Utrecht University

School of Economics

Entrepreneurial Ecosystems and Structural Change in European Regions

Schrijvers, M.T., Bosma, N.S. & Stam, E.

U.S.E. Working Paper Series nr: 22-02

School of Economics

Utrecht University School of Economics (U.S.E.) is part of the faculty of Law, Economics and Governance at Utrecht University. The U.S.E. Research Institute focuses on high quality research in economics and business, with special attention to a multidisciplinary approach. In the working papers series the U.S.E. Research Institute publishes preliminary results of ongoing research for early dissemination, to enhance discussion with the academic community and with society at large.

The research findings reported in this paper are the result of the independent research of the author(s) and do not necessarily reflect the position of U.S.E. or Utrecht University in general.

U.S.E. Research Institute
Kriekenpitplein 21-22, 3584 EC Utrecht, The Netherlands Tel: +31 30 253 9800, e-mail: use.ri@uu.nl www.uu.nl/use/research

Utrecht University School of Economics

U.S.E. Research Institute
Working Paper Series 22-02
ISSN: 2666-8238

Entrepreneurial Ecosystems and Structural Change in European Regions

M. T. Schrijvers
N.S. Bosma
E. Stam
Utrecht School of Economics
Utrecht University

January 2022

Abstract

The process of structural change is investigated in six European regions that were recently confronted with a severe decline in manufacturing jobs. Entrepreneurs are key actors in this process, as they are the agents driving creative destruction that is needed to transform the economy. The entrepreneurial ecosystem of each of the regions is analysed using ecosystem metrics and case study methods. Having a strong entrepreneurial ecosystem helps regions to be resilient to shocks, such as a decline in traditional industries or closures of large focal firms. Institutions, knowledge, and skilled labour play key roles in a successful economic transformation. Formal institutions can provide the leadership and investment needed to quickly adapt to shocks, as shown in the West Midlands (UK), Eindhoven (NL), and Oulu (Finland). The cases of Sofia, Bulgaria, and the Ruhr region, Germany, show however that a strong ecosystem does not guarantee a swift structural transformation. To explain these exceptions, it is important to consider the economic history and regional context. For example, a strong dependence on one industry or firm can create a lock-in effect that prevents resilience in the face of shocks. When diagnosing ecosystems to inform policies, it is therefore crucial to combine metrics with a thorough understanding of the regional context.

Keywords: Structural change, entrepreneurship, entrepreneurial ecosystem, regional diversity, economic resilience

JEL classification: L16, L26, M13, R11

Acknowledgements: We would like to thank the Beyond 4.0 project partners for sharing the results of their regional analyses with us. Steven Dhondt provided useful comments and feedback on earlier versions of this paper. This research was supported by funding from the Netherlands Organisation for Applied Scientific Research (TNO).

Comments welcomed to: m.t.schrijvers@uu.nl

1. Introduction

Many regions in Europe that have been successful in the manufacturing era struggle with maintaining productivity levels and employment since the 1990s. Structural change in these regions is needed to increase productivity and create new jobs. For this structural change to take place, agents of change are necessary. In practice this means that innovative startups are needed. Innovative startups are the embodiment of Schumpeter's creative destruction (Schumpeter, 1942; Baumol, 2002). They are the drivers of structural change in the economy (Kuznets, 1966), creating new high productivity activities and destroying low productivity activities (Foster et al., 2001; Metcalfe and Ramlogan, 2006). However, this process of creative destruction by innovative startups is very fragile and its success depends strongly on the context in which it takes place: the entrepreneurial ecosystem (Acs et al., 2017). To stimulate the process of creative destruction, we need insight into the nature of the innovative startups themselves (Colombo and Grilli, 2005; Stam and Wennberg, 2009) and especially into their context, which provides more direct levers for policy intervention (Autio et al., 2014; Colombelli et al., 2016). The entrepreneurial ecosystem comprises a set of interdependent actors and factors that are governed in such a way that they enable productive entrepreneurship (Stam, 2015). The entrepreneurial ecosystem approach embodies the shift from entrepreneurship policy to policy for an entrepreneurial economy (Thurik et al., 2013; Stam and Bosma, 2014).

How does entrepreneurial ecosystem quality enhance or constrain structural change in European regions? In this chapter, we compare and contrast a set of six European regions that are confronted with the need for structural change (see Table 1). These regions have been faced with a severe decline in manufacturing jobs, which necessitates structural change from manufacturing to knowledge-based activities. This structural change includes the creation of a diverse set of entrepreneurial firms to reduce the dependence on a large anchor firm (e.g. Nokia in Oulu, Philips in Eindhoven, MG Rover in West Midlands). We discuss six remarkable cases. The capital region of Sofia in Bulgaria with a history of communism that has realized a high entrepreneurship output despite its low ranking on entrepreneurial ecosystem measures. The sparsely populated Oulu region in Finland, a showcase of entrepreneurial recycling after the collapse of Nokia. The Eindhoven region in the Netherlands and the West Midlands in the United Kingdom, which both showed strong resilience in the face of declining traditional industries. Dusseldorf in the Ruhr Area in Germany saw a similar and probably even stronger decline in the steel and coal industry but had more difficulty to adapt. The Basque region in Spain also had to restructure its economic activities and is set apart by its regional autonomy and regional culture. We perform a comparative analysis of the quality and output of the entrepreneurial ecosystems in each of these six European manufacturing regions and trace back their recent history to explain their evolution and (lack of) transformation.

When linking the results from the quantitative angle (metrics) and the qualitative angle (case descriptions), we observe substantial variation in the development of entrepreneurial ecosystems and the adaptation to structural change. These results are largely consistent for both types of analysis. We conclude that a metrics-based assessment of regional entrepreneurial ecosystems provides a useful initial diagnosis of the regional ecosystem and enables comparison with other regions.

However, this is not sufficient for initiating policy interventions: further elaboration is required, ideally in dialogue with key stakeholders.

Overall, we find formal institutions to play a key role in developing strong entrepreneurial ecosystems, as they can enable leadership and spur investment. A strong entrepreneurial ecosystem in turn helps to quickly adapt to economic shocks. A strong presence of formal institutions was mainly observed in the West Midlands (UK), Eindhoven (Netherlands) and Oulu (Finland) entrepreneurial ecosystems. Sofia, on the other hand, showcases an ecosystem whose success can be traced back to a dominant IT sector and strong private sector involvement in enhancing entrepreneurship in that sector. Strong formal institutions, however, do not guarantee successful structural change. The Basque country shows a case where institutions are actively enhancing investments in innovation but an entrepreneurial culture is lacking. In Dusseldorf, institutions were dominated by the steel industry and the focus on prolonging the life of traditional industries inhibited new sectors from emerging. There is thus not one simple recipe for success and additional insights from the context and history of regions are needed to design effective policy interventions.

2. Entrepreneurial ecosystems, creative destruction, and structural change

Creative destruction is the central process for structural change and productivity growth in the economy. Creative destruction takes place at the micro level, with the entry and growth of innovative firms, and the decline and exit of non-innovative or unsuccessful innovative firms. This micro-level creative destruction has been shown to increase productivity at the meso level: in regions (Bosma et al., 2011; Andersson al., 2012) as well as industries (Bartelsman and Doms, 2000; Bartelsman et al., 2005). Creative destruction also takes place at the macro level, with the emergence and growth of new industries and the decline and extinction of established industries. This macro level creative destruction is an emergent property of an economic system in which the micro level processes of creative destruction takes place.

