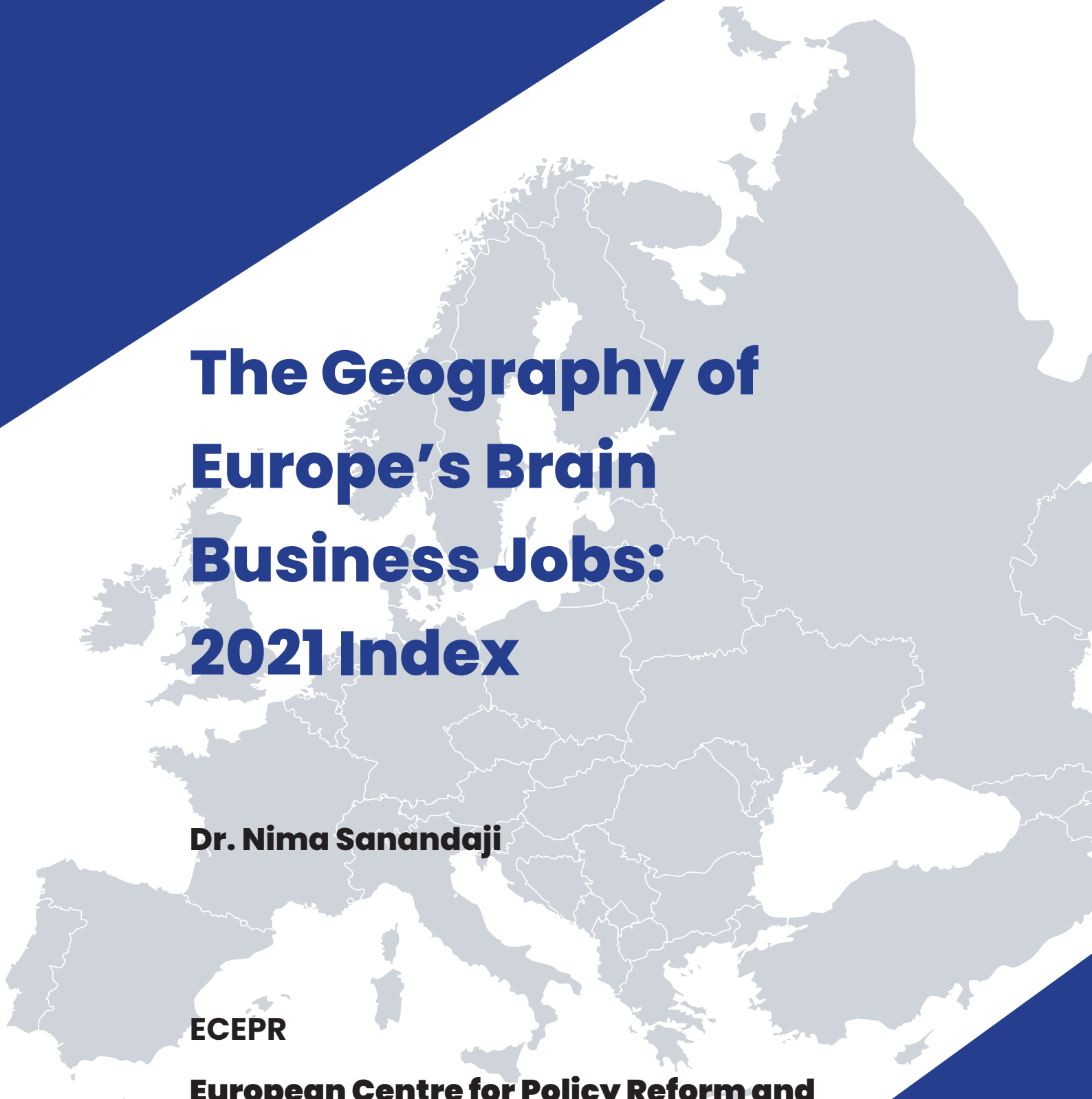

The Geography of Europe's Brain Business Jobs: 2021 Index

Dr. Nima Sanandaji

ECEPR

European Centre for Policy Reform and Entrepreneurship, in collaboration with Nordic Capital

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Summary: Nordic nations best at retaining Brain Business Jobs during the 2020-crisis, but long-term winners are Eastern and Central European capital regions.

The study *The Geography of Europe's Brain Business Jobs* measures the share of the working age population across Europe employed in highly knowledge-intensive enterprises. The data is compiled through analysis of detailed structural business statistics for European countries and regions. This fourth edition of the index expands the analysis, by looking at the changes in volume index of production and by mapping the successful start-up companies that exist in various European brain business hubs. The study finds significant shifts in knowledge-intensive jobs in 31 European countries and 283 regions within these countries.[1] Several interesting findings emerge:

Steady growth of knowledge-intensive jobs turned to recession in 2020, except in the Nordics. Before 2020, knowledge-intensive jobs were growing steadily in Europe. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs fell for the first time, by nearly 167 000. The exception is the Nordic region, which added 8 600 brain business jobs during 2020, despite the global corona crisis. Most of the brain business job losses occurred in the tech-sector, in which 118 000 jobs were lost. In ICT close to 22 000 jobs were lost, compared to 15 000 in advanced services and 11 000 in creative professions.

Creative professions have been hit hard by the 2020 crisis. Knowledge-intensive companies have fared better during 2020 compared to the rest of the economy. The volume production of all manufacturing firms fell by 16

1 Regional analysis includes only 30 countries, as data of high quality does not exist yet for Switzerland.

percent during the second quarter, as compared with same quarter previous year, but only by 8 percent in the tech-sector. During the third quarter, the total manufacturing index of production fell by 4 percent, but only 2 percent in the tech-sector. Volume index of all services fell by 15 percent during the second quarter, compared to 9 percent in advanced services. During the third quarter, volume index of production fell by 7 percent in all services, and 3 percent in advanced services. However, the creative professions experienced a significant fall of volume index of production, in form of a 21 percent drop in the second quarter and 9 percent in the third quarter. An explanation is that parts of the film, television and music sectors have experienced significant difficulties in keeping up production, due to the social distancing made necessary by the corona pandemic.

The ICT-sector fares well despite the crisis. The ICT sector also stands out, since its volume index of production has increased by 1 percent in the second quarter of 2020, and 2 percent in the third quarter, compared to same quarters the previous year. The fact that the ICT sector has experienced a slight increase of production, but also a reduction of jobs, during the year, can be explained by increased automation. The corona pandemic has given rise to a significant shift towards the digitalization of the economy, making it more common for employees to work from home, as well as speeding up the already on-going transition to online shopping. If current trends continue, within a year or two ICT will outpace tech as Europe's main brain business sector.

Successful new European firms often combine service innovations with digital platforms for service delivery. A study of 150 innovation companies, founded in the top-30 leading European brain business jobs hubs, finds that the most common forms of innovations are business service innovation, consumer service innovation, and digital infrastructure/platform innovation. Often firms rely on digital platforms for service delivery. The least common form of innovation is manufacturing technology. Several of the innovative companies are pushing technological and social change, for example by relying on space technology or offering solutions for the sharing economy.

New Nordic firms in brain business hubs have significant lead in investments. The average company in Eastern and Central European brain business hubs, founded since 2015, has attracted 10 million Euros in funding, compared to 23 million in Southern Europe, and 35 million in Western Europe. The innovation firms of the Nordic regions on the top-30 regional list, have on average attracted 85 million Euros in investments, far outstripping firms in other parts of Europe.

Fostering brain business jobs important aspect of reducing regional unemployment. The European region with the highest concentration of brain business jobs is the Slovakian capital region of Bratislava, which has a low unemployment rate of 2.4 percent. A comparison of 280 European regions shows that a strong link exists between high brain business jobs concentration and low unemployment, and that this link is driven by regions with low brain business jobs concentration. Amongst regions with up to 50 brain business jobs per 1 000 working age population, a straight-forward linear regression shows that 28 percent of the variation of unemployment can be explained by differences of brain business jobs concentration.

