according to some commentators, has also produced a decline in quality starting in the 1990s, caused by the building of anonymous office blocks, among other things (Clapson 2004).

31 Nonetheless, city privileges were never granted. According to the Guardian (2016): 'Britain's fastest-growing city is not, strictly speaking, an official city, mysteriously overlooked by government officials who anoint less significant places, but its residents have always called it one'.

32 http://www.semlep.com/news/2016/boost-for-region-as-government-pledges-multi-million-pound-investment/.

33 https://www.milton-keynes.gov.uk/planning-and-building/planning-policy/.

34 http://www.semlep.com/.

35 https://www.gov.uk/government/news/growth-deals-firing-up-local-economies.

36 https://www.lepnetwork.net/the-network-of-leps/.

37 The rates applied in 2007 can be found here: https://www.google.nl/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwj4uqP3hO_TAhWFOxoKHZxjDkkQFggrMAE&url=https%3A%2F%2Fwww.milton-keynes.gov.uk%2Fassets%2Fattach%2F5068%2FUrban_Development_Tariff_SPD.pdf&usg=AFQjCNHO4X1CDub7LmXXPMKN_ToCv4cnKg. The rate is indexed every year. In 2014, for example, it was set at £22,000 per dwelling. https://environmentonsite.com/40054/suds-fighting-for-innovation.

38 https://www.mkccm.co.uk/about-us/who-are-we/.

39 http://www.mkblp.co.uk/our-aim. Consulted on 24-12-2016.

40 Part of the MK Future City Programme.

41 http://www.mksmart.org/about/.

42 This also covers the Sustainable Action Plan, which is a requirement set by the European Union Covenant of Mayors. http://www.covenantofmayors.eu.

43 Part of the EU INTEREG project IMAGINE.

44 http://www.ai-online.com/Adv/Previous/show_issue.php?id=4066&search=true#sthash.ipsRh5Dg.dpbs.

45 http://www.energy-cities.eu/Milton-Keynes-to-boost-electric.

46 https://www.goultralow.com/press-centre/releases/milton-keynes-makes-15000-parking-spaces-free-electric-cars/.http://www.mkgoultralowcity.com/promoting-the-uptake-of-evs.

47 After the Irish War of Independence (1918–1922), the Irish Free State was declared under the Anglo-Irish Treaty. It implied being a constitutional monarchy, meaning the British King had to be recognised as Head of State. A struggle ensued between the Free State supporters, who were in favour of the Anglo-Irish Treaty, and the Republicans, who argued for full independence with their own president leading the country. In 1932, the pro-republican party Sinn Feín managed to obtain seats in parliament. An economic war was launched against the United Kingdom and strict autocratic policies were adopted. In 1949, the Republic of Ireland was officially declared. It took until 1965 for the Anglo-Irish Free Trade Agreement to be signed. This coincided roughly with the Economic Development Programmes drawn up between 1959 and 1970. These programmes stongly focused on reopening the Irish economy and consequently, the economic situation improved greatly (Kennedy et al. 1989).

48 Import tariffs, quota and licences (Crossa et al. 2010).

49 The first Economic Development Programme was drawn up under President Valera between 1959 and 1963; the second was plannend between 1964 and 1970. In 1965, the Anglo-Irish Free Trade Agreement was signed (Kennedy et al. 1989).

50 The Economist (2004) refers to these reactionary, monetary and fiscal policies as knucklehead policies. Kennedy et al. (1989) talk about the reactionary policy of increasing government loans and introducing tax cuts to offset the decline in domestic demand caused by the oil crisis (everything had become more expensive). The authors argue that the government maintained the policy for too long, even as a period of recovery began. At the start of the second oil crisis in the late 1970s and early 1980s, policies continued to follow the approach used in the previous oil crisis, which meant that public debt increased even further.

51 The conflict was about Protestants in Northern Ireland wanting to be part of the United Kingdom, while the Catholics were in favour of independence. The Protestants had a slim majority and Catholics had to resign themselves to the Northern Ireland breakaway and felt oppressed. The Irish Republican Army (IRA) put up a struggle on behalf of the Catholics and in 1969 the conflict escalated. The 1998 Belfast Agreement meant that the IRA laid down its arms and that the rights of the Catholic minority were extended.

52 The IFSC is said to be connected to schadow banking practices (The Irish Times 2013; Stewart 2013).

53 Special-purpose entities (SPEs) are businesses that establish themselves on paper, for example in Ireland, because of the tax advanteges, while their actual business activities are carried out elsewhere.

54 Another point is that the impact of FDI on the economy is often overestimated because foreign companies import many things–in the form of knowledge (patents, royalties or other necessary inputs)–which means the investments are not made in the country where the businesses are established (Buckley et al. 2006). Another explanation for the overestimate is that a large part of the profits made is returned to the companies' countries of origin (The Economist 2004). When imports or transfers of profits are subtracted from the gross domestic product, the picture is often different (gross national product).

55 See for example https://www.rijksoverheid.nl/onderwerpen/europa-financieel-gezond/financiele-steun-aan-noodlijdende-landen/financiele-steun-ierland.

56 The IDA is a key player in FDI policy development. It was established in 1949 as part of the Ministry of Industry. The first Economic Development Plan of 1958 introduced the zero-tax policy, which meant attracting foreign investment became an important task for IDA. In 1967, IDA was transformed into a government-sponsored, independent institute focusing on all kinds of activities related to industrial development. Nevertheless, since 1994, IDA has focused exclusively on attracting foreign investment and supporting foreign companies. http://www.idaireland.com/about-ida/history/.

57 Software localisation, for example–the proces of adapting things such as language and design to make software suitable for the country where it is going to be used–was initially an important supply activity to multinational customers. This work did not necessarily require specifically trained software developers, but in later stages, these activities became increasingly advanced (White, 2004).

58 Later taken over by Pfizer (The New York Times, 2016).

59 https://www.pfizer.ie/operations.cfm. Other Ireland offices in Limerick and Cork.

60 http://www.dell.com/learn/ie/en/iecorp1/careers/careers-about-ireland. Limerick, Cork.

61 http://www.irishtimes.com/business/lotus-positions-itself-successfully-1.140294. Later taken over by IBM.

62 http://www.intel.ie/content/www/ie/en/company-overview/intel-in-ireland.html.

63 https://www.microsoft.com/en-ie/aboutireland.

64 http://www8.hp.com/ie/en/contact-hp/office-locations.html. Other Ireland office in Galway.

65 http://www-05.ibm.com/ie/ibm/codetail.html. Other Ireland offices in Cork and Galway; and Belfast in Northern Ireland.

66 https://www.symantec.com/contact-us.

67 https://www.oracle.com/ie/corporate/contact/index.html.

68 When it was first established, SFI was part of Forfás, but in 2002 it became an idependent institute. For further details, see: http://www.sfi.ie/about/history.html.