We construct a conceptual model including key elements enabling and shaping creative destruction. We focus on the elements of the enabling environment, making use of a long-established literature on the environment for industry emergence (Van de Ven, 1993; Forbes and Kirsch, 2011) and on entrepreneurship and economic development (Fritsch, 2013; Stam and Bosma, 2014), which is integrated in the entrepreneurial ecosystem approach (Spigel, 2017; Stam, 2015; Stam and Spigel, 2018; Wurth et al., 2021; Leendertse et al., 2021). This entrepreneurial ecosystem approach builds on previous economic development approaches, including the industrial district, cluster and innovation system approaches, but is also distinct, with entrepreneurship taking centre stage (see Acs et al., 2017; O'Connor et al., 2018; Stam and Spigel, 2018).

Three key elements are knowledge, capital, and labour. Empirical research has shown that these are key elements enabling entrepreneurial activity and industry emergence. Knowledge from both public and private organizations is an important source of opportunities for entrepreneurship (see e.g. Audretsch and Lehmann, 2005). Capital, access to financing – preferably provided by investors with entrepreneurial knowledge – is crucial for investments in uncertain entrepreneurial

projects with a long-term horizon (see e.g. Kerr and Nanda, 2009). The presence of a diverse and skilled group of workers has also been shown to be a key condition in many empirical studies (see e.g. Acs and Armington, 2004; Lee et al., 2004; Qian et al., 2013). There are multiple actors involved in ecosystems to create, adapt, allocate, and coordinate finance, knowledge, and human capital. These actors and their interactions are enabled and constrained by the social (informal and formal institutions) and physical conditions of economic action: infrastructures. A key connection between resource endowments and these infrastructures is governance: "the use of institutions, structures of authority and even collaboration to allocate resources and coordinate or control activity in society or the economy" (Bell, 2002: 4). Governance in entrepreneurial ecosystems involves networks and leadership coordinating resources in such a way that productive entrepreneurship is enabled, and industry emergence is likely to happen. Recent studies have shown the positive effects of the quality of governance – measured as a composite of control of corruption, rule of law, government effectiveness, voice, and accountability - on knowledge production (Rodríguez-Pose and Di Cataldo, 2014), entrepreneurship (Nistotskaya et al., 2015), employment (Di Cataldo and Rodríguez-Pose, 2017), and productivity (Olson et al., 2000). No direct effect of these formal institutions on industrial diversification (macro level creative destruction) has been found, while informal institutions, like the level of generalized trust in regions seems to enhance industrial diversification (Cortinovis et al., 2017).

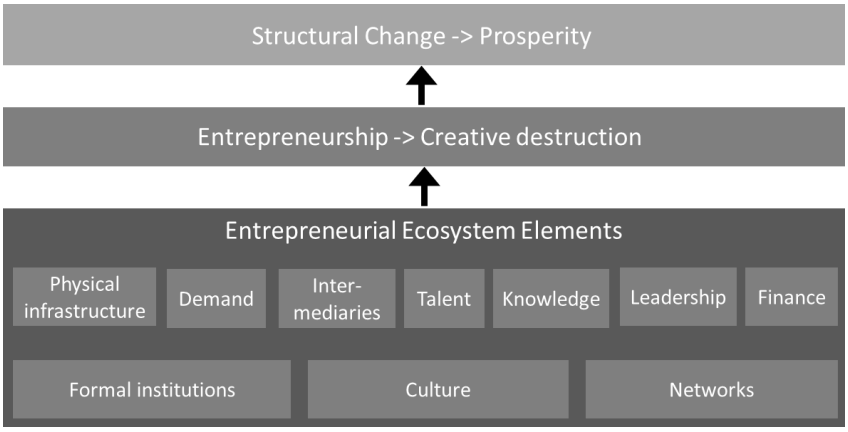

Fig. 1. Entrepreneurial ecosystems, creative destruction, and structural change: a conceptual model

3. Data and method

To diagnose the entrepreneurial ecosystem in the six regions of our study we collected data for all ten elements, as discussed in section 2. Most of the elements are measured with multiple indicators to capture the different aspects of the element. For example, general and entrepreneurship specific indicators or national and regional data were sometimes combined to create a comprehensive measure. The data collection is extensively described in Leendertse et al. (2021). The indicators were standardized (1 thus being the European average) and scaled to a range from zero to five.

We study six European regions which were all confronted with the need to structurally change their economy (Table 1). All these regions had an economy focused on manufacturing and faced a decline in the traditional industries that dominated regional production, with a corresponding decline in manufacturing jobs and closures of large firms. We selected regions in six different countries to create a sample with a large variation in national context. All of these regions are well-known industrial clusters and have been extensively studied, providing us with ample material for the case studies.[1] For an overview of the scores of the six regions see Figure 2. As is immediately clear from Figure 2, the regions in our sample show a large variety in the quality of their entrepreneurial ecosystem, based on this quantitative assessment. It ranges from Noord Brabant and West Midlands with strong all-round ecosystems to Sofia with only one element scoring above the European average.

Table 1. Case study regions with the corresponding NUTS 2 regions

City region	**NUTS 2 region**	**NUTS 2 code**	**Ranking EEI***	**Ranking entrepreneurship output***
Sofia	Yugozapaden	BG41	220	34
Dusseldorf	Dusseldorf	DEA1	84	125
Basque Country	Basque Country	ES21	82	78
Eindhoven	Noord-Brabant	NL41	23	54
Oulu	Northern Osthrobrothnia	FI1D	77	63
West Midlands	West Midlands	UKG3	36	64

*out of 273 European NUTS 2 regions; EEI=entrepreneurial ecosystem index; source: Leendertse et al. (2021)

To create one index measure of the ecosystem quality, the scores of the elements were added together (other calculation methods give similar results see Leendertse et al. (2021)). In addition, the output of the entrepreneurial ecosystem was measured with the number of Crunchbase firms founded in the last five years. Crunchbase is an online database that collects data on innovative new firms, most of which are looking to acquire funding (Crunchbase, 2021). The ranking of the case study regions on our index and output measure are shown in Table 1. Note however that the data was collected on NUTS 2 level, which is a larger area than the city regions we focus on in this study (often NUTS 3 level).

[1] These regions are all part of a European Union Horizon 2020 project called Beyond 4.0 (Beyond 4.0, n.d.). As part of this project, local partners conducted interviews with stakeholders in the entrepreneurial ecosystem. The report of the results (Dhondt et al., 2022) has been used in some parts of the analysis, as indicated by the references.