Geographic equalization of brain business jobs in Europe. Despite the 2020 slump, the long-term trend is a rapid increase of the share of the working age population of European nations employed in knowledge-intensive enterprises. Growth is particularly strong in the Eastern and Central Europe, and some Southern European nations. The two greater regions of Europe with lower brain business jobs concentration are thus gradually catching up to Northern and Western Europe, which have a higher concentration of knowledge-intensive jobs, but a slower rate of increase. Since 2014, Cyprus has experienced an almost 50 percent increase of brain business jobs per capita, while Slovakia, Hungary, Poland, Latvia, Portugal, and Bulgaria have experienced an increase of a third or more. Ireland is the Western European nation with the strongest rate of growth, with an increase of 25 percent since 2014. In Finland, the share of the working age population employed by knowledge-intensive enterprises has risen by 16 percent since 2014, the strongest growth rate in Northern Europe.

Brain businesses surge in Eastern and Central Europe. Estonia and Hungary currently have a higher share of their working-age population employed in knowledge-intensive businesses, than several richer European nations, such as Norway, Belgium, Austria, and France. This reflects a major shift in the business landscape of Europe, taking place over the past years. Lower cost of labour and significant share of young people investing in higher education has led to a brain business surge in Central and Eastern European nations. While some talents leave Eastern and Central European nations to work in Western and Northern Europe, those who stay drive up the brain business concentration.

Warsaw is the fastest growing region, alongside Bratislava and three German regions. On a regional basis, the most significant increase of brain business jobs has occurred in Warsaw, the Polish capital region, followed by the Slovakian capital region Bratislava, and the German region of Braunschweig. Braunschweig was an important centre of commerce already in medieval Germany and is one of several strongly growing German regions. Two other German regions, Mittelfranken and Karlsruhe, are also among the top-5 growing regions.

Bratislava builds on its leading position. Bratislava is the European region that has the highest total share of brain business jobs per capita, as fully 22 percent of the working age population of the region is employed in knowledge-intensive businesses. The 2019 edition of the brain business jobs index found that Bratislava is also the region with the second highest rate of increase in knowledge-intensive jobs, which is also the finding in this year's index. The Slovakian capital region succeeds by combining its cluster effect with competitive wages for knowledge workers.

Prague, Budapest, Stockholm and Oberbayern maintain strong performance. Bratislava is followed by the Czech capital region Prague in second place as the region with highest share of working age population employed in knowledge-intensive jobs. On third place is the Hungarian capital region Budapest, followed by Sweden´ s capital region Stockholm, and the Oberbayern region in Germany. The Oxford Region in the UK has fallen to sixth place in this year's ranking. The French capital region of Paris is on seventh place, nar-

rowly ahead of the UK capital region of London ranked eight. The Danish capital region of Copenhagen has the ninth highest concentration of brain business jobs, in comparison of 283 regions, slightly ahead of the Hamburg region in Germany on tenth place.

Paris only region with more than one million brain business jobs. While the concentration of brain business jobs is higher in regions such as Bratislava and Stockholm, Paris and London are the dominant regions in terms of total brain business jobs. In Paris, there are fully 1,2 million employees in knowledge-intensive businesses. London follows on second place with 923 000, Oberbayern on third place with 492 000, the Spanish capital region Madrid on fourth place with 427 000, and the Italian region of Lombardy on fifth place with 424 000.

Figur 1. Share of workforce in brain business jobs

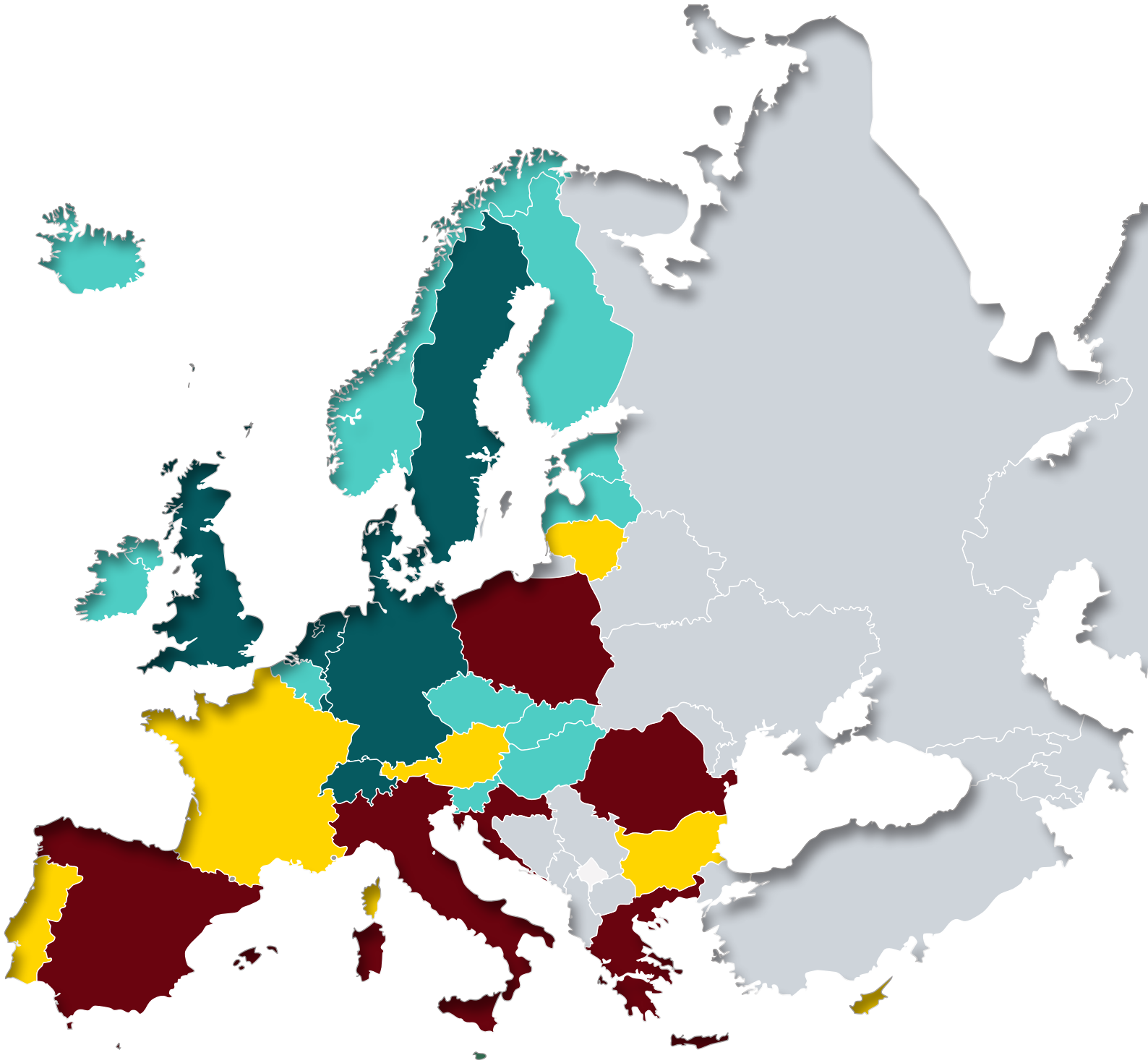


Table 1. Rate of change in brain business jobs concentration (per 1000 working age inhabitants) between 2014 and 2020.

Cyprus	49.8%
Slovakia	42.1%
Hungary	35.1%
Poland	35.0%
Latvia	33.2%
Portugal	32.5%
Bulgaria	32.5%
Estonia	32.0%
Ireland	25.1%
Malta	24.0%
Spain	23.1%
Slovenia	21.8%
Romania	21.4%
Czechia	20.9%
Belgium	20.0%
Lithuania	19.9%
Germany	18.9%
Croatia	17.4%
Finland	16.1%
Netherlands	14.5%
Italy	13.1%
United Kingdom	11.8%
Sweden	6.7%
Norway	6.2%
Luxembourg	6.1%
France	2.3%
Switzerland	2.3%
Austria	-1.7%
Denmark	-3.2%
Greece	-5.6%
Iceland	-15.4%

Structural business statistics for years 2014-18 and quarterly business statistics for years 2019-20 (based on Q2 data for each year).