69 Enterprise Ireland was established under the Industrial Development Act in 1998 (Hardiman and MacCarthaigh 2010) and served to replace three already existing organisations: Forbairt (for national industry), An Bord Tráchtála (the Trade Board) en FÁS (employee training). IDA went on to dedicate itself exclusively to attracting foreign direct investment. Enterprise Ireland concentrates on granting subsidies for innovation, startup and expansion projects and on providing support to Irish companies for export and innovation activities; see: https://www.enterprise-ireland.com/en/About-Us/Services/.

70 In other European countries which had been underperforming, such as Greece, Portugal and Spain, large-scale economic reform took place in the 1960s (see also Madrid case study) but in Ireland, the 'catching-up effect' did not materialise until much later.

71 http://www.irishtimes.com/life-and-style/homes-and-property/new-to-market/rising-tide-lifting-all-boats-in-dublin-docklands-1.2600323.

72 As in the United Kingdom (see the Milton Keynes case study), Ireland lacks a strong regional government. There only are national and local authorities, with the national government having a large say in local affairs (Bartley and Shine, 2005).

73 This coincides with NUTS3.

74 Population figures for 2015, retrieved in January 2017 from the Spanish Statistics Office, INE: http://www.ine.es/jaxiT3/Datos.htm?t=2911.

75 Approximate population figures for 2015, retrieved in January 2017 from the Spanish Statistics Office, INE: http://www.ine.es/jaxiT3/Datos.htm?t=2911.

76 http://www.abc.es/20110729/espana/abcp-varias-autonomias-meditan-devolver-20110729.html.

77 Madrid is characterised by its many parks and trees, and the nature areas that have been preserved within the city limits.

A new plan fo urban greenery aims strengthen these qualities. http://www.citylab.com/design/2016/01/madrid-green-plan-car-ban-roofs-buildings/426777/.

78 In 1982 a total of 250 buildings were renovated and a further 750 in1983 (Stapell 2010).

79 In that period, every year 20,000 local residents (adults and children) took part in these programmes (Stapell 2010).

80 http://www.citylab.com/crime/2016/03/madrids-plan-to-end-municipal-corruption/475803/.

81 http://www.economist.com/news/europe/21711525-mariano-rajoy-having-learn-negotiate-opposition-spains-uncertain-experiment?zid=307&ah=5e80419d1bc9821ebe173f4f0f060a07.

82 QS Rankings 2016: http://www.topuniversities.com/university-rankings-articles/qs-best-student-cities/madrid.

83 https://arosaid.com/2016/11/09/comunidad-de-madrid-plan-regional-de-investigacion-cientifica-e-innovacion-tecnologica-pricit-2016-2020/.

84 The electronics sector is an exception. Rama et al. (2003) refer to it as a regional industrial district.

85 Reforms made after the financial crisis involved cut-backs which have led to the closing down of many government bodies, including IMADE. See: http://elpais.com/diario/2011/01/04/madrid/1294143855_850215.html. These operations are also related a number of corruption cases which have been exposed in Spain, including the Gürtel and Barcenas cases. https://www.theguardian.com/world/2016/oct/04/spanish-politicians-court-corruption-case-trial-year; https://www.theguardian.com/business/2014/oct/09/former-caja-directors-accused-credit-card-misuse-bankia.

86 http://www.madrimasd.org/foundation/who-are-we?lan=en.

87 http://www.madridemprende.es/en/who-we-are.

88 Communidad de Madrid (2015); http://www.madrid.org/cs/Satellite?cid=1158849749174&language=en&pagename=Inversor%2FPage%2FINVE_contenidoFinal; https://www.citypopulation.de/Spain-Madrid.html.

89 http://www.citylab.com/crime/2016/03/madrids-plan-to-end-municipal-corruption/475803/.

90 The COROP region (NUTS3) of Greater Amsterdam covers Aalsmeer, Amstelveen, Amsterdam, Beemster, Diemen, Edam-Volendam, Haarlemmermeer, Landsmeer, Oostzaan, Ouder-Amstel, Purmerend, Uithoorn, Waterland.

91 https://www.metropoolregioamsterdam.nl/.

92 http://www.ois.amsterdam.nl/publicaties/.

93 http://statline.cbs.nl/Statweb/?LA=nl.

94 http://www.beursgeschiedenis.nl/400-jaar-beursgeschiedenis.

95 https://economie.rabobank.com/publicaties/2013/december/een-historie-van-regionale-economische-variatie/.

96 The massive exodus of Amsterdam citizens had not been entirely foreseen. For instance, the Bijlmer district was built to house middle-class families which in the end did not take up residence there, or only very briefly. Instead, the district, and other modern extensions, were largely inhabited by immigrants. In the 1960s, this involved mainly foreign workers from Mediterranean countries (mostly Turkey and Morocco) and subsequent family reunifications, and also people coming from the former colonies, mainly from Indonesia in the 1950s and from Suriname in the 1970s and refugees and asylum seekers in the 1980s and 1990s (Pethe et al. 2010).

97 Zeeburgerpad, Cruquius and Veemarkt maintained their character as work locations, i.e. separate from other residential areas in the Eastern Docklands (Hoppenbrouwer and Louw, 2005). Business premises were built on the Veemarkt site in 1987. The former cafeteria, several houses and transshipment warehouses have been preserved.

98 Currently named Amsterdam.

99 In addition to Amsterdam, the first round of urban redevelopment projects (key projects) included the Céramique site in Maastricht and the area around the railway station in Amersfoort.

100 https://fd.nl/economie-politiek/1143806/sociale-woningvoorraad-amsterdam-neemt-in-hoog-tempo-af.

101 SEO (2006) shows that although 60% of the Amsterdam housing stock consists of social rental units, only 35% of its population falls within the target group. http://www.seo.nl/uploads/media/875_Woningcorporaties_in_Amsterdam__Marktmacht_en_subsidies.pdf.

102 In 1975, Amsterdam celebrated its 700th anniversary under the motto living, working, playing (Hoog and Vermeulen, 2011). Some 260 events took place throughout the jubilee year. Several events have since become traditions, such as Sail, Holland Festival and the Amsterdam Marathon. The events organised in the Jordaan district later grew into the Jordaan Festival. The Amsterdam 700 football tournament in the Olympic Stadium evolved into the Amsterdam Tournament and the football tournament for players from Suriname later grew into the Kwakoe festival.

103 In the early 1880s, the city council wanted to make the land on present-day Museumplein available for building. However, at the insistence of Rijksmuseum architect Pierre Cuypers, a large space for events was laid out (1883), following the example of many other European cities at the time (Hoog and Vermeulen, 2011). It grew into a place where demonstrations, concerts, markets and tribute events take place.