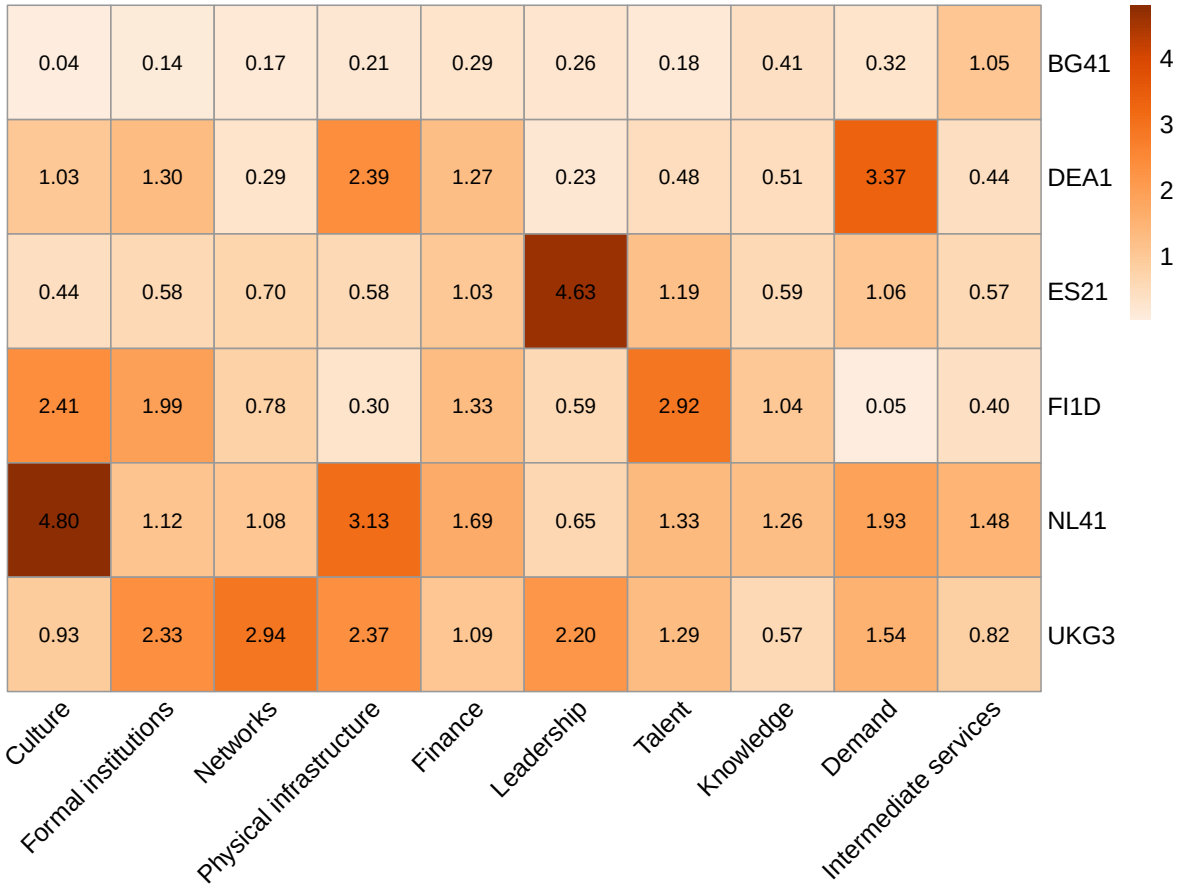

Fig. 2. Overview of entrepreneurial ecosystem element scores for case study regions

Figure 3 shows the position of the (NUTS 2) case study regions on the entrepreneurial ecosystem quality and output dimensions. Overall, the figure suggests a positive relation between the quality of entrepreneurial ecosystems (as measured by the Entrepreneurial Ecosystem Index) and entrepreneurial outputs (as measured by the prevalence of startups registered in the Crunchbase database) (cf. Stam & Van de Ven, 2021; Leendertse et al., 2021). The Sofia region is a clear outlier, in the sense that it has a much higher entrepreneurial output than one would expect based on the quality of the entrepreneurial ecosystem. The other regions more closely follow the expected pattern, with the German region having somewhat lower output than expected and the Finnish region showing a slightly higher output.

The quantitative analysis is done with specific indicators and output measures that were available for all NUTS 2 regions (Leendertse et al., 2021). These data will not capture everything related to entrepreneurship in the region, especially when the region does not conform to the 'standard' entrepreneurial ecosystem model. In addition, the data only cover a specific time frame; most of the indicators are from 2014-2016. To get a clearer picture of the development of entrepreneurial ecosystems in the face of economic shocks, we need to collect more (qualitative) data covering a longer period. In the next section, we therefore provide thick descriptions of the six regional entrepreneurial ecosystems.

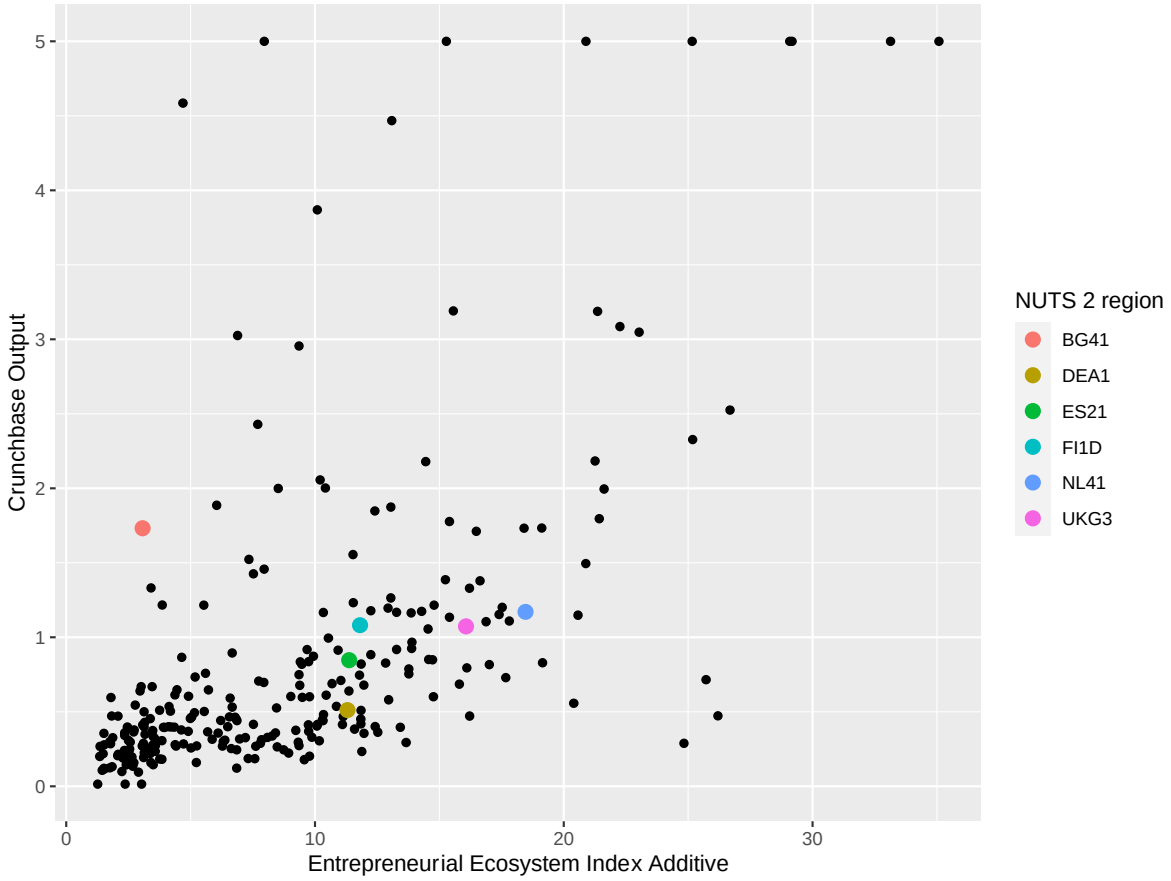

Fig. 3. Entrepreneurial Ecosystem Index values and entrepreneurship outputs for NUTS 2 regions

4. Regional case studies

4.1 Eindhoven

The Eindhoven region largely coincides with the NUTS 3 region South-East North-Brabant, which is part of the NUTS 2 region Noord Brabant (NL41). It is branded as Brainport, being the region with the highest R&D investments per capita of the Netherlands. The region has "reinvented" itself several times during the past century and is an example of successful structural transformation (Boekholt and Van der Weele, 1998; Engstrand and Stam, 2002). It emerged as a leading manufacturing region in the early 20th century with the growth of the large multinational corporations Philips (electronics) and DAF (automotive), and continued to grow rapidly until the 1970s. It has experienced major structural changes since the 1970s with crises in the 1970s, 1980s, 1990s and 2000s. During these crises Philips and DAF restructured, downsized, and DAF even went bankrupt (in 1993; with parts being acquired by Paccar in 1996). However, Philips has also been the source of many successful spin-off firms that were established in the Eindhoven region and flourished afterwards. These include Neways (industrial electronics), NXP (semiconductors) and ASML (waferstepper production), with the latter now investing more in R&D than Philips and still growing rapidly, employing more people than Philips (Stam et al., 2020).