What innovations are driving new business development, in Europe's 30 strongest brain business hubs?

This year's index includes a mapping of newly founded innovation companies, in the 30 leading brain business jobs hubs of Europe. The source of the data is Crunchbase, a leading international enterprise database, which includes information on firm activity, investments, industry trends and innovations. For each region, the 5 top-ranking firms on the Crunchbase founded since 2015 have been examined. The result is data on 150 European innovation companies, with focus on their key innovations and financing. Crunchbase was originally created as a tool for investors to find promising start-up firms to invest in and has since grown to become perhaps the most comprehensive global business database, with focus on firm innovation. Information on Crunchbase is gathered via four different channels: from the listed companies, through machine-learning, from a team of researchers working at the database, and lastly through some half a million active users of Crunchbase, who are able to contribute information as well as accessing it.

Information on investments and other changes in the firms listed on Crunchbase is often updated live, or the day following the investment. While Crunchbase is created mainly as a tool for investors and entrepreneurs, it has also gained considerable academic interest during recent years. Jean-Michel Dalle, Matthijs den Besten and Carlo Menoni for example during 2017 published a study for the OECD on the possibilities to use Crunchbase for research in economics and management. The authors noted that Crunchbase is attracting interest from researchers in different fields, since it contains unique data on the start-up eco-system.[2] Yuxian Eugene Liang and Soe-Tsyr Daphne Yuan have relied on Crunchbase for studying firm investments, with the motivation that Crunchbase is the largest global database with profiles for the included firms.[3] Ross Brown and Augusto Rocha have used the database in order to study the actions of investors during the uncertainty created by the covid-19 pandemic.[4]

2 Dalle, Den Besten & Menon (2017).

3 Liang & Yuan (2016).

4 Brown & Rocha (2020).

An example of the 30 regions studied is the Slovakian capital region of Bratislava, the European region with the highest concentration of brain business jobs. In the Bratislava region, the five highest ranked companies on the Crunchbase database are Hilbi (which offers an AI-enhanced communication platform which can facilitate instant payments), altFINS (cloud-based platform allowing investors and traders to track and analyze digital assets across various platforms), Eterbase (a cryptocurrency exchange), eyerim (online store that offers designer sunglasses and prescription glasses) and iERP.ai (provides pre-packaged artificial intelligence algorithms to businesses). The key innovations of the three first firms include business services and digital infrastructure/platform, with altFINS and Eterbase additionally also having innovation in consumer services.

One of the most common feature amongst the 150 businesses studied, in the 30 leading brain business hubs of Europe, is indeed a combination of business services (sometimes also consumer services) and digital infrastructure/platform for providing the service in question.

One of the most common feature amongst the 150 businesses studied, in the 30 leading brain business hubs of Europe, is indeed a combination of business services (sometimes also consumer services) and digital infrastructure/platform for providing the service in question. Eyerim is an example of a company on the list which does not rely on any innovation, as the concept of online store is already well established. An important point is that firms do not necessarily need to rely on innovation to succeed, as they can alternatively rely on already well-established business models, in this case online sales. iERP.ai offers an innovative business service, coupled with innovation in the software/AI/digital media category (in this case, AI).

Figure 2. Firm innovation reliance, panel of 150 high-ranking businesses founded since 2015 in 30-top brain buiness jobs centres of Europe (firms can rely on combination of innovations).

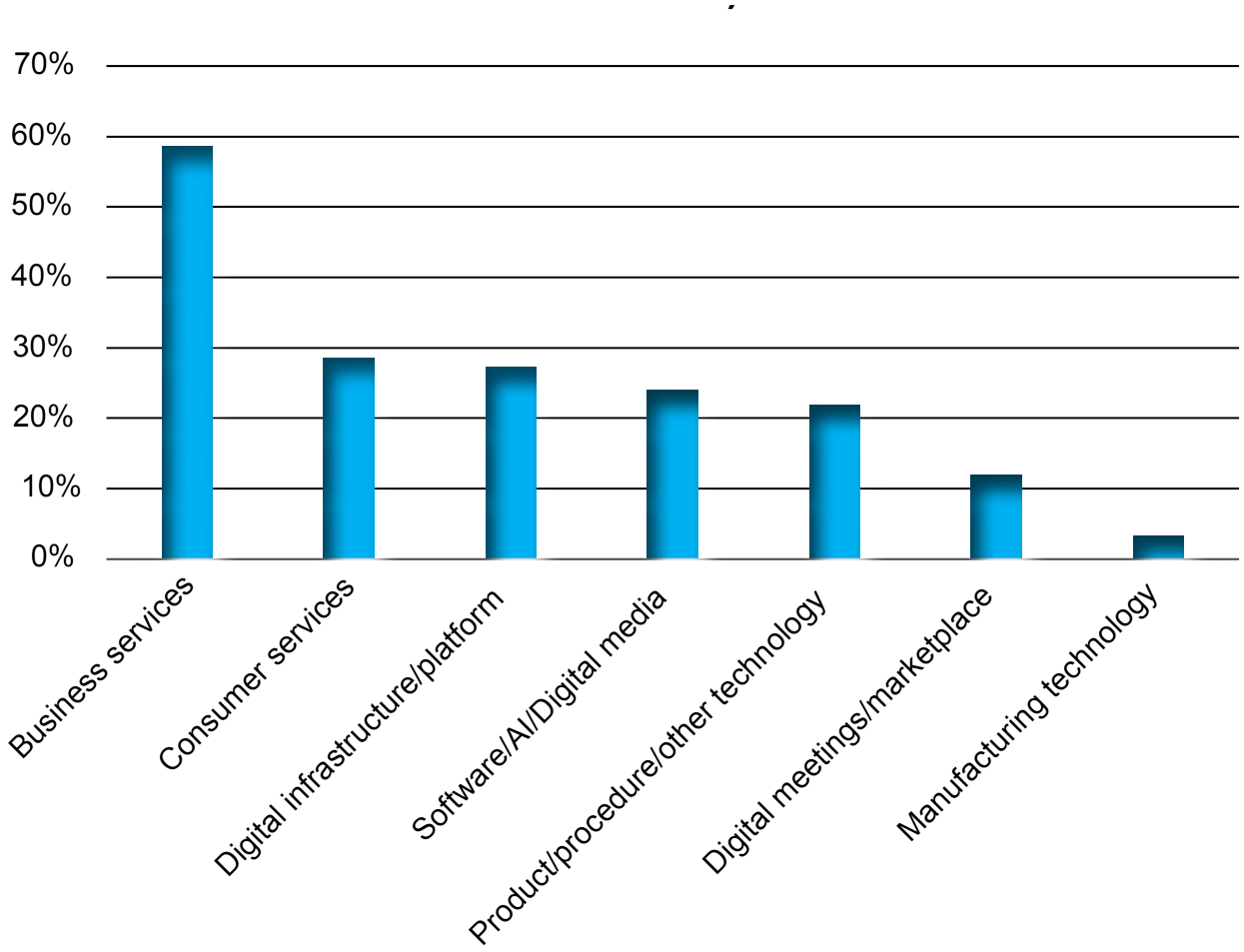


Figure 2 shows the innovation reliance, of the panel of 150 newly founded, and on Crunchbase highly ranked, firms in the 30 leading brain business hubs of Europe. A majority of 59 percent of the firms rely on business service innovations, while 29 percent rely on service innovations. Some firms offer services, often through a digital platform, to businesses as well as consumers. Of the firms, 27 percent rely on digital infrastructure/platforms, typically as a means of standardizing a form of service delivery. The highest-ranking firm in the Czech capital region of Prague, the region with the second highest concentration of brain business jobs in Europe, is for example GAMEE. The firm offers a social gaming network, that connects friends across casual-style games and gaming tournaments. The innovations of this firm fit in with the category of consumer services, as well as digital infrastructure/platform since the service is offered to consumers via a digital platform.