104 In 2017, the debate on the number of tourists is radically different: their impact on quality of life in city is too profound. Moreover, the rising popularity of Airbnb has generated a dynamics and types of nuisances of its own in the city. See for example: https://www.parool.nl/amsterdam/-gebruik-airbnb-verdubbeld-in-amsterdam~a4491932/.

105 See: https://www.amsterdamsciencepark.nl/about-amsterdam-science-park/facts-figures/.

106 See: https://www.amsterdamsciencepark.nl/about-amsterdam-science-park/facts-figures/.

107 See: http://www.dsf.nl/ for a detailed description.

108 See: http://www.ams-institute.org/institute/home/.

109 https://nl.wikipedia.org/wiki/Universiteit_van_Amsterdam.

110 See: https://www.iamsterdam.com/en/business/setting-up/our-services/about-us.

111 See: https://www.iamsterdam.com/en/our-network/in-amsterdam.

112 Westpoort industrial estate (the Amsterdam port area) houses around 2,451 companies. A total of 46,417 employees work in high-grade manufacturing, designer clothing and the media (figures by O+S Municipality of Amsterdam, published in Port of Amsterdam, 2017).

113 Airport policies are largely determined by the national government and the city council of Haarlemmermeer, where the airport is located. Nevertheless, the municipality of Amsterdam is one of the major airport shareholders, which enables it to exert influence. See https://www.schiphol100jaar.nl/tijdlijn for a historical overview of developments and policy efforts with regard to Amsterdam Airport Schiphol.

114 https://www.cbs.nl/nl-nl/nieuws/2016/37/bijna-60-miljoen-passagiers-via-schiphol & https://nl.wikipedia.org/wiki/Luchthaven_Schiphol.

115 Jobs with more than 12 working hours per week, not converted to Full Time Equivalent employees.

116 http://www.natgeotraveler.nl & https://www.schiphol.nl/nl/jij-en-schiphol/pagina/ruim-100-jaar-schiphol/.

117 In 1995 there was a plan to transform Amsterdam and a further 25 to 30 municipalities into an urban province. Most of the district councils were to be turned into municipalities and the city centre of Amsterdam had to become a municipality, too (Van der Lans, 2006). the plan was rejected in a referendum.

118 'The core of the organisation is the Coordination Commission (CoCo), which considers the issues that need to be dealt with at the regional level. The commission is jointly chaired by the Royal Commissioner for North Holland province and the mayor of Amsterdam, and is made up of city council representatives (usually mayors) of a large number of municipalities in the region (from the North Sea to the Gooimeer) and the provinces of North Holland and Flevoland' (Van der Lans, 2006: 45).

119 https://www.metropoolregioamsterdam.nl/.

120 Aalsmeer, Amstelveen, Amsterdam, Beemster, Diemen, Edam/Volendam, Haarlemmermeer, Landsmeer, Oostzaan, Ouder-Amstel, Purmerend, Uithoorn, Waterland, Wormerland, Zaanstad.

121 https://vervoerregio.nl/.

122 See https://www.amsterdameconomicboard.com/ for a detailed description.

123 Source: https://www.amsterdameconomicboard.com.

124 https://www.mediamatic.net/nl/page/40511/amsterdamse-innovatie-motor.

Appendix: Indicators

Cog-wheel	Cogwheel name	Indicator	Description (and sub-indicators)	Source (many sources include maps of the indicators)	Original source
Co	Agglomeration effects	Population size	Total number of inhabitants.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
Co	Agglomeration effects	Population density	Total number of inhabitants per square kilometre.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
Co	Agglomeration effects	Monocentrism	Indicator for the degree of centricity in a region. The value is based on the share of the population in the largest municipality (at the LAU level) of a region. A value of 100% means the region is purely monocentric. A value of 25% means the smaller cities in the region are home to 75% of the population and the region is considered to be polycentric. The threshold value for urban character has been set at 25,000 inhabitants in an LAU area.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat / PBL
C1	Clusters	Clustering of the region	Clustering of the entire region. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages). The value for the entire region has been weighted across all sectors.	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Agriculture	Clustering in the agricultural sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Food industry	Clustering in the food processing industry. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Materials	Clustering in the materials industry. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Technology	Clustering in the technology industry. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Chemical	Clustering in the chemical sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Energy	Clustering in the energy sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Financial services	Clustering in the financial services sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Business services	Clustering in the business services sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Forestry and Mining	Clustering in forestry and the mining industry (note: refining is included in this sector sector). Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Clothing	Clustering in the clothing industry. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Furniture	Clustering in the furniture industry. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Construction	Clustering in the construction sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Clustering Commercial services	Clustering in the commercial services sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL

Cog-wheel	Cogwheel name	Indicator	Description (and sub-indicators)	Source (many sources include maps of the indicators)	Original source
C1	Clusters	Clustering Public services	Clustering in the public services sector. Clustering is based on the share of inputs used in the production chain within the same sector in the region (backward linkages).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation region	Regional specialisation. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation share total production	Regional specialisation, share in total production. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation agriculture	Regional specialisation in agriculture. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation food processing industry	Regional specialisation in the food processing industry. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation materials	Regional specialisation in materials. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation technology	Regional specialisation in technology. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation chemistry	Regional specialisation in chemistry. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation energy	Regional specialisation in energy. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation financial services	Regional specialisation in financial services. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation business services	Regional specialisation in business services. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation forestry and mining	Regional specialisation in forestry and the mining industry (note: refining is included in this sector sector). Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation clothing	Regional specialisation in the clothing and paper & pulp industry. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation furniture	Regional specialisation in furniture manufacturing. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation construction	Regional specialisation in construction. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation commercial services	Regional specialisation in commercial services. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C1	Clusters	Specialisation public services	Regional specialisation in public services. Relative specialisation (share of a sector in the regional economy as a whole).	Thissen et al. (2017) and Thissen et al. (2014)	PBL
C3	Human Capital	Share of population with higher education	Share of employees with Higher Professional Education or University Education in relation to the total number of employees.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C3	Human Capital	Employment (low level of unemployment)	Unemployment. Composite indicator based on 2 components: 1. Unemployment 15-25-year age group; 2. Unemployment 20-65-year age group. The higher the indicator value, the lower the unemployment rate.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat / Regional labour market statistics
C3	Human Capital	Life expectancy	Composite indicator based on 5 components: 1. Life expectancy at given exact age; 2. Life expectancy at birth; 3. Life expectancy, females at age 65; 4. Life expectancy, males at age 65; 5. Number of years of healthy life expected.	Lagas, et al. (2014) and Lagas, et al. (2015)	DG Regional Policy
C3	Human Capital	Labour force, aged 15 to 64 (%)	Labour force participation rate 15-to-64-year-olds (%).	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat

Cog-wheel	Cogwheel name	Indicator	Description (and sub-indicators)	Source (many sources include maps of the indicators)	Original source
C4	Knowledge infrastructure	Public-sector share of R&D	Spending on R&D by the public sector (government and higher education) as a percentage of GRP in the region.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C4	Knowledge infrastructure	Private-sector share of R&D	Spending on R&D by private businesses as a percentage of GRP in the region.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C4	Knowledge infrastructure	Patents	Number of patents per capita.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C4	Knowledge infrastructure	Quality of education	Composite indicator based on 5 components: 1. Satisfied with schools; 2. Quality of University - best 20% in world = 5 etc; 3. PISA score; 4. Aged 15-65 qualified at tertiary level (ISCED 5-6); 5. Number of foreign languages.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey
C4	Knowledge infrastructure	Educational opportunities	Composite indicator based on 2 components: 1. Number of universities per region (distance decay); 2. Number of international schools per region (distance decay).	Lagas, et al. (2014) and Lagas, et al. (2015)	Wikipedia various data
C5	Physical infrastructure	Road connectivity	The number of inhabitants in all other European regions that can be reached by road from a given region. The value is weighted by the minimum travel time from that region to all other regions as captured in a travel time matrix. The values are standardised by setting the European average at 100 and then determining the deviation for each region.	Thissen et al. (2017) and Thissen et al. (2014)	Espon
C5	Physical infrastructure	Air connectivity	The number of inhabitants in all other European regions that can be reached by air from a given region. The value is weighted by the minimum travel time from that region to all other regions as captured in a travel time matrix. The values are standardised by setting the European average at 100 and then determining the deviation for each region.	Thissen et al. (2017) and Thissen et al. (2014)	Espon
C5	Physical infrastructure	Sea connectivity	Travel time by road from the centre of a region to the nearest commercial seaport (with a capacity of 0.5–100 million tonnes per year). The value is weighted for the number of services provided in the seaport. The maximum travel time that can be recorded is 3 hours.	Thissen et al. (2017) and Thissen et al. (2014)	Espon
C5	Physical infrastructure	Congestion	Daily travel time on roads affected by congestion in relation to total travel time between all links in a region.	Thissen et al. (2017) and Thissen et al. (2014)	Espon
C5	Physical infrastructure	Internet	Composite indicator based on 4 components: 1. Satisfied with public internet access; 2. Households with access to the Internet; 3. Households with broadband access; 4. Individuals who ordered goods or services over the Internet.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey
C5	Physical infrastructure	Accessibility (overall, via several modes)	Composite indicator based on 4 components: 1. Satisfied with public transport; 2. Rail accessibility; 3. Road accessibility; 4. Air accessibility.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey
C6	Financing	Banks	Composite indicator for the quality of the banking system based on 2 components: 1. Standard and Poor country ratings; 2. Soundness of banks	Lagas, et al. (2014) and Lagas, et al. (2015)	Wikipedia various data
C6	Financing	Income tax rate	Income tax rate percentage	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C6	Financing	Total tax rate	Total tax rate percentage	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C7	Governance	Governance effectiveness	Composite indicator for the quality of public services, legislation, norms and values in society and corruption, based on 5 components: 1. Government Effectiveness; 2. Regulatory Quality; 3. Rule of Law; 4. Control of Corruption; 5. Corruption.	Lagas, et al. (2014) and Lagas, et al. (2015)	World Bank (World governance Indicators)

Cog-wheel	Cogwheel name	Indicator	Description (and sub-indicators)	Source (many sources include maps of the indicators)	Original source
C7	Governance	Political stability	Composite indicator for political stability, based on 4 components: 1. Political Terror Scale; 2. Political Stability and Absence of Violence/terrorism; 3. Physical Integrity; Rights Index; 4. Political Stability	Lagas, et al. (2014) and Lagas, et al. (2015)	Global Peace Index
C8	Quality of the physical and residential environments	Cost of living	Composite indicator based on 2 components: 1. Price goods; 2. Price fuel/alcohol.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat / purchasing power parities
C8	Quality of the physical and residential environments	Housing affordability	Composite indicator for housing-related costs (buying, maintaining and occupying a dwelling), based on 2 components: 1. Price owner-occupied housing (relative); 2. Price rented housing (relative).	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Key cities
C8	Quality of the physical and residential environments	Safety	Composite indicator for safety and crime perception, based on 6 components: 1. Feel safe in this city; 2. Most people can be trusted; 3. Feel safe in neighbourhood; 4. Business costs of crime and violence; 5. Reliability of police services; 6. Organised crime.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey
C8	Quality of the physical and residential environments	Personal liberty	Composite indicator, based on 3 components: 1. Civil Rights; 2. Access to information; 3. Voice and accountability	Lagas, et al. (2014) and Lagas, et al. (2015)	OECD Sustainable Governance Indicators
C8	Quality of the physical and residential environments	Social cohesion	Composite indicator, based on 5 components: 1. Most of the time: people helpful or mostly looking out for themselves; 2. Important to help people and care for the well-being of others; 3. Important to be loyal to friends and devote to people close; 4. Participating in social activities of a club, society or association; 5. How often have you done unpaid voluntary work in the last 12 months?	Lagas, et al. (2014) and Lagas, et al. (2015)	European Social Survey
C8	Quality of the physical and residential environments	Health care	Composite indicator, based on 8 components: 1. Infant mortality rate; 2. Satisfied with hospitals; 3. Cancer death rate; 4. Per capita government expenditure on health; 5. Satisfied with healthcare; 6. Satisfied with doctors; 7. Heart disease death rate; 8. Per capita total expenditure on health at average exchange rate (USD).	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat / Regional demographic statistics
C8	Quality of the physical and residential environments	Food security	Food quality and food security	Lagas, et al. (2014) and Lagas, et al. (2015)	Global Food Security Index (Economic Intelligence Unit)
C8	Quality of the physical and residential environments	Environmental quality	Composite indicator, based on 7 components: 1. Air pollution is a big problem here; 2. Noise is a big problem here; 3. This is a clean city; 4. Number of days ozone concentration exceeds 120 µg/m3; 5. Number of days particulate matter concentration PM10 exceeds 50 µg/m3; 6. Accumulated ozone concentration in excess 70 µg/m3; 7. Annual average concentration PM10.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey

Cog-wheel	Cogwheel name	Indicator	Description (and sub-indicators)	Source (many sources include maps of the indicators)	Original source
C8	Quality of the physical and residential environments	Access to energy	Energy security and access to energy sources.	Lagas, et al. (2014) and Lagas, et al. (2015)	World Economic Forum
C8	Quality of the physical and residential environments	Cultural amenities and restaurants	Composite indicator, based on 3 components: 1. Michelin star restaurants (distance decay); 2. Satisfied with cultural facilities; 3. Satisfied with cinemas.	Lagas, et al. (2014) and Lagas, et al. (2015)	Wikipedia various data
C8	Quality of the physical and residential environments	Recreational possibilities	Composite indicator, based on 6 components: 1. Satisfied with sport facilities; 2. Area for recreational sports and leisure use/cap; 3. Land area for recreational sports and leisure use/cap; 4. Length of bicycle network; 5. Satisfied with outdoor recreation; 6. Recreation, leisure and sport.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey
C8	Quality of the physical and residential environments	Climate	Composite indicator, based on 5 components: 1. Number of days rain per year; 2. Average number of hours sunshine per day; 3. Average temperature of warmest month; 4. Average temperature of coldest month; 5. Rainfall.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Key cities
C8	Quality of the physical and residential environments	Natural disasters	Composite indicator, based on 2 components: 1.Aggregated hazard exposure potential (floods, forest fires, droughts, earthquakes, tropical storms); 2. Sensitivity and response. The indicator has a high value for densely populated, high-risk areas.	Lagas, et al. (2014) and Lagas, et al. (2015)	ESPON
C8	Quality of the physical and residential environments	Nature	Composite indicator, based on 5 components: 1. Satisfied with outdoor recreation; 2. Recreation, leisure and sport; 3. Nature reserves; 4. Forestry; 5. Landscape diversity, expressed as Shannon's Evenness Index.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey
C8	Quality of the physical and residential environments	Housing quality	Composite indicator, based on 4 components: 1. Average price per m2 – apartment; 2. Average price per m2 – house; 3. Rooms per person; 4. dwellings with basic facilities.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Key cities
C8	Quality of the physical and residential environments	Local residential environment	Composite indicator, based on 6 components: 1. Satisfied with green space; 2. Satisfied to live in this city; 3. In 5 years it will be more pleasant to live here; 4. Satisfied with public spaces; 5: Publicly accessible green space in m2 per capita; 6: Proportion of green space in the area.	Lagas, et al. (2014) and Lagas, et al. (2015)	Eurostat Urban Audit Perception survey
C8	Quality of the physical and residential environments	Hospital beds	Number of hospital beds (per capita).	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C8	Quality of the physical and residential environments	Poverty risk (in %)	Indicator based on income (after tax and social security contributions. The share of the population with income lower than 60% of the national median income.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat
C8	Quality of the physical and residential environments	Cases of theft and robbery	Cases of theft and robbery reported to the police.	Thissen et al. (2017) and Thissen et al. (2014)	Eurostat

Table A.1:
Correlations between indicators

Population size	Population density	Share of population with a higher education	Public-sector share of R&D	Private-sector share of R&D	Patents	Road connectivity	Air connectivity	Sea connectivity	Congestion	Governance effectiveness	Employment	Cost of living	Housing affordability	Personal liberty	Health care	Life expectancy	Environmental quality
0.00	0.09	0.15	0.17	0.15	0.16	0.12	0.32	-0.01	-0.16	-0.14	-0.07	-0.12	-0.18	-0.16	0.05	0.04	-0.11
0.09	0.00	0.32	0.15	0.03	0.04	0.16	0.43	-0.14	-0.40	0.10	-0.02	-0.11	-0.10	0.09	0.18	0.10	0.01
0.15	0.32	0.00	0.48	0.56	0.54	0.50	0.71	-0.16	-0.51	0.63	0.48	-0.14	0.13	0.61	0.62	0.38	0.25
0.17	0.15	0.48	0.00	0.35	0.30	0.18	0.35	-0.13	-0.23	0.28	0.20	0.12	0.03	0.28	0.30	0.19	0.04
0.15	0.03	0.56	0.35	0.00	0.95	0.47	0.54	0.00	-0.36	0.52	0.50	-0.08	0.20	0.53	0.54	0.36	0.09
0.16	0.04	0.54	0.30	0.95	0.00	0.53	0.52	0.03	-0.28	0.49	0.50	-0.10	0.24	0.51	0.55	0.35	0.05
0.12	0.16	0.50	0.18	0.47	0.53	0.00	0.65	0.18	-0.29	0.34	0.58	-0.20	0.51	0.37	0.49	0.15	-0.10
0.32	0.43	0.71	0.35	0.54	0.52	0.65	0.00	-0.10	-0.61	0.43	0.50	-0.19	0.26	0.40	0.55	0.31	0.00
-0.01	-0.14	-0.16	-0.13	0.00	0.03	0.18	-0.10	0.00	0.14	-0.20	0.18	-0.26	0.25	-0.24	-0.36	-0.60	-0.11
-0.16	-0.40	-0.51	-0.23	-0.36	-0.28	-0.29	-0.61	0.14	0.00	-0.37	-0.32	0.11	0.09	-0.25	-0.30	-0.19	-0.03
-0.14	0.10	0.63	0.28	0.52	0.49	0.34	0.43	-0.20	-0.37	0.00	0.65	0.13	0.18	0.90	0.71	0.43	0.37
-0.07	-0.02	0.48	0.20	0.50	0.50	0.58	0.50	0.18	-0.32	0.65	0.00	-0.08	0.54	0.56	0.38	0.02	0.15
-0.12	-0.11	-0.14	0.12	-0.08	-0.10	-0.20	-0.19	-0.26	0.11	0.13	-0.08	0.00	-0.09	0.10	0.19	0.21	-0.08
-0.18	-0.10	0.13	0.03	0.20	0.24	0.51	0.26	0.25	0.09	0.18	0.54	-0.09	0.00	0.23	0.13	-0.16	-0.05
-0.16	0.09	0.61	0.28	0.53	0.51	0.37	0.40	-0.24	-0.25	0.90	0.56	0.10	0.23	0.00	0.69	0.44	0.34
0.05	0.18	0.62	0.30	0.54	0.55	0.49	0.55	-0.36	-0.30	0.71	0.38	0.19	0.13	0.69	0.00	0.73	0.20
0.04	0.10	0.38	0.19	0.36	0.35	0.15	0.31	-0.60	-0.19	0.43	0.02	0.21	-0.16	0.44	0.73	0.00	0.11
-0.11	0.01	0.25	0.04	0.09	0.05	-0.10	0.00	-0.11	-0.03	0.37	0.15	-0.08	-0.05	0.34	0.20	0.11	0.00
0.08	0.20	0.79	0.40	0.57	0.52	0.43	0.59	-0.20	-0.55	0.83	0.58	-0.02	0.05	0.73	0.72	0.43	0.34
0.22	0.30	0.58	0.32	0.51	0.46	0.53	0.74	-0.23	-0.59	0.51	0.48	-0.05	0.14	0.49	0.52	0.35	0.00
-0.08	0.13	0.67	0.28	0.51	0.48	0.43	0.50	-0.09	-0.49	0.90	0.72	0.05	0.18	0.75	0.61	0.32	0.29
0.17	0.29	0.61	0.22	0.53	0.55	0.90	0.76	0.07	-0.45	0.52	0.60	-0.25	0.43	0.49	0.57	0.24	0.03
0.14	0.17	0.53	0.22	0.42	0.41	0.53	0.54	-0.19	-0.40	0.62	0.53	-0.03	0.07	0.49	0.73	0.52	0.21
0.05	0.15	0.62	0.25	0.38	0.33	0.27	0.44	-0.23	-0.41	0.84	0.49	0.04	0.02	0.67	0.67	0.40	0.41
0.09	-0.13	-0.34	-0.07	-0.22	-0.20	-0.12	-0.28	0.31	0.39	-0.57	-0.37	-0.23	0.04	-0.48	-0.34	-0.30	-0.13
0.16	0.18	0.02	0.00	-0.04	-0.02	-0.01	0.19	-0.15	-0.16	-0.21	-0.23	-0.14	-0.17	-0.21	-0.07	0.14	-0.15
-0.23	-0.25	-0.12	-0.01	-0.07	-0.10	-0.48	-0.42	0.04	0.28	0.12	-0.01	0.15	-0.13	0.09	-0.18	-0.12	0.31
0.22	0.15	0.26	0.18	0.27	0.26	0.08	0.29	-0.44	-0.25	0.07	-0.18	0.08	-0.39	0.11	0.48	0.72	-0.15
-0.12	-0.04	0.38	0.19	0.34	0.30	0.16	0.20	-0.04	-0.25	0.74	0.64	0.14	0.15	0.63	0.42	0.18	0.34
-0.07	0.28	0.03	0.04	-0.16	-0.21	-0.17	0.03	-0.13	-0.20	-0.02	-0.15	-0.02	-0.13	-0.03	0.01	0.01	0.13
-0.04	0.08	0.27	0.22	0.20	0.18	0.10	0.25	-0.36	-0.19	0.36	0.24	0.33	0.17	0.34	0.36	0.30	0.00
-0.12	0.09	0.40	0.31	0.29	0.29	0.33	0.36	-0.37	-0.17	0.46	0.34	0.26	0.23	0.47	0.52	0.41	0.02
-0.12	0.07	0.38	0.22	0.35	0.33	0.24	0.30	-0.14	-0.25	0.65	0.38	0.18	0.11	0.57	0.50	0.36	0.23
0.14	0.05	-0.06	0.06	-0.02	0.01	0.05	0.04	0.12	-0.05	-0.18	-0.04	-0.04	-0.05	-0.18	-0.06	-0.03	-0.12
-0.02	-0.13	-0.26	-0.20	-0.28	-0.27	-0.20	-0.23	0.44	0.11	-0.28	-0.03	-0.24	-0.03	-0.30	-0.53	-0.62	-0.01
0.04	0.06	0.02	0.05	-0.03	-0.02	0.01	0.05	-0.05	-0.05	-0.02	-0.07	0.09	-0.11	0.01	0.10	0.10	0.03