Many of these firms share a regional supplier base, which is very advanced and serves a larger set of high-tech system integrators. These successful spin-off firms have become less and less dependent on the originating organization and succeeded to develop new business, largely circumventing the established large firm culture of the dominant local multinationals (Engstrand and Stam, 2002). In one of the major regional crises, in the 1990s, the university, the dominant businesses (organized via the Chamber of Commerce) and the municipality took the lead in a regional strategy and initiated public-private collaboration to renew the regional economy. This has later evolved in the regional leadership organization Brainport, which has been essential in initiating and implementing regional development strategies with public and private parties. In the last decades, Eindhoven University of Technology has also become a major source of spin-off firms (Van Burg et al., 2008), and the so-called High-Tech Campus Eindhoven has professionalized the support of corporate spin-offs (Van der Borgh et al., 2012).

Currently, the South-East North-Brabant excels in knowledge, networks, and leadership elements, and is one of the best entrepreneurial ecosystems of the Netherlands (Cloosterman and Stam, 2020). The Eindhoven region is part of the NUTS 2 region (the Province of) Noord-Brabant. From a European perspective, Noord-Brabant has an all-round ecosystem, with very high scores on most entrepreneurial ecosystem elements, with the exception of leadership. However, more spatially fine-grained analysis on the NUTS3 level shows that the Eindhoven city region stands out with very well performing leadership (Stam et al., 2020).

4.2 West Midlands

The West Midlands is a county in the United Kingdom (UKG3) which covers a largely urban area with Birmingham and Coventry as the main cities. It is considered part of the larger Motorsport Valley which is a large cluster of automotive industry (Henry et al., 2021). After the Second World War this strong automotive cluster developed and created thousands of jobs in manufacturing. Currently, the economic focus of the area has shifted to automotive design and performance engineering. As shown in Figure 2, the West Midlands has a strong and all-round ecosystem, with particularly high scores on formal institutions, leadership, and networks. The entrepreneurial output of the ecosystem is also high although the region is not part of the top 10% in Europe (Table 1).

The history of the entrepreneurial ecosystem is characterized by the great resilience (Henry et al., 2021). It had to adapt during various crises, notably the oil crisis in the 1970s and the more recent financial crisis (Focacci and Kirov, 2021). Although this did affect the prosperity of the region and many manufacturing jobs were lost, it did recover again and has been quite successful in the last ten years. Two developments are important for this recovery; the region was successful in diversifying the economic basis and invested in innovation to adapt to new developments such as the shift to low carbon vehicles (Henry et al., 2021). The manufacturing and engineering skills which were developed for the automotive industry proved useful for sectors ranging from aerospace to healthcare technology (Amison and Bailey, 2014). A main driver of these developments was the government which was always engaging with the sector (Henry et al., 2021). The government was involved in devising strategies and providing direction to the ecosystem. The public sector also invested in the

development of various ecosystem elements such as education and R&D (Henry et al., 2021). More recently, the private sector has taken a more prominent role and is both on its own (for example in the so-called Silverstone Technology Cluster) and in cooperation with the government (e.g. in Local Enterprise Partnerships) working to improve the ecosystem (Henry et al., 2021).

While the ecosystem thus has a strong institutional framework and good access to resources, there are several challenges ahead. One of these will be navigating the climate crisis and shifting to more environmentally friendly products, especially in the automotive sector, the second revolves around the digital transformation as engineering will be heavily impacted by developments in the IT sector (Focacci and Kirov, 2021). The region will thus once more have to face a period of transformation.

4.3 Oulu

Oulu (FI1D) is the seventh largest city in Finland and the only city located in the sparsely populated North of Finland. It is not surprising therefore that the region lacks a large local demand and is not very well connected to the outside world as reflected in the low score on infrastructure (Figure 2). The region was nevertheless a key location for the Nokia cooperation and experienced high growth in the 1990s (Dhondt et al., 2022). Even before the arrival of Nokia, Oulu was a centre of economic activity. The traditional wood industry started the development of electronic devices and thus created a basis for electrical engineering. In 1958 the University of Oulu was established and a technology campus for companies was launched in 1982 (Salo, 2014). The operations of Nokia in Oulu focused on the research and development of new products and involved mainly high-skilled labour.

When Nokia started to downsize after 2010 about 3,500 workers were laid off (Simonen et al., 2020). Most of the employees laid off by Nokia were highly skilled and could find jobs in related industries. Nokia also provided support for previous employees to start a new business or follow training programs. Other actors such as BusinessOulu and the Oulu Innovation Alliance were already anticipating the decline of Nokia and invested in new economic activities such as health technologies (Simonen et al., 2020). An incubator for startups was established and there were various funding opportunities for startups from the public sector (Dhondt et al., 2022). Two factors that are important to explain the relatively easy structural adjustment to the decline of Nokia are the presence of a university and a strong entrepreneurial culture (Dhondt et al., 2022; Salo, 2014). People were committed to the region and did not move away but stayed in Oulu to find new work or start a new business (Simonen et al., 2020). The University of Oulu is not only an important provider of education but has also established many collaborations with enterprises (Salo, 2014). There are various R&D projects with businesses, made possible by the available public funding (Daveri and Sila, 2004). A good example is the 6G flagship project which involves various companies and research institutes and is funded by the Academy of Finland (Dhondt et al., 2022). The university also created some successful spinoffs such as the Polar Electro company (Salo, 2014).

In the future, many expect the health technology sector to be the new growth engine (Nummi, 2007; Simonen et al., 2020). Nokia also announced to open new

research facilities in Oulu (Dhondt et al., 2022). The region faces some challenges, the main one being the supply of qualified workers. Especially in the ICT sector there is a lack of skilled workers, which might force companies to relocate. To prevent this the education system in Oulu needs to be adjusted to provide the necessary training in ICT. Another solution that companies push for is to make it easier to attract foreign workers (Dhondt et al., 2022).

4.4 Basque Country

The Basque Country (ES21) can be characterized as an old industrial region that has transformed into an innovative region with an emphasis on collective approaches (Cooke et al., 1997). Morgan (2016) describes how this transformation emerged after facing economic challenges in the 1980s and 1990s. Some of prominent elements are the Mondragon Cooperative Corporation model, the focus on 'urban design' circles (imaginative urban regeneration plan including the Guggenheim Museum) and the promotion and preservation of the historic Basque language and heritage (Markuartu, 2015; Morgan, 2016). Furthermore, the Basque Country (like Catalunya and Galicia) has a large regional autonomy and its own tax system (Cooke and Morgan, 1998). Since these elements all suggest strong linkages with institutions and culture, it seems striking that these elements come out least favourable in the Basque Country's entrepreneurial ecosystem (Figure 2).