Software/AI/Digital media is a category of innovation that 24 percent of the firms rely on. An example from the Hungarian capital region of Budapest, the region with third highest concentration of brain business jobs, is Almotive, which develops software for automated vehicles. Often, software development in the innovative firms involves AI (artificial intelligence) aspects. Out of the 150 innovative firms, 22 percent rely on innovation in product/procedure/other technology. One of the leading newly founded firms in the Swedish capital region of Stockholm, which besides the Eastern and Central European nations has the highest concentration of brain business jobs in Europe, is Einride. The firm is a cargo and freight company that designs and builds technologies for transportation systems, mainly semi-autonomic trucks. Freight services are offered to partner companies. Einride engages in business service innovation, by offering an innovative freight service, and product/procedure/other technology innovation through the development of semi-autonomous freight vehicles.

Digital meetings/marketplaces are a form of innovation that 18 percent of the firms on the list rely on. In the Oberbayern region of Germany, one of the leading newly founded innovation companies is Demodesk, a cloud-based meeting platform that supports screen-sharing and video conferencing for inside and remote sales teams' demo. The firm offers a business service innovation, in the form of a digital place for meetings. The least common form of innovation is manufacturing technology, which merely 3 percent of the innovation firms rely on. An example is MiniBrew, from the Utrecht region in the Netherlands. The Utrecht region is unique as it has a somewhat higher concentration of brain business jobs even compared to the capital region of Amsterdam, which also is found on the top-30 regional list. MiniBrew build an all-in-one beer brewing machine, an innovation in manufacturing technology since the product being built is designed for production purposes. NanoWired, in the German Darmstadt region, develops NanoWelds, a 3D-integration technique based on a nanotechnology, which allows for joining and contacting of electrical components at room temperature. This is again an example of manufacturing technology innovation.

Some of the firms in the list rely on innovation within the sharing economy. VOI Technology in Stockholm for example owns, operates, and manages electric scooters for urban commuters. Dott, in the capital Netherlands region of Amsterdam, similarly offers dock-less,

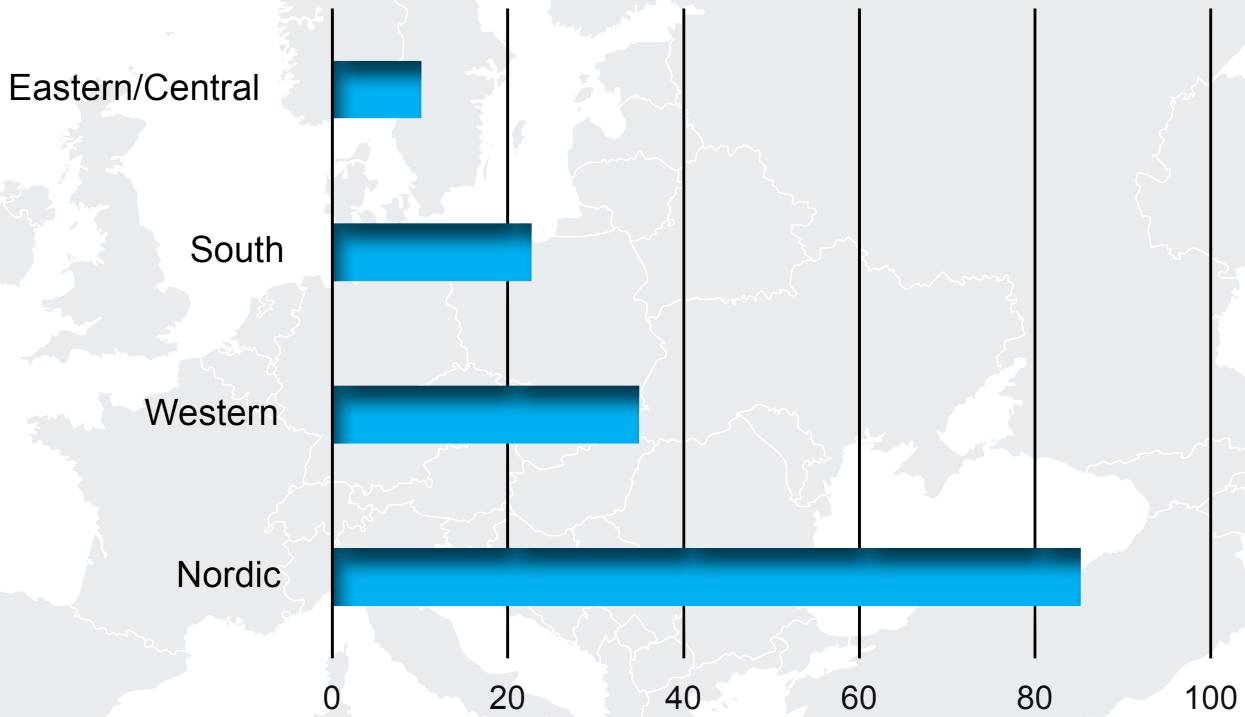
shared electrical scooters, and bikes as alternatives for short-distance travel. Others are within the health sector, such as Sensyne Health in the Oxford region, which operates digital healthcare services. ViViDoctor in the Belgian Waloon Brabant region, is another such example. The firm operates an online telemedicine platform that enables its users to make appointments with doctors in hospitals or independently.

Several firms on the list are focused on space technology. Examples include Space Products and Innovation, in Darmstadt, which is a space company specialized in satellite hardware and development, and Isar Aerospace, in the German region of Oberbayern, which offers access to space for small and medium satellites, enabling global satellite constellations. There are also notable innovations occurring in biotechnology and pharmaceuticals. Probably Genetics, in the German region of Karlsruhe, offers educational material and DNA sequencing tests to make it easy to find out if there is a genetic link to disease. FindMeCure, in the Bulgarian capital region of Sofia, makes it easy for individuals to find and participate in medical treatment studies.

There are, as shown in figure 3, geographical differences in funding for innovation businesses. The average leading innovation company in Eastern and Central Europe founded since 2015 has attracted 10 million Euros in funding, compared to 23 million in the average leading innovation firm of Southern Europe and 35 million Euros in the average leading innovation firm of Western Europe.[5] The innovation firms of the Nordic region have on average attracted 85 million Euros in funding, far outstripping the other regions.

5 The Spanish capital region of Madrid is the only Southern European region on this top-30 list, and therefore the Southern European metric is based on only data for five firms.

Figure 3. **Average fundindgs (million Euros) in the panel of 150 high-ranking businesses founded since 2015 in 30-top brain business jobs centres of Europe.**



Brain Business Jobs went into recession in 2020, but the crisis spells opportunity for ICT

During 2020 we have seen a dramatic slump in economic activity, due to the corona pandemic and the social distancing measures introduced to reduce the spread of the deadly disease. Global economic exchange and global cooperation have been impaired by the pandemic. When lockdown measures were introduced in March, European nations had limited cooperation and focused on internal damage control. Yet, cooperation throughout Europe soon gained strength, and European nations became increasingly involved in the global struggle against the pandemic. Significant advances in medicine and biotechnology have been achieved, leading to more rapid development of vaccines and medical treatments than any other time in human history. The corona pandemic will have long-lasting influence on the daily behaviour of people and businesses, with more focus on preventing and tracking dangerous diseases. It has also brought significant changes in economic activity, with shifts towards digital work and digital trade.