	Quality of education	Educational opportunities	Internet	Accessibility	Cultural amenities and restaurants	Recreational possibilities	Climate	Natural disasters	Nature	Housing quality	Local residential environment	Monocentrism	Income tax rate	Total tax rate	Labour force participation rate 15-to-64-year-olds (%)	Hospital beds	Poverty risk (in %)	Cases of theft and robbery reported to the policy
	0.08	0.22	-0.08	0.17	0.14	0.05	0.09	0.16	-0.23	0.22	-0.12	-0.07	-0.04	-0.12	-0.12	0.14	-0.02	0.04
	0.20	0.30	0.13	0.29	0.17	0.15	-0.13	0.18	-0.25	0.15	-0.04	0.28	0.08	0.09	0.07	0.05	-0.13	0.06
	0.79	0.58	0.67	0.61	0.53	0.62	-0.34	0.02	-0.12	0.26	0.38	0.03	0.27	0.40	0.38	-0.06	-0.26	0.02
	0.40	0.32	0.28	0.22	0.22	0.25	-0.07	0.00	-0.01	0.18	0.19	0.04	0.22	0.31	0.22	0.06	-0.20	0.05
	0.57	0.51	0.51	0.53	0.42	0.38	-0.22	-0.04	-0.07	0.27	0.34	-0.16	0.20	0.29	0.35	-0.02	-0.28	-0.03
	0.52	0.46	0.48	0.55	0.41	0.33	-0.20	-0.02	-0.10	0.26	0.30	-0.21	0.18	0.29	0.33	0.01	-0.27	-0.02
	0.43	0.53	0.43	0.90	0.53	0.27	-0.12	-0.01	-0.48	0.08	0.16	-0.17	0.10	0.33	0.24	0.05	-0.20	0.01
	0.59	0.74	0.50	0.76	0.54	0.44	-0.28	0.19	-0.42	0.29	0.20	0.03	0.25	0.36	0.30	0.04	-0.23	0.05
	-0.20	-0.23	-0.09	0.07	-0.19	-0.23	0.31	-0.15	0.04	-0.44	-0.04	-0.13	-0.36	-0.37	-0.14	0.12	0.44	-0.05
	-0.55	-0.59	-0.49	-0.45	-0.40	-0.41	0.39	-0.16	0.28	-0.25	-0.25	-0.20	-0.19	-0.17	-0.25	-0.05	0.11	-0.05
	0.83	0.51	0.90	0.52	0.62	0.84	-0.57	-0.21	0.12	0.07	0.74	-0.02	0.36	0.46	0.65	-0.18	-0.28	-0.02
	0.58	0.48	0.72	0.60	0.53	0.49	-0.37	-0.23	-0.01	-0.18	0.64	-0.15	0.24	0.34	0.38	-0.04	-0.03	-0.07
	-0.02	-0.05	0.05	-0.25	-0.03	0.04	-0.23	-0.14	0.15	0.08	0.14	-0.02	0.33	0.26	0.18	-0.04	-0.24	0.09
	0.05	0.14	0.18	0.43	0.07	0.02	0.04	-0.17	-0.13	-0.39	0.15	-0.13	0.17	0.23	0.11	-0.05	-0.03	-0.11
	0.73	0.49	0.75	0.49	0.49	0.67	-0.48	-0.21	0.09	0.11	0.63	-0.03	0.34	0.47	0.57	-0.18	-0.30	0.01
	0.72	0.52	0.61	0.57	0.73	0.67	-0.34	-0.07	-0.18	0.48	0.42	0.01	0.36	0.52	0.50	-0.06	-0.53	0.10
	0.43	0.35	0.32	0.24	0.52	0.40	-0.30	0.14	-0.12	0.72	0.18	0.01	0.30	0.41	0.36	-0.03	-0.62	0.10
	0.34	0.00	0.29	0.03	0.21	0.41	-0.13	-0.15	0.31	-0.15	0.34	0.13	0.00	0.02	0.23	-0.12	-0.01	0.03
	0.00	0.67	0.85	0.60	0.67	0.80	-0.53	-0.13	-0.02	0.24	0.61	0.05	0.29	0.40	0.52	-0.06	-0.25	0.06
	0.67	0.00	0.55	0.64	0.50	0.44	-0.44	0.11	-0.29	0.29	0.30	0.04	0.30	0.41	0.31	-0.03	-0.25	0.04
	0.85	0.55	0.00	0.61	0.62	0.80	-0.58	-0.18	0.08	0.01	0.73	-0.03	0.30	0.44	0.63	-0.09	-0.21	-0.03
	0.60	0.64	0.61	0.00	0.62	0.47	-0.27	0.00	-0.44	0.09	0.29	-0.10	0.13	0.35	0.41	0.03	-0.21	-0.01
	0.67	0.50	0.62	0.62	0.00	0.69	-0.27	-0.09	-0.22	0.35	0.46	0.03	0.25	0.33	0.38	-0.02	-0.33	0.07
	0.80	0.44	0.80	0.47	0.69	0.00	-0.46	-0.20	0.08	0.15	0.65	0.09	0.26	0.32	0.50	-0.14	-0.23	0.02
	-0.53	-0.44	-0.58	-0.27	-0.27	-0.46	0.00	0.02	-0.12	-0.15	-0.52	0.00	-0.25	-0.23	-0.39	0.09	0.24	0.02
	-0.13	0.11	-0.18	0.00	-0.09	-0.20	0.02	0.00	-0.28	0.29	-0.37	-0.04	-0.04	-0.01	-0.09	0.05	-0.11	0.03
	-0.02	-0.29	0.08	-0.44	-0.22	0.08	-0.12	-0.28	0.00	-0.22	0.40	-0.01	-0.07	-0.23	0.03	-0.08	0.12	0.00
	0.24	0.29	0.01	0.09	0.35	0.15	-0.15	0.29	-0.22	0.00	-0.04	0.02	0.19	0.16	0.08	0.09	-0.45	0.17
	0.61	0.30	0.73	0.29	0.46	0.65	-0.52	-0.37	0.40	-0.04	0.00	0.00	0.22	0.16	0.46	-0.11	-0.10	0.01
	0.05	0.04	-0.03	-0.10	0.03	0.09	0.00	-0.04	-0.01	0.02	0.00	0.00	0.20	0.12	0.03	-0.20	-0.07	0.13
	0.29	0.30	0.30	0.13	0.25	0.26	-0.25	-0.04	-0.07	0.19	0.22	0.20	0.00	0.76	0.29	-0.14	-0.30	0.05
	0.40	0.41	0.44	0.35	0.33	0.32	-0.23	-0.01	-0.23	0.16	0.16	0.12	0.76	0.00	0.41	-0.06	-0.42	0.04
	0.52	0.31	0.63	0.41	0.38	0.50	-0.39	-0.09	0.03	0.08	0.46	0.03	0.29	0.41	0.00	-0.10	-0.29	-0.03
	-0.06	-0.03	-0.09	0.03	-0.02	-0.14	0.09	0.05	-0.08	0.09	-0.11	-0.20	-0.14	-0.06	-0.10	0.00	0.04	0.70
	-0.25	-0.25	-0.21	-0.21	-0.33	-0.23	0.24	-0.11	0.12	-0.45	-0.10	-0.07	-0.30	-0.42	-0.29	0.04	0.00	-0.14
	0.06	0.04	-0.03	-0.01	0.07	0.02	0.02	0.03	0.00	0.17	0.01	0.13	0.05	0.04	-0.03	0.70	-0.14	0.00