In fact, an analysis on the Basque Country's entrepreneurial ecosystem by Pena-Legazkue et al. (2015) shows that *entrepreneurial* culture is indeed lacking in the Basque Country, also relative to other Spanish regions. Notwithstanding promotion of entrepreneurship by local policymakers since the 2000s, also other entrepreneurial ecosystems elements were seen to be relatively underdeveloped according to local experts including education, finance, local demand, and institutions (stressing in particular bureaucratic barriers). One specific feature of the Basque model relates to collective entrepreneurship. Public and private actors collaborate to pursue mutual goals and firms are encouraged to explore joint solutions to local societal problems. This is reflected in the high value of the leadership element (Figure 2). The Basque Country has, over the years, developed a highly networked region which has according to Barrutia and Echebarria (2011) resulted in high absorptive capacity among the existing actors and rich development of tacit knowledge. Instead, Pena-Legazkue et al. (2015) criticize the weak absorptive capacity from an entrepreneurial perspective, and observe the interaction among local actors to be fragile along with a lack of self-monitoring and action by local policy leaders.

Concluding, the Basque Country has transformed in the past decades with ambiguous progress concerning the development of its entrepreneurial ecosystem. In the 1980s, entrepreneurs had a bad image in the region and the leadership of the Basque government was crucial to respond to the economic crisis (Navarro et al., 2014). Since the 1990s, the Basque Country has been successful in gradually developing private–public partnerships which, along with cluster initiatives and associations, has resulted in the creation of substantial social capital in the region (Navarro et al., 2014). This development has, however, not (yet) resulted in a thriving entrepreneurial ecosystem which could still cherish features of collectivism and heritage that are inherent to the region. This may partially explain why the Basque Country does not appear to excel, in terms of

entrepreneurial outcome indicators presented in Table 1. Entrepreneurial outcomes that can be linked to the collective approach in transforming the region, such as cohesion, inclusiveness, and heritage-based values, may contribute to its citizens' wellbeing.

4.5 Dusseldorf

The Dusseldorf region (DEA1) is part of the western Ruhr area located in the West of Germany. The Ruhr area is well known for its heavy industries, in particular mining, steel, electricity, and chemicals (Grabher 1993; Rehfeld and Nordhause-Janz, 2017). However, these industries have been in decline since the second half of the twentieth century (Danielzyk and Wood, 2004). The region is still trying to restructure its economic activities and make up for the job losses and factory closures as a consequence of the decline of this traditional industrial base. It has not managed to diversify into new sectors which is reflected in the relatively low entrepreneurial output as shown in Table 1.

The region has several strongly developed ecosystem elements (Figure 2). The infrastructure is excellent which has been one of the drivers for traditional industries to locate there, besides the natural coal deposits (Rehfeld and Nordhause-Janz, 2017). The waterways, especially the Rhine, are important for transport of industrial products. In addition, there are excellent road and railway connections and a large international airport. There is also ample demand because of the large population in the region and economic activity by a few large well-established companies. On the contrary, the elements of talent and knowledge are almost absent. The region has problems with attracting and retaining highly skilled people (Van Winden et al., 2007). In addition, much of the research and knowledge development in the region is still concentrated on steel production and mainly applied by already existing steel companies (Dhondt et al., 2022).

This shows that the Dusseldorf region is still dominated by the steel industry, which is concentrated around the city of Duisburg. Even though the steel industry is under pressure from competition of countries such as China and strict environmental regulations, the region did not successfully diversify or reform its economic base (Zimmermann et al., 2017). Traditional institutions such as trade unions and chambers of commerce are still important but see a decrease in membership. Networks of companies also suffer from strict antitrust regulations, which prevents firms from collaborating on R&D projects. While there are several startups working on new technologies in steel production the extent of this is limited. There have been various efforts from regional and local governments to reinvigorate the steel cluster but these have not been very successful (Rehfeld and Nordhause-Janz, 2017).

4.6 Sofia

Sofia (BG41) is the capital city of Bulgaria and located in the Yugozapaden region in the west of the country. The city has recently become a hub for IT companies. This is evidenced by the high number of Crunchbase firms as shown in Table 1. While the entrepreneurial output of the region is high, the entrepreneurial ecosystem index is low. Figure 2 shows that Sofia scores very low on all ecosystem elements except intermediate services. Note that the scores of the elements may

be a bit downward biased as the NUTS 2 region does not only include the capital city but also the surrounding region. The high entrepreneurial output (ranking 34th of the NUTS 2 regions) is surprising since Bulgaria is one of the poorest countries of the EU.

The IT sector is the most important contributor to new firm creation. Already in the communist era Sofia produced computers for the former Soviet Republic (Focacci and Kirov, 2021). When the economy opened up after 1989, many foreign companies outsourced IT tasks to Bulgarian firms because of the low labour costs. Later on, these companies also invested in R&D centres, showing the development of the sector towards more knowledge intensive products. Bulgarian entrepreneurs have benefitted from these investments and have set up new companies in software and hardware development that became successful (Dhondt et al., 2022).

The obstacles entrepreneurs in Sofia face are higher than in most other European regions. Bulgaria still lacks behind in various respects, one of the most important obstacles being the pervasive corruption (Vorley and Williams, 2016). However, the image that appears from a series of interviews done in a study by Dhondt et al. (2022) is one of self-starting entrepreneurs that creatively deal with the challenges of the region. Leadership is strongly developing within the ecosystem and (corrupt) local institutions are avoided because of the sector's strong international focus (Kominos et al., 2021). Even education is not left to the state, as various entrepreneurs have set up private IT academies to teach the skills needed by IT companies. The support of the European Union also plays an important role in providing funding for startups and investment in knowledge and infrastructure, for example in 2018 the Sofia tech park was opened. Partly because of this EU investment, the entrepreneurial ecosystem seems to be strongly developing (Focacci and Kirov, 2021). Local institutions are getting more involved with the entrepreneurial ecosystem and the City of Sofia together with the Invest Sofia agency proposed a digital strategy that comprises various investments in education, finance and offers a proposition to create more local demand (Kominos et al., 2021).

There are a few reasons these positive developments were not properly captured by the entrepreneurial ecosystem index shown in Figure 3. Firstly, the index is mostly based on data from 2014-2016 and thus does not capture the changes happening after 2016, which in the case of Sofia seem to be generally positive. Secondly, the data underlying the index are focused on the regional and national context, while the entrepreneurs in the Sofia region clearly interact strongly with an international market. The comparative advantage of Sofia in this market is mainly cheap labour, although the ecosystem is likely to become more dependent on (scarcer) skilled labour in the near future (Dhondt et al., 2022). Finally, the dominant IT sector is one part of the broader entrepreneurial ecosystem which is not limited to a specific sector or industry. The conditions for entrepreneurs in other sectors may be less favourable.

While leadership and infrastructure have already been improving over the recent years (Dhondt et al., 2022), the hardest challenge of the entrepreneurial ecosystem in Sofia will lie in boosting local demand. Although the public sector can generate some demand for IT products as proposed in the digital strategy (Kominos et al., 2021), the growth of the local market will mostly be determined

by the economic development of the general economy. This economic development will in turn depend on the creation of inclusive growth which is not solely concentrated in the IT sector.