For the past 30 years, digitalization has been a key driving force in economic development. During the pandemic, as personal meetings were made difficult due to social distancing and limits on travel between countries, a further leap towards digital work occurred. More than before, businesses are keeping in contact through digital meetings. Employees have increasingly been working from home, or through a combination of work in the office and home. While much of this behaviour has been in response to the pandemic and safety measures put in place to limit the pandemic, part of the behavioural change is likely to continue during coming years. Many businesses find that they can reduce their costs by having less office space, and having the staff work from the office and the home alternatively. Companies and professionals are increasingly using digital meetings and digital tools to organize the work. Also, while the shift from physical to digital retail was already in place, it has been accelerated recently. The elderly in particular, but also the population as a whole,

have switched from physical to digital retail, a change in behaviour which is likely to remain even after vaccinations limit the extent and danger associated with the corona pandemic.

From an economic viewpoint, 2020 is therefore not only characterized by an pandemic-driven economic downturn, and significant stresses in the global economic exchange, but also a shift towards digitalization. The increased use of digital technologies for organizing work is important since it further lowers the barriers for companies to cooperate over geographical distances. Already previously editions of the brain business jobs index have found that significant growth long-term is occurring in Eastern and Central European countries, and some Southern European countries. In these parts of Europe, the cost of wage is lower, while an increasingly number of people are graduated with advanced knowledge. To a degree, talents from Eastern and Central and Southern Europe migrate to brain business jobs hub in richer European countries, to places such as London, Paris, Amsterdam, Stockholm, and Copenhagen. However, a stronger driving force is that the capital regions of the Eastern and Central European countries are growing with knowledge-intensive jobs. Often companies in these capital regions work closely with knowledge-intensive firms in Northern and Western Europe. The increased digitalization of work, which has occurred throughout Europe as an adjustment to the corona pandemic, makes it even more accessible than before to outsource jobs from Northern and Western Europe, to knowledge centres such as Bratislava, Prague, Budapest, Warsaw, Bucharest.

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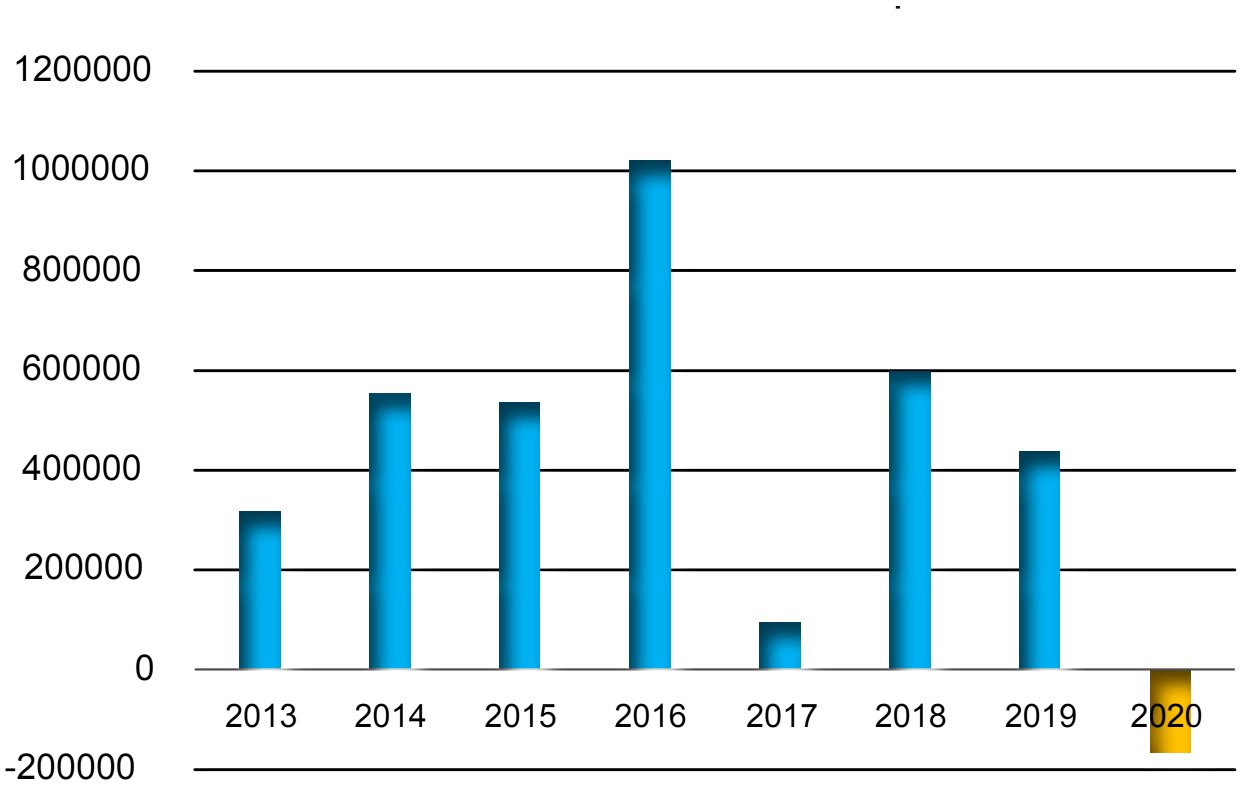
This fourth edition of *The Geography of Europe's Brain Business Jobs* maps the national and regional distribution of knowledge-intensive jobs—for 31 European countries and 283 regions within these countries. The study is based on analysis of structural business statistics, coupled with quarterly employment statistics for European economies. Through this analysis, the share of the working age population across Europe who work in the most knowledge-intensive parts of the economy is calculated. These brain business jobs are made up of employment in firms within highly knowledge-intensive parts of the tech sector, the ICT-sector, advanced services and creative professions.[6] In total, 5.4 percent of working age individuals in Europe worked in brain business jobs in 2014. By 2019, this share had risen to 6.3 percent. During 2020, the number of brain business jobs in Europe fell for the first time, although the fall was limited, so that the share of working age adults in Europe working in brain business jobs remain at 6.3 percent.

Figure 4. Annual change in number of Brain Business Jobs in Europe



6 The countries are the EU-27 members plus the UK, Switzerland, Norway and Iceland. These countries are referred to as Europe in this study. NUTS2-regional division of Europe is used. The methodology is described in the section: Mapping Europe's Brain Business Jobs. Regional division has been updated compared to last year's index. Structural business statistics is detailed, but since it relies on firm's annual accounts, and firms have different accounting years, the data measures the situation two years previously. Quarterly employment statistics (for Q2 of each year) is added to the analysis to estimate Brain Business Jobs also during 2019 and 2020.

Before 2020, knowledge-intensive jobs were growing steadily in Europe. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2016 the rate of growth was just over a million, while 2017 had a limited growth rate. With the exception of these two years, the rate of growth of brain business jobs has been relatively even in Europe. However, in 2020 the number of brain business jobs fell for the first time, by nearly 167 000. In Eastern and Central Europe, the number of brain business jobs fell by 58 400 during 2020 (see figure 4). The same rate of decline, 58 400, was recorded for the Southern European countries, while Western Europe experienced a similar reduction of 58 300 brain business jobs. The Nordic region stands out by having experienced a small growth of brain business jobs, of 8 600, during 2020. Most of the brain business job losses occurred in the tech-sector, in which 118 000 jobs were lost. In ICT close to 22 000 jobs were lost, compared to 15 000 in advanced services and 11 000 in creative professions.

A new feature in this year's index is that also structural business statistics on the volume index of production, for the four categories of brain business jobs (tech, ICT, advanced services, and creative professions) are analysed.[7] This data shows that knowledge-intensive companies have fared better during 2020 compared to the rest of the economy, with creative professions being an exception. As shown in figure 5, the volume production of all manufacturing firms fell by 16 percent during the second quarter, as compared with same quarter previous year, but only by 8 percent in the tech-sector. During the third quarter, total manufacturing index of production fell by 4 percent, but only 2 percent in the tech-sector. Similarly, volume index of all services production fell by 15 percent during the second quarter, compared to 9 percent in advanced services.