Table B.2:
Correlation between variable clustering and specialisation

Clustering of the entire region	Clustering within the agricultural sector	Clustering within the food processing industry	Clustering within the materials industry[1]	Clustering within the technology industry	Clustering within the chemical sector	Clustering within the energy sector	Clustering within the financial services sector	Clustering within the business services sector	Clustering within forestry and the mining industry	Clustering within the clothing and paper & pulp industry	Clustering within the furniture industry	Clustering within the construction sector	Clustering within the commercial services sector	Regional specialisation	Regional specialisation, share in total production
0.00	0.33	0.58	0.57	0.52	0.34	0.41	0.56	0.55	0.33	0.63	0.30	0.43	0.38	-0.11	0.11
0.33	0.00	0.50	0.44	-0.05	0.15	0.21	0.08	-0.20	-0.20	-0.07	0.26	0.26	0.01	0.28	0.04
0.58	0.50	0.00	0.58	0.29	0.27	0.20	0.17	0.17	0.02	0.26	0.17	0.55	0.30	0.05	0.10
0.57	0.44	0.58	0.00	0.53	0.37	0.12	0.45	0.31	0.21	0.29	0.25	0.44	0.20	0.05	-0.01
0.52	-0.05	0.29	0.53	0.00	0.41	-0.13	0.49	0.51	0.51	0.43	0.34	0.30	0.14	-0.19	0.01
0.34	0.15	0.27	0.37	0.41	0.00	0.04	0.33	0.08	0.10	0.04	0.27	0.35	0.40	-0.15	-0.06
0.41	0.21	0.20	0.12	-0.13	0.04	0.00	-0.02	-0.08	-0.36	0.31	0.19	0.19	0.45	-0.05	0.17
0.56	0.08	0.17	0.45	0.49	0.33	-0.02	0.00	0.46	0.67	0.42	0.38	0.12	-0.04	-0.30	-0.03
0.55	-0.20	0.17	0.31	0.51	0.08	-0.08	0.46	0.00	0.49	0.48	0.14	0.13	0.10	-0.13	0.14
0.33	-0.20	0.02	0.21	0.51	0.10	-0.36	0.67	0.49	0.00	0.31	-0.02	-0.09	-0.23	-0.33	0.03
0.63	-0.07	0.26	0.29	0.43	0.04	0.31	0.42	0.48	0.31	0.00	0.09	0.24	0.01	-0.20	-0.02
0.30	0.26	0.17	0.25	0.34	0.27	0.19	0.38	0.14	-0.02	0.09	0.00	0.18	0.07	0.00	-0.05
0.43	0.26	0.55	0.44	0.30	0.35	0.19	0.12	0.13	-0.09	0.24	0.18	0.00	0.40	0.08	0.00
0.38	0.01	0.30	0.20	0.14	0.40	0.45	-0.04	0.10	-0.23	0.01	0.07	0.40	0.00	-0.08	0.04
-0.11	0.28	0.05	0.05	-0.19	-0.15	-0.05	-0.30	-0.13	-0.33	-0.20	0.00	0.08	-0.08	0.00	-0.07
0.11	0.04	0.10	-0.01	0.01	-0.06	0.17	-0.03	0.14	0.03	-0.02	-0.05	0.00	0.04	-0.07	0.00
-0.07	0.70	0.39	0.34	-0.20	0.10	-0.03	-0.18	-0.36	-0.24	-0.42	-0.03	0.16	0.03	0.46	0.02
0.09	0.54	0.53	0.22	-0.10	0.11	0.19	-0.08	-0.24	-0.21	-0.20	0.13	0.21	0.11	-0.02	0.05
0.30	0.10	0.29	0.54	0.43	0.37	0.06	0.45	0.13	0.13	0.00	0.47	0.29	0.26	-0.25	-0.09
0.11	-0.35	-0.14	0.02	0.64	0.20	-0.19	0.26	0.36	0.34	0.13	0.31	0.01	-0.02	-0.34	-0.04
-0.05	-0.03	-0.05	-0.12	0.00	0.39	-0.19	0.06	0.09	0.00	0.01	0.07	-0.10	-0.07	-0.03	-0.26
0.11	0.26	0.05	-0.10	-0.29	0.18	0.50	-0.12	-0.23	-0.35	-0.06	0.06	-0.11	0.19	-0.09	0.41
0.16	0.24	0.10	0.02	-0.10	-0.11	0.06	0.28	-0.05	0.09	0.14	0.25	-0.02	-0.16	0.07	-0.17
0.16	0.21	0.10	0.05	-0.24	-0.08	0.28	0.11	0.06	-0.19	-0.08	0.17	0.08	0.17	0.15	0.26
-0.03	-0.10	-0.07	-0.07	-0.14	-0.17	-0.09	0.12	-0.11	0.17	0.07	-0.09	0.01	-0.15	0.21	-0.15
0.02	-0.51	-0.21	-0.22	0.15	-0.18	-0.07	0.06	0.19	0.27	0.62	-0.26	-0.11	-0.25	-0.34	-0.10
0.20	0.19	0.18	0.13	0.12	0.05	0.16	-0.04	0.15	-0.33	-0.02	0.57	0.32	0.11	0.42	0.18
0.05	0.20	0.20	0.09	0.00	0.14	0.15	-0.09	-0.12	-0.39	-0.21	0.33	0.57	0.23	0.06	-0.09
0.03	0.00	0.14	0.10	0.08	0.34	0.17	0.08	-0.09	-0.14	-0.20	0.24	0.33	0.46	-0.35	-0.01