5. Discussion and conclusion

In this chapter we analysed the entrepreneurial ecosystems of six regions that were confronted with the need to structurally transform their economies. We focused on entrepreneurship, which is a key driver of creative destruction and thus an important force for structural change. As the emergence of entrepreneurship depends on a supportive context, the first part of the analysis diagnosed the quality of the six entrepreneurial ecosystems with entrepreneurial ecosystem metrics. There were large differences between regions, both in the quality of the ecosystem and the entrepreneurial output they produced. The results of the quantitative analysis and the case descriptions provided a largely consistent picture of the quality of the regional entrepreneurial ecosystem. Overall, there is a positive relationship between the quality of the entrepreneurial ecosystem and the entrepreneurial output of the ecosystem.

The detailed descriptions of the regions in the second part of the analysis showed that the regions adjusted to the shocks of a declining industry or anchor firm with differing success. The key challenge for all regions was to develop new sectors in the economy that can create jobs and economic development. The institutions in a region can play a key role in this development, enabling leadership and investment where necessary. This strong role of formal institutions was mainly observed in the West Midlands, Eindhoven, and Oulu. Sofia provided an interesting exception, as the formal institutions in Bulgaria were more of a hindrance than help to the development of the ICT sector and productive entrepreneurship in general. The leadership of the ecosystem in Sofia completely depended on the private sector, in particular entrepreneurs in the ICT sector, who themselves took initiative to develop several elements of the ecosystem. This also shows how a (dominant) city-region can enable entrepreneurship in a very different (positive) way than a country at large (cf. Casper, 2007).

For institutions and leadership to be instrumental for structural change, it is important that they anticipate the decline of industries or firms and invest in the development of new sectors early on. The transformation of the Dusseldorf region was hindered by the strong interest of the steel industry and essential resources were spent to extend the life of the incumbent companies instead of enabling new ones to emerge. In Oulu, the opposite happened; even before Nokia closed there was awareness of the need to diversify the regional economy and invest in new enterprises. The presence of a university or research institute can be of great importance to generate the new skills and knowledge that startups in emerging sectors need.

While a strong entrepreneurial ecosystem provides many of the ingredients for a successful transformation, it does not automatically translate in a quick adaptation and resilient regional economy. Some regions with a strong entrepreneurial ecosystem seem to pull below their weight and vice versa. As discussed above, when studying these cases in more detail it becomes apparent what makes these regions unique. The strong entrepreneurial spirit in Sofia and the focus on international markets makes up for the weaker elements of the local (and national)

ecosystem. While the dominance of declining industries in the Ruhr region seems to inhibit the formation of new enterprises. This shows that there is not one recipe for success and not everything is captured in the calculation of an ecosystem index, even though such indices do provide a useful initial diagnosis. Regions adapt to their own idiosyncrasies and are influenced by their economic history, which can create a lock-in effect when certain industries or firms become very important (Grabher, 1993; Henning et al., 2013).

The data used for the quantitative analysis offer various opportunities for improvement. The measures of the elements were mostly taken from 2014-2016 and do therefore not give a good picture of the current state of the ecosystem. Because of this specific time frame, it was important to corroborate the results with information from more recent literature. Especially in the case of Sofia, the conditions for entrepreneurs seem to be improving and their ecosystem may score higher on a ranking with more recent data. The data was collected on NUTS 2 level, which in most cases overlap quite closely with the region of interest. For the Oulu region in Finland, the NUTS 2 area is however extremely large and it would be informative to collect data on a smaller spatial level (NUTS 3).

The measure of entrepreneurial output used in this chapter is quite specific and tries to capture profit-oriented Schumpeterian entrepreneurship. It does not measure the growth of existing enterprises or the total number of new firms. If other types of enterprises are specifically important for regions (think of the "Mittelstand" in Germany), this output measure may not give a full picture of regional entrepreneurship. This might explain the very low ranking of Dusseldorf on Crunchbase output. The measure we use is however currently the best available measure to capture innovative entrepreneurship. Developing more accurate measures of different types of entrepreneurship on the regional level is an important avenue for future research.

Entrepreneurs are drivers of economic change and a strong entrepreneurial ecosystem is necessary to enable new firms to emerge and flourish. The six different regions all showed the importance of institutional actors, skilled labour, and knowledge in the transformation of the economy. The presence of these is however no guarantee for success. The variety in regional contexts is hard to capture in an index measure of ecosystem quality. Studying regions in more detail proved instrumental in explaining why some of these did not conform to the standard pattern observed in the data. When diagnosing ecosystems to inform policies, it is therefore crucial to combine metrics with a thorough understanding of the regional context.

References

Acemoglu, D., U. Akcigit, H. Alp, N. Bloom, and W. Kerr. 2018. 'Innovation, Reallocation, and Growth'. *American Economic Review*.

Acs, Z. J., and C. Armington. 2004. 'The impact of geographic differences in human capital on service firm formation rates'. *Journal of Urban Economics* 56 (2): 244–278.

Acs, Z. J., E. Stam, D. B. Audretsch, and A. O'Connor. 2017. 'The lineages of the entrepreneurial ecosystem approach'. *Small Business Economics* 49 (1): 1-10.

Aghion, P., J. Boulanger, and E. Cohen. 2011. *Rethinking industrial policy* (No. 2011/04). Brussels: Bruegel.

Aldrich, H. E., and C. M. Fiol. 1994. 'Fools rush in? The institutional context of industry creation'. *Academy of management review* 19 (4): 645-670.

Amison, P., and D. Bailey. 2014. 'Phoenix industries and open innovation? The Midlands advanced automotive manufacturing and engineering industry'. *Cambridge Journal of Regions, Economy and Society* 7 (3): 397-411.

Andersson, M., P. Braunerhjelm, and P. Thulin. 2012. 'Creative destruction and productivity: entrepreneurship by type, sector and sequence'. *Journal of Entrepreneurship and Public Policy* 1 (2): 125-146.

Arrow, K. J. 1962. 'Economic welfare and the allocation of resources for invention'. In *The Rate and Direction of Inventive Activity*, pp. 609–626. Princeton: Princeton University Press.

Audretsch, D. B., W. J. Baumol, and A. E. Burke. 2001. 'Competition policy in dynamic markets'. *International journal of industrial organization* 19 (5): 613-634.

Audretsch, D. B., and E. E. Lehmann. 2005. 'Does the knowledge spillover theory of entrepreneurship hold for regions?'. *Research Policy* 34 (8): 1191-1202.

Autio, E., M. Kenney, P. Mustar, D. Siegel, and M. Wright. 2014. 'Entrepreneurial innovation: The importance of context'. *Research Policy* 43 (7): 1097-1108.

Barrutia, J. M., and C. Echebarria. 2012. 'Greening regions: The effect of social entrepreneurship, co-decision and co-creation on the embrace of good sustainable development practices'. *Journal of environmental planning and management* 55 (10): 1348-1368.

Baumol, W. J. 2002. *The free-market innovation machine: Analyzing the growth miracle of capitalism.* Princeton, NJ: Princeton University Press.

Bartelsman, E. J., and M. Doms. 2000. 'Understanding productivity: Lessons from longitudinal microdata'. *Journal of Economic literature* 38 (3): 569-594.

Bartelsman, E., S. Scarpetta, and F. Schivardi. 2005. 'Comparative analysis of firm demographics and survival: evidence from micro-level sources in OECD countries'. *Industrial and Corporate Change* 14(3): 365-391.

Bell, S. 2002. *Economic Governance and Institutional Dynamics.* Oxford: Oxford University Press.

Beyond 4.0. n.d. 'The project'. https://beyond4-0.eu/the-project (accessed 07-01-2022).

Bosma, N., E. Stam, and V. Schutjens. 2011. 'Creative Destruction and Regional Productivity Growth: Evidence from the Dutch Manufacturing and Services Industries'. *Small Business Economics* 36 (4): 401-418.