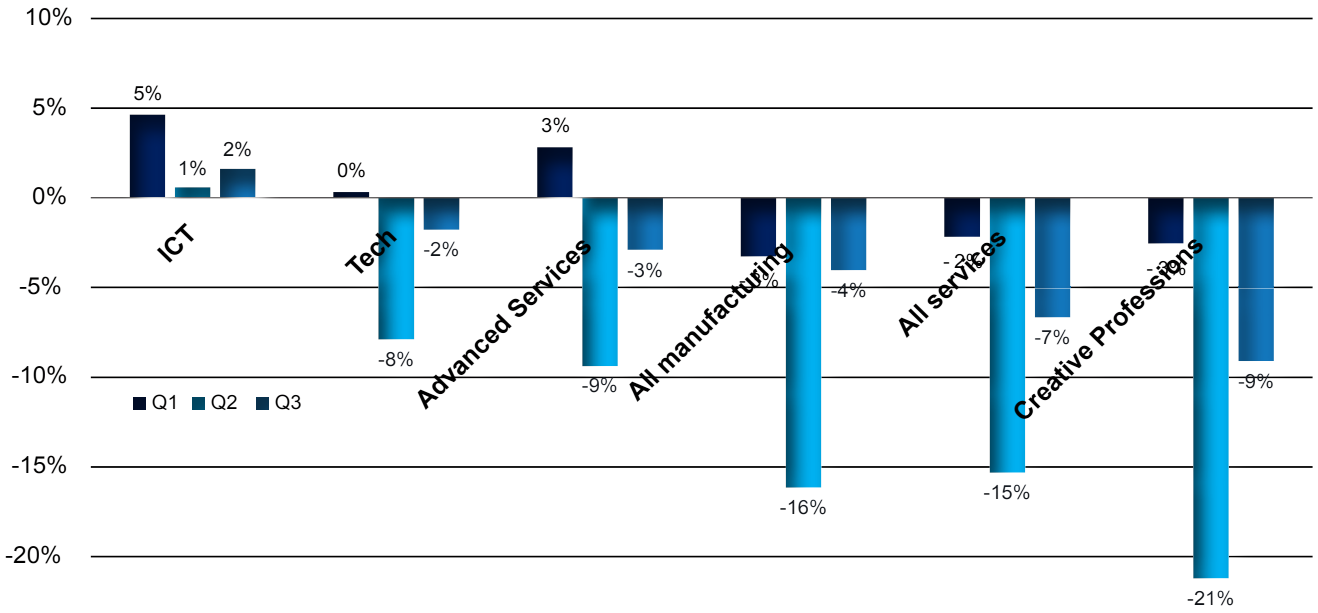
During the third quarter, volume index of production fell by 7 percent in all services, and 3 percent in advanced services. Creative professions however experienced a significant fall of volume index of production, of 21 percent in the second quarter and 9 percent in the third quarter. An explanation is that parts of the film/TV/music sectors have

7 Quarterly production volume data are not reported for each European country and each sector. A panel of eight countries with best available data (Bulgaria, Czechia, France, Latvia, Slovenia, Slovakia, Finland and Sweden) has been used in the analysis. For management consultancy activities, Czechia was replaced with Romania due to data availability. For high-tech manufacturing and pharmaceuticals, Latvia, Slovenia, Slovakia and Finland were not included (lack of data) while Romania was instead. The panel is representative of the European countries, as evident by data on production volumes in all manufacturing, for which the panel gave nearly identical results as when including 30 European nations (all nations in this study, except Iceland).

experienced significant difficulties in keeping up production, due to the corona-pandemic and social distancing. The ICT-sector stands out, since it has in fact increased volume index of production by 1 percent in the second quarter, and 2 percent in the third quarter, compared to same quarters the previous year. The number of jobs in ICT firms thus fell somewhat, while production volume increased slightly. This can be explained by increased automation. This trend is in line with a significant shift towards digital solutions during the 2020 corona crisis. Knowledge intensive firms in tech and advanced services are thus proving more resilient to the crisis compared to all firms in manufacturing and services. The ICT sector is narrowly growing, despite the 2020 crisis, while creative professions are instead hit hard by the crisis.

Knowledge intensive firms in tech and advanced services are thus proving more resilient to the crisis compared to all firms in manufacturing and services. The ICT sector is narrowly growing, despite the 2020 crisis, while creative professions are instead hit hard by the crisis.

Figure 5. Volume indexes of production, Q1-Q3 2020, as share of same quarters in 2019.



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The share of Brain Business Jobs differs markedly across Europe. At one end of the spectrum are Switzerland, Sweden, and the Netherlands, in which between 9.0 to 10.4 percent of the working age population are employed in brain business jobs. On the other end of the spectrum is Romania and Greece where the same share is below 4 percent. The country ranking still follows a geographical division of Europe: with Northern and Western Europe at top and Southern, Central and Eastern Europe at bottom. Yet, same as in previous years indexes, the data shows that significant changes in the geographical distribution is occurring. Despite the 2020 slum, the long-term trend is a rapid increase of the share of working age population of European nations that work in knowledge-intensive enterprises. The growth is particularly strong in the Eastern and Central European nations, and some Southern European nations. The two regions with lower brain business jobs concentration are thus gradually catching up to northern and western Europe, which have a higher concentration of knowledge-intensive jobs, but a slower rate of increase.

Equalization of knowledge intensive jobs concentration is a strong economic force in Europe. Since 2014, Cyprus has experienced almost 50 percent increase of brain business jobs per capita. Slovakia, Hungary, Poland, Latvia, Portugal, and Bulgaria have experienced an increase of a third or more.

Table 2 shows the national the national ranking of brain business jobs concentration, for the 31 European countries. The growth of concentration of brain business jobs between 2014 and 2020 is also shown. Overall, the growth rate is clearly higher for the countries with low share of brain business jobs, except for Greece which has few and reduced share. Equalization of knowledge intensive jobs concentration is a strong economic force in Europe. Since 2014, Cyprus has experienced almost 50 percent increase of brain business jobs per capita. Slovakia, Hungary, Poland, Latvia, Portugal, and Bulgaria have experienced an increase of a third or more. Ireland is the Western European nation with the strongest rate of growth, with an increase of 25 percent since 2014. In Finland, the share of the working age population employed by knowledge-intensive enterprises has risen by 16 percent since 2014. This represents the strongest growth rate in the Nordic region.

Table 2. National Ranking of Brain Business Jobs

(All brain business sectors, jobs per 1 000 working age population)

2020 Rank	Country	2014	2015	2016	2017	2018	2019	2020	% change 2014-20
1	Switzerland	101	100	99	103	103	104	104	2.3%
2	Sweden	90	91	94	96	96	97	96	6.7%
3	Netherlands	78	80	82	84	88	90	90	14.5%
4	Luxembourg	82	82	83	82	86	87	87	6.1%
5	Denmark	90	91	85	87	87	88	87	-3.2%
6	Germany	68	70	74	76	80	82	81	18.9%
7	United Kingdom	73	76	88	80	81	82	81	11.8%
8	Finland	68	68	69	67	73	73	79	16.1%
9	Ireland	62	65	70	109	77	78	77	25.1%
10	Estonia	57	59	60	63	68	71	75	32.0%
11	Hungary	53	56	60	63	66	72	72	35.1%
12	Malta	58	64	67	68	76	77	72	24.0%
13	Norway	65	67	66	66	67	69	70	6.2%
14	Belgium	57	58	61	58	64	67	68	20.0%
15	Slovenia	54	56	58	61	65	67	66	21.8%
16	Iceland	78	77	80	79	73	71	66	-15.4%