1 Manufacture of glass, pottery, cement, lime and gipsum products, metals in primary form and metal products (not including machinery and transport equipment).

Regional specialisation in agriculture	Regional specialisation in the food processing industry	Regional specialisation in materials1	Regional specialisation in technology	Regional specialisation in chemistry	Regional specialisation in energy	Regional specialisation in financial services	Regional specialisation in business services	Regional specialisation in forestry and the mining industry	Regional specialisation in the clothing and paper & pulp industry	Regional specialisation in furniture manufacturing	Regional specialisation in construction	Regional specialisation in commercial services
-0.07	0.09	0.30	0.11	-0.05	0.11	0.16	0.16	-0.03	0.02	0.20	0.05	0.03
0.70	0.54	0.10	-0.35	-0.03	0.26	0.24	0.21	-0.10	-0.51	0.19	0.20	0.00
0.39	0.53	0.29	-0.14	-0.05	0.05	0.10	0.10	-0.07	-0.21	0.18	0.20	0.14
0.34	0.22	0.54	0.02	-0.12	-0.10	0.02	0.05	-0.07	-0.22	0.13	0.09	0.10
-0.20	-0.10	0.43	0.64	0.00	-0.29	-0.10	-0.24	-0.14	0.15	0.12	0.00	0.08
0.10	0.11	0.37	0.20	0.39	0.18	-0.11	-0.08	-0.17	-0.18	0.05	0.14	0.34
-0.03	0.19	0.06	-0.19	-0.19	0.50	0.06	0.28	-0.09	-0.07	0.16	0.15	0.17
-0.18	-0.08	0.45	0.26	0.06	-0.12	0.28	0.11	0.12	0.06	-0.04	-0.09	0.08
-0.36	-0.24	0.13	0.36	0.09	-0.23	-0.05	0.06	-0.11	0.19	0.15	-0.12	-0.09
-0.24	-0.21	0.13	0.34	0.00	-0.35	0.09	-0.19	0.17	0.27	-0.33	-0.39	-0.14
-0.42	-0.20	0.00	0.13	0.01	-0.06	0.14	-0.08	0.07	0.62	-0.02	-0.21	-0.20
-0.03	0.13	0.47	0.31	0.07	0.06	0.25	0.17	-0.09	-0.26	0.57	0.33	0.24
0.16	0.21	0.29	0.01	-0.10	-0.11	-0.02	0.08	0.01	-0.11	0.32	0.57	0.33
0.03	0.11	0.26	-0.02	-0.07	0.19	-0.16	0.17	-0.15	-0.25	0.11	0.23	0.46
0.46	-0.02	-0.25	-0.34	-0.03	-0.09	0.07	0.15	0.21	-0.34	0.42	0.06	-0.35
0.02	0.05	-0.09	-0.04	-0.26	0.41	-0.17	0.26	-0.15	-0.10	0.18	-0.09	-0.01
0.00	0.55	0.05	-0.46	-0.15	0.05	0.04	0.09	-0.10	-0.65	0.07	0.09	0.02
0.55	0.00	0.19	-0.21	0.00	0.21	0.10	0.06	-0.20	-0.36	0.01	0.23	0.23
0.05	0.19	0.00	0.39	-0.02	-0.01	0.07	0.09	-0.10	-0.26	0.19	0.44	0.58
-0.46	-0.21	0.39	0.00	0.17	-0.22	-0.19	-0.23	-0.22	0.22	0.09	0.14	0.19
-0.15	0.00	-0.02	0.17	0.00	0.26	-0.08	-0.21	-0.14	0.10	-0.05	-0.09	-0.10
0.05	0.21	-0.01	-0.22	0.26	0.00	0.02	0.30	-0.25	-0.13	0.11	0.01	0.03
0.04	0.10	0.07	-0.19	-0.08	0.02	0.00	0.21	0.08	-0.07	0.10	0.10	0.05
0.09	0.06	0.09	-0.23	-0.21	0.30	0.21	0.00	0.08	-0.26	0.29	0.25	0.20
-0.10	-0.20	-0.10	-0.22	-0.14	-0.25	0.08	0.08	0.00	0.09	-0.13	-0.14	-0.17
-0.65	-0.36	-0.26	0.22	0.10	-0.13	-0.07	-0.26	0.09	0.00	-0.28	-0.30	-0.30
0.07	0.01	0.19	0.09	-0.05	0.11	0.10	0.29	-0.13	-0.28	0.00	0.49	0.00
0.09	0.23	0.44	0.14	-0.09	0.01	0.10	0.25	-0.14	-0.30	0.49	0.00	0.57
0.02	0.23	0.58	0.19	-0.10	0.03	0.05	0.20	-0.17	-0.30	0.00	0.57	0.00

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