Casper, S. 2007. *Creating Silicon Valley in Europe: Public policy towards new technology industries*. Oxford: Oxford University Press.

Chatterji, A., E. Glaeser, and W. Kerr. 2014. 'Clusters of Entrepreneurship and Innovation'. *Innovation Policy and the Economy* 14: 129-166.
Coenen, L., T. Hansen, and J. V. Rekers. 2015. 'Innovation Policy for Grand Challenges. An Economic Geography Perspective'. *Geography Compass* 9 (9): 483-496.
Colombelli, A., J. Krafft, and M. Vivarelli. 2016. 'To be born is not enough: the key role of innovative start-ups'. *Small Business Economics* 47(2): 277-291.
Colombo, M. G., and L. Grilli. 2005. 'Founders' human capital and the growth of new technology-based firms: A competence-based view'. *Research policy* 34 (6): 795-816.
Cooke, P., M.G. Uranga, and G. Etxebarria. 1997. 'Regional innovation systems: Institutional and organisational dimensions'. *Research policy* 26 (4-5): 475-491.
Cooke, P., and K. Morgan. 1998. *The associational economy: Firms, regions and innovation*. Oxford: Oxford University Press.
Cooke, P. 2001. 'Regional innovation systems, clusters, and the knowledge economy'. *Industrial and corporate change* 10 (4): 945-974.
Cortinovis, N., J. Xiao, R. Boschma, and F. G. van Oort. 2017. 'Quality of government and social capital as drivers of regional diversification in Europe'. *Journal of Economic Geography* 17 (6): 1179-1208.
Criscuolo, C., R. Martin, H. Overman, and J. Van Reenen. 2012. 'The causal effects of an industrial policy'. NBER working paper, No. 17842, Cambridge, MA: National Bureau of Economic Research.
Crunchbase. 2021. 'Where does Crunchbase get their data?' https://support.crunchbase.com/hc/en-us/articles/360009616013-Where-does-Crunchbase-get-their-data- (accessed 26-11-2021).
Danielzyk, R., and G. Wood. 2004. 'Innovative strategies of political regionalization: the case of North Rhine-Westphalia'. *European Planning Studies* 12 (2): 191-207.
Daveri, F., and O. Silva. 2004. 'Not only Nokia: what Finland tells us about *new economy* growth'. *Economic Policy* 19 (38): 118-163.
Dhondt, S., R. Dekker, T. Van Bree, G. Hulsegge, P. Oeij, S. Barnes, A. Götting, O. Kangas, E. Karonen, E. Pomares, A. Unceta, V. Kirov, M. Kohlgrüber, S. Wright, G. Yordanova, and M. Schrijvers. 2022. Regional report: entrepreneurial ecosystems in six European countries. Deliverable D4.1 Beyond 4.0.
Di Cataldo, M., and A. Rodríguez-Pose. 2017. 'What drives employment growth and social inclusion in the regions of the European Union?'. *Regional Studies* 51 (12): 1840-1859.
Elert, N., M. Henrekson, and M. Stenkula. 2017. *Institutional reform for innovation and entrepreneurship: An agenda for Europe.* New York: Springer International Publishing.
Focacci, C. N., and V. Kirov. 2021. 'Regional entrepreneurial ecosystems: Technological transformation, digitalisation and the longer term-The automotive and ICT sectors in the UK and Bulgaria'. *Local Economy* 36 (1): 56-74.
Foray, D., D. C. Mowery, and R. R. Nelson. 2012. 'Public R&D and social challenges: What lessons from mission R&D programs?'. *Research Policy* 41 (10): 1697-1702.
Foray, D. 2014. *Smart specialisation: opportunities and challenges for regional innovation policy,* Routledge.

Forbes, D. P., and D. A. Kirsch. 2011. 'The study of emerging industries: Recognizing and responding to some central problems'. *Journal of Business Venturing* 26 (5): 589-602.
Foster, L., J. C. Haltiwanger, and C. J. Krizan. 2001. 'Aggregate productivity growth: Lessons from microeconomic evidence'. In *New developments in productivity analysis,* pp. 303-372. University of Chicago Press.
Fritsch, M. 2013. 'New business formation and regional development – A Survey and Assessment of the Evidence'. *Foundations and Trends in Entrepreneurship* 9: 249–364.
George, G., J. Howard-Grenville, A. Joshi, and L. Tihanyi. 2016. 'Understanding and tackling societal grand challenges through management research'. *Academy of Management Journal* 59 (6): 1880-1895.
Gertler, M. S., and D. A. Wolfe. (2004). 'Local social knowledge management: Community actors, institutions and multilevel governance in regional foresight exercises'. *Futures* 36 (1): 45-65.
Grabher, G. 1993. *The embedded firm. On the socio-economics of industrial networks*. Routledge: London.
Hall, B. H. 2002. 'The financing of research and development'. *Oxford review of economic policy* 18 (1): 35-51.
Henning, M., E. Stam, and R. Wenting. 2013. 'Path dependence research in regional economic development: Cacophony or knowledge accumulation?'. *Regional Studies* 47 (8): 1348-1362.
Henry, N., T. Angus, and M. Jenkins. 2021. 'Motorsport Valley revisited: Cluster evolution, strategic cluster coupling and resilience'. European Urban and Regional Studies 28 (4): 466-486.
Jacobs, B., and J. Theeuwes. 2005. 'Innovation in the Netherlands: The Market Falters and the Government Fails'. *De Economist* 153 (1): 107-124.
Forbes, D. P., and D. A. Kirsch. 2011. 'The study of emerging industries: Recognizing and responding to some central problems'. *Journal of Business Venturing* 26 (5): 589-602.
Kerr, W. R., and R. Nanda. 2009. 'Democratizing entry: Banking deregulations, financing constraints, and entrepreneurship'. *Journal of Financial Economics* 94 (1): 124-149.
Kominos, N., C. Kakderi, A. Collado, I. Papadaki, and A. Panori. 2021. 'Digital Transformation of City Ecosystems: Platforms Shaping Engagements and Externalities across Vertical Markets'. *Journal of Urban Technology* 28 (1-2): 93-114.
Kuznets, S. 1966. *Modern Economic Growth: Rate, Structure and Spread*. New Haven: Yale University Press.
Langlois, R. N., and P. L. Robertson. 1995. *Firms, markets and economic change*. London: Routledge.
Lee, S. Y., R. Florida, and Z. J. Acs. 2004. 'Creativity and entrepreneurship: a regional analysis of new firm formation'. *Regional Studies* 38 (8): 879–891.
Leendertse, J., M. T. Schrijvers, and E. Stam. 2021. 'Measure Twice, Cut Once: Entrepreneurial Ecosystem Metrics'. *Research Policy.*
Lindblom, C. E. .1959. 'The Science of Muddling Through'. *Public Administration Review* 19 (2): 79-88.
Lindblom, C. E. 1968. *The policy-making process*. Prentice-Hall.
Markuartu, J. J. I. 2015. 'The Basque experience: Constructing sustainable human development'. Center for Basque Studies.
Mason, C., and R. Brown. 2014. *Entrepreneurial ecosystems and growth oriented entrepreneurship.* Final Report to OECD, Paris, 30 (1): 77-102.