2020 Rank	Country	2014	2015	2016	2017	2018	2019	2020	% change 2014-20
17	Czechia	53	55	59	62	64	66	64	20.9%
18	Latvia	48	52	57	60	67	68	64	33.2%
19	Slovakia	44	49	50	53	58	64	62	42.1%
20	Austria	60	60	60	62	59	60	59	-1.7%
21	Cyprus	38	41	44	46	54	56	57	49.8%
22	France	55	55	56	56	54	56	56	2.3%
23	Lithuania	43	46	49	52	54	52	51	19.9%
24	Portugal	38	40	42	45	50	52	51	32.5%
25	Bulgaria	36	39	42	45	48	49	48	32.5%
26	Spain	36	39	41	42	46	47	45	23.1%
27	Croatia	37	37	39	40	43	43	43	17.4%
28	Italy	38	39	40	41	42	43	43	13.1%
29	Poland	31	33	36	37	40	41	42	35.0%
30	Greece	41	37	38	39	40	39	38	-5.6%
31	Romania	30	31	33	34	36	38	36	21.4%

As in the previous three years editions of this index, significant shifts are found on the regional level. The capital regions of Central and Eastern European nations have some of the highest levels of brain business jobs concentration. The Slovakian capital region of Bratislava again emerges as the number one region in Europe in terms of the concentration of brain business jobs. Fully 22 percent of the working age population of the region is employed in knowledge-intensive businesses. The 2019 edition of the brain business jobs index found that Bratislava is also the region with the second highest rate of increase in knowledge-intensive jobs, which is also the finding in this year's index. Bratislava is followed by the Czech capital region Prague in second place as the region with highest share of working age population employed in knowledge-intensive jobs. On third place is the Hungarian capital region Budapest, followed by Sweden's capital region Stockholm, and the Oberbayern region in Germany. Many amongst the new generation growing up in Central and Eastern Europe work hard to learn those skills which are in hot demand in the marketplace, such as programming and engineering. While the countries still have not reached the levels of Northern and Western Europe, their capital regions are becoming hotbeds for knowledge-intensive occupations—relying on an ample supply of talent combined with lower wages and typically business-friendly taxation.

On a regional basis, the most significant increase of brain business jobs has occurred in Warsaw, the Polish capital region, followed by the Slovakian capital region Bratislava, and the German region of Braunschweig. Braunschweig was an important centre of commerce already in medieval Germany and is one of several strongly growing German regions. Two other German regions, Mittelfranken and Karlsruhe, are also among the top-5 growing regions. Germany stands out in this comparison, as the country has many different strong brain business hubs. While Berlin is strong in terms of brain business jobs concentration, and growth of same, it is one among many hubs in the country.

In France, on the other hand, much of brain business jobs are focused on the Paris region. In Paris, there are fully 1,2 million employees in knowledge-intensive businesses. London follows on second place with 923 000, Oberbayern on third place with 492 000, the Spanish capital region Madrid on fourth place with 427 000, and the Italian region of Lombardy on fifth place with 424 000. The capital region of Romania, which as a nation has the lowest concentration of brain business jobs per capita, is Bucharest. With 203 000 brain business jobs,

Bucharest ranks on 14th place in brain business jobs concentration amongst the European regions and has additionally strong growth performance. Romania and Poland are two examples of nations which lag in brain business jobs, but have strong increase over time, and particularly strong rate of growth in their respective capital regions. Greece on the other hand stands out as having a low and reducing share. This comparison shows that while catch-up opportunities are strong for countries with a lower share of knowledge intensive firm occupation, it is not a force of nature, and instead relies on policies and institutions that boost knowledge firm growth and encourage education.

Table 3. Regional Ranking of Brain Business Jobs

Rank	Region	All brain business sectors, jobs per 1 000 working age population
1	Bratislava	224.4
2	Prague	197.4
3	Budapest	180.3
4	Stockholm	178.9
5	Oberbayern	171.5
6	Berkshire, Buckingham-shire and Oxfordshire	169.5
7	Paris	165.6
8	London	163.4
9	Copenhagen	158.0
10	Hamburg	156.1
11	Warsaw	145.7
12	Utrecht	144.7
13	Walloon Brabant	136.9
14	Bucharest	134.5
15	Amsterdam	133.2
16	Oslo	132.7
17	Darmstadt	130.8
18	Berlin	130.5

19	Köln	124..8
20	Helsinki	124.1
21	Madrid	116.6
22	Bedfordshire and Hertfordshire	116.5
23	Karlsruhe	116.2
24	Mittelfranken	115.8
25	Sofia	115.5
26	North Eastern Scotland	114.6
27	Vienna	114.0
28	Brussels	113.5
29	Vilnius	109.7
30	Cheshire	106.5
31	Stuttgart	106.2
32	Surrey, East and West Sussex	101.2
33	Lisbon	98.5
34	Flemish Brabant	97.4
35	Ljubljana	95.5
36	Düsseldorf	94.9
37	Gloucestershire, Wiltshire and Bristol/Bath area	93.8

38	Hampshire and Isle of Wight	93.5
39	East Anglia	88.2
40	Antwerp	86.3
41	Bremen	85.5
42	Västsverige	85.2
43	Noord-Brabant	84.3
44	Zuid-Holland	81.5
45	Sydsverige	80.8
46	Iceland	80.7
47	Braunschweig	79.8
48	Herefordshire, Worcestershire and Warwickshire	78.9
49	Malta	77.3
50	Greater Manchester	74.5

Capital regions marked in blue. Smaller countries such as Iceland and Malta make up single NUTS2 regions and are marked in green. Regional data not available for Switzerland. Regional data is based on the 2018 distribution of brain business jobs.

Mapping Europe's Brain Business Jobs

For an investor, a business or employee choosing where to locate, the characteristics of regions and countries matter. Previous studies that have attempted to identify knowledge-intensive industries tend to end up with the following four knowledge-intensive types of business, namely the *tech sector, ICT (information and communications technology), advanced services, and creative professions.* These broad fields are in the data analysis divided into twelve subfields, as shown below. This comprehensive way of defining knowledge business jobs includes not only those who work with novel technological solutions, but also the creators and advanced service providers who play a key role in modern societies.

Table 4. Division of Brain Business Jobs

Tech sector	High-tech Manufacturing Engineering/Architecture Research and Development Pharmaceutical industry
ICT	Telecom IT Services Computer Programming
Advanced services	Head office Management Advertising and Market Research
Creative professions	Publishing Film/TV/Music Design and other Creative Work

The source of data is structural business statistics, published by the European statistics agency Eurostat. Through this comprehensive database of activity in the business sector, the share of people who work in *highly specialized knowledge-intensive work places or local units of firms* are measured. Thus, employees of local units of larger companies, focused, for example, on high tech manufacturing, are counted as brain business jobs. A potential shortcoming of this approach is that, for example, administrators working in specialized IT-companies are counted as brain business workers, while IT-specialists in sectors such as construction are not. For some purposes, for example determining how many people belong to different professions, this might constitute a measurement error. For the purposes of this report, however, mapping how many people work in advanced knowledge-intensive firms is the more interesting metric since it reflects the size of brain businesses.