Mazzucato, M. 2015. *The entrepreneurial state: Debunking public vs. private sector myths*. Anthem Press.
Metcalfe, J. S., and R. Ramlogan. 2006. 'Creative destruction and the measurement of productivity change'. *Revue de l'OFCE* (5): 373-397.
Moe, E. 2009. 'Mancur Olson and structural economic change: Vested interests and the industrial rise and fall of the great powers'. *Review of International Political Economy* 16(2): 202-230.
Morgan, K. 2016. 'Collective entrepreneurship: The Basque model of innovation'. *European Planning Studies* 24 (8): 1544-1560.
Mueller, D. 2003. *Public Choice III*, New York: Cambridge University Press.
Navarro, M., J. M. Valdaliso, M. J. Aranguren, and E. Magro. 2014. 'A holistic approach to regional strategies: The case of the Basque Country'. *Science and Public Policy* 41 (4): 532-547.
Nistotskaya, M., N. Charron, and V. Lapuente. 2015. 'The wealth of regions: quality of government and SMEs in 172 European regions'. *Environment and Planning C: Government and Policy* 33 (5): 1125-1155.
Nooteboom, B., and E. Stam. 2008. *Microfoundations for Innovation Policy*, Amsterdam: Amsterdam University Press.
Nummi, J. 2007. 'University-Industry Collaboration in Medical Devices Development: Case Study of the Oulu Region in Finland'. In *Innovation, Universities and the Competitiveness of Regions,* edited by R. K. Lester, and M. Sotarauta, pp. 95-124. Helsinki: Tekes.
O'Connor, A., E. Stam, F. Sussan, and D. B. Audretsch. 2018. *Entrepreneurial Ecosystems. Place-Based Transformations and Transitions.* New York: Springer.
Olson, M. 1982. *The Rise and Decline of Nations: Economic Growth, Stagflation, and Social Rigidities*, Yale University Press.
Olson, M., N. Sarna, and A. V. Swamy. 2000. 'Governance and growth: A simple hypothesis explaining cross-country differences in productivity growth'. *Public Choice* 102 (3-4): 341-364.
Pena-Legazkue, I., M. Guerrero, and J. L. Gonzalez-Pernía. 2015. Entrepreneurship and Sustainable Development. In The Oxford Handbook of Local Competitiveness, edited by D. B. Audretsch, A. N. Link, and M. Walshok. Oxford: Oxford University Press.
Qian, H., Z. J. Acs, and R. R. Stough. 2013. 'Regional systems of entrepreneurship: the nexus of human capital, knowledge and new firm formation'. *Journal of Economic Geography* 13 (4): 559-587.
Rehfeld, D., and J. Nordhause-Janz. 2017. 'Integration-fragmentation-reintegration? Studying cluster evolution, regional path development and cluster policies in the Ruhr Area'. In *The Life Cycle of Clusters*, edited by D. Fornahl, and R. Hassink, pp. 242-258. Edward Elgar.
Rigby, J., and R. Ramlogan. 2013. 'The impact and effectiveness of entrepreneurship policy'. NESTA.
Rodríguez-Pose, A., and M. Di Cataldo. 2014. 'Quality of government and innovative performance in the regions of Europe'. *Journal of Economic Geography* 15 (4): 673-706.
Salo, M. 2014. 'High-Tech Centre in the Periphery: The Political, Economic and Cultural Factors behind the Emergence and Development of the Oulu ICT Phenomenon in Northern Finland'. *Acta Borealia* 31(1): 83-107.
Schumpeter, J.A. 1934. *The Theory of Economic Development*, Cambridge, MA: Harvard University Press.

Schumpeter, J.A. 1942. *Capitalism, Socialism, and Democracy,* New York: Harper and Brothers.
Simon, H. A. .1947. *Administrative behavior; a study of decision-making processes in administrative organization,* New York: The Free Press.
Simonen, J., J. Herala, and R. Svento. 2020. 'Creative destruction and creative resilience: Restructuring of the Nokia dominated high-tech sector in the Oulu region'. *Regional Science: Policy & Practice* 12(5): 931-953.
Spigel, B. 2017. 'The Relational Organization of Entrepreneurial Ecosystems'. *Entrepreneurship Theory and Practice* 41: 49–72.
Stam, E. 2015. 'Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique'. *European Planning Studies* 23 (9): 1759-1769.
Stam, E. 2018. 'Measuring Entrepreneurial Ecosystems'. In *Entrepreneurial Ecosystems. Place-Based Transformations and Transitions*, edited by A. O'Connor, E. Stam, F. Sussan, and D. B. Audretsch, pp. 173-196. New York: Springer.
Stam, E., and N. S. Bosma. 2014. 'Growing Entrepreneurial Economies: Entrepreneurship and Regional Development'. In *The Routledge Companion to Entrepreneurship*, edited by T. Baker, and F. Welter, pp. 325-340. London: Routledge.
Stam, E., and N. S. Bosma. 2015. 'Local policies for high-growth firms'. In *The Oxford Handbook of Local Competitiveness*, edited by D. B. Audretsch, A. Link, and A. Walshok, pp. 286-305. Oxford: Oxford University Press.
Stam, E., E. Cloosterman, and B. van der Starre. 2020. 'The Brabant Ecosystem. Analysis of the entrepreneurial ecosystem'. Braventure.
Stam, E., and B. Nooteboom. 2011. 'Entrepreneurship, Innovation and Institutions'. In *Handbook of Research on Innovation and Entrepreneurship*, edited by D. Audretsch, O. Falck, and S. Heblich, pp. 421-438. Cheltenham: Edward Elgar.
Stam, E., and B. Spigel. 2018. 'Entrepreneurial Ecosystems'. In *The SAGE Handbook of Small Business and Entrepreneurship*, edited by R. Blackburn, D. De Clercq, and J. Heinonen, pp. 407-422. London: SAGE.
Stam, E., and K. Wennberg. 2009. 'The roles of R&D in new firm growth'. *Small Business Economics* 33(1): 77-89.
Stam, E., and A. Van de Ven. 2021. 'Entrepreneurial ecosystem elements'*. Small Business Economics* 56: 809-832.
Thurik, R., E. Stam, and D. Audretsch. 2013. 'The Rise of the Entrepreneurial Economy and the Future of Dynamic Capitalism'. *Technovation* 33 (8-9): 302-310.
Tushman, M. L., and P. Anderson. 1986. 'Technological discontinuities and organizational environments'. *Administrative science quarterly*: 439-465.
Van Burg, E., A. G. L. Romme, V. A. Gilsing, and I. M. Reymen. 2008. 'Creating university spin-offs: a science-based design perspective'. *Journal of Product Innovation Management* 25 (2): 114-128.
Van der Borgh, M., M. Cloodt, and A. G. L. Romme. 2012. 'Value creation by knowledge-based ecosystems: evidence from a field study'. *R&D Management* 42 (2): 150-169.
Van de Ven, A. H. 1993. 'The development of an infrastructure for entrepreneurship'. *Journal of Business Venturing* 8: 211-230.
Van Winden, W., L. van den Berg, and P. Pol. 2007. 'European Cities in the Knowledge Economy: Towards a Typology'. *Urban Studies* 44 (3): 525-549.
Vorley, T., and N. Williams. 2016. 'Between petty corruption and criminal extortion: How entrepreneurs in Bulgaria and Romania operate within a

devil's circle'. *International Small Business Journal: Researching Entrepreneurship* 34 (6); 797-817.
Zimmerman, K., C. Hundt, C. Jütte, and C. Pofalla. 2017. 'Dortmund, Duisburg and the 2008/2009 Recession – Why two Cities of one Region show Different Patterns of Economic Resilience'. *Raumforschung und Raumordnung* 75 (5): 439-453.