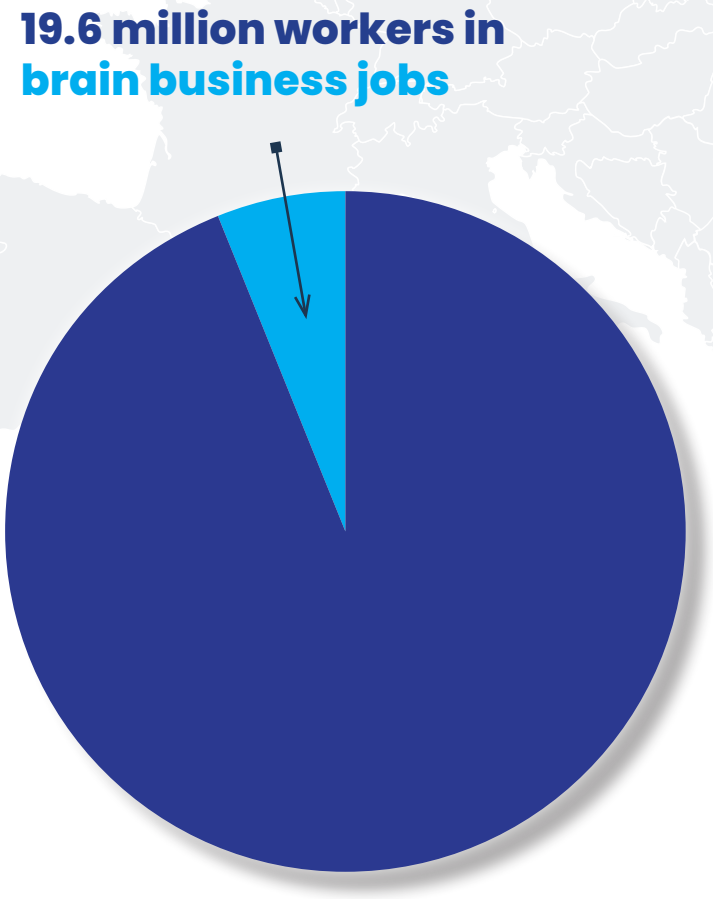
Structural business statistics is highly detailed, but since it relies on firms' annual accounts, and firms have different accounting years, the data measures the situation two years previously. Quarterly employment statistics (for Q2 of each year) is added to the analysis to estimate brain business jobs also during 2019 and 2020. The technical source of regional data is SBS data by NUTS 2 regions and NACE Rev. 2. The statistical unit used for regional SBS is generally the local unit, which is an enterprise or part of an enterprise situated in a geographically identified place. Local units are usually classified under NACE according to their main activity. Quarterly production volume data are not reported for each European country and each sector. A panel of eight countries with best available data (Bulgaria, Czechia, France, Latvia, Slovenia, Slovakia, Finland, and Sweden) has been used in the analysis.

Short-term and long-term business data, as well as population data, all have Eurostat as their source. Following Brexit, quarterly data over changes in labour input are no longer reported by the UK, as the information is now deemed to be confidential. Structural business data is however still published for the UK. To calculate the brain business jobs concentration for the UK, an assumption is made that quarterly changes in labour output follows the average of the other European countries. This means that the total brain business concentration of the UK can be calculated for 2018 and estimated for 2019 and 2020.

National and regional data for 31 countries is included in this study. These countries are the 27 EU member-states

plus the UK, Switzerland, Norway, and Iceland. Regional data is based on the 2018 distribution of brain business jobs, while national data ranges from 2014 to 2020. Data over the working age (20-64 years old) population is calculated for the corresponding years in each region and country—again with Eurostat as the source. As shown in figure 6, 6.5 percent of the working age population of the 31 studied European countries fit the definition of Brain Business Employees.

Figure 6. The Brain Business Workers of Europe



312 million working-aged individuals live in the 31 European countries

Table 5. Detailed Brain Business Jobs Ranking

(Jobs per 1 000 working age population)

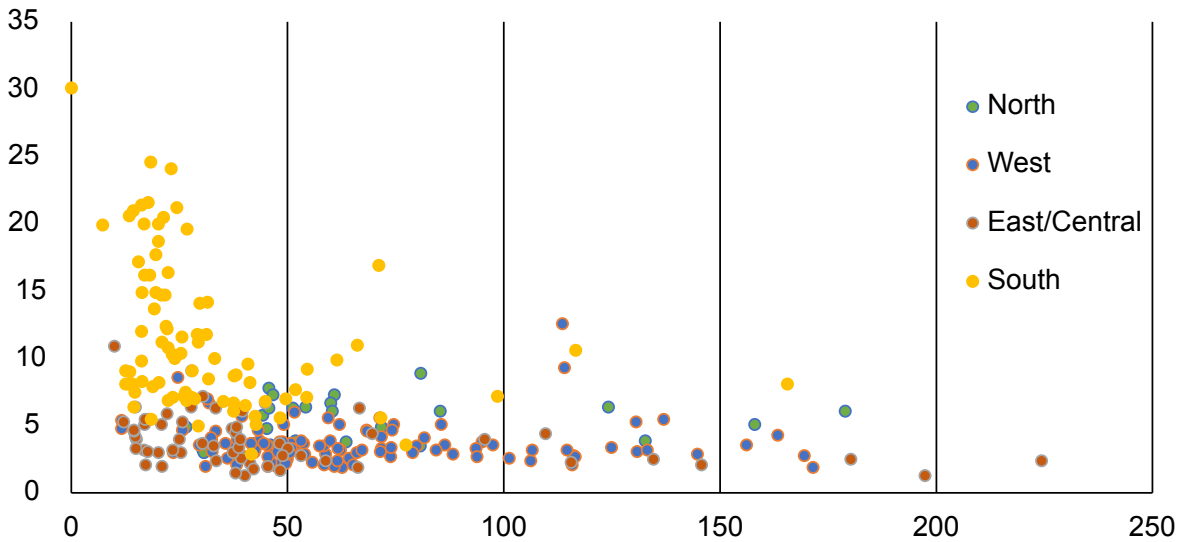
Cumulative ranking	Country	All knowledge-intensive sectors	Tech sector ranking	Tech sector per capita	ICT ranking
1	Switzerland	103.6	1	53.5	13
2	Sweden	95.6	4	29.3	2
3	Netherlands	89.7	10	22.4	7
4	Luxembourg	87.5	14	18.8	1
5	Denmark	86.8	3	30.2	11
6	Germany	81.3	2	30.6	12
7	United Kingdom	81.1	12	21.1	10
8	Finland	79.3	5	26.0	4
9	Ireland	77.2	6	26.0	5
10	Estonia	74.6	17	17.1	3
11	Hungary	72.1	7	25.2	16
12	Malta	71.9	25	13.6	8
13	Norway	69.6	8	23.6	14
14	Belgium	67.8	15	17.6	19
15	Slovenia	66.1	13	20.7	21
16	Iceland	65.8	18	17.1	9
17	Czechia	64.0	9	23.1	18
18	Latvia	63.6	24	13.7	6
19	Slovakia	62.4	21	15.3	17
20	Austria	58.5	11	21.8	23
21	Cyprus	57.2	29	10.4	20
22	France	55.9	16	17.4	22
23	Lithuania	51.1	23	13.8	24
24	Portugal	50.7	27	13.2	25
25	Bulgaria	47.9	31	10.2	15
26	Spain	44.7	22	14.3	30
27	Croatia	43.3	20	15.3	29
28	Italy	42.8	26	13.4	27
29	Poland	41.8	28	11.1	26
30	Greece	38.4	19	16.2	31
31	Romania	35.8	30	10.4	28

ICT per capita	Advanced services ranking	Advanced services per capita	Creative professions ranking	Creative professions per capita
23.2	7	18.7	18	8.3
33.4	8	17.9	4	14.9
26.5	1	26.9	5	13.9
46.1	12	15.1	24	7.4
24.0	11	15.4	1	17.1
23.6	13	15.0	9	12.1
25.4	4	21.0	6	13.5
28.4	20	12.3	8	12.6
27.7	10	16.1	25	7.4
31.3	16	13.4	7	12.7
21.3	15	14.0	11	11.7
25.9	3	24.2	21	8.1
22.0	25	8.4	2	15.6
19.3	2	24.3	28	6.6
18.5	9	17.4	14	9.5
25.6	26	7.9	3	15.1
19.3	23	9.7	10	11.8
27.1	18	12.6	13	10.2
19.9	5	19.6	23	7.6
16.9	19	12.5	26	7.3
18.6	6	18.8	15	9.3
17.0	21	10.1	12	11.4
16.4	17	12.7	19	8.3
15.2	14	14.0	17	8.4
21.9	31	6.7	16	9.1
13.4	24	8.9	22	8.0
13.9	29	7.0	27	7.1
14.2	28	7.0	20	8.2
14.5	22	9.8	29	6.4
8.0	27	7.9	30	6.2
13.9	30	6.8	31	4.7

Brain Business Jobs and Unemployment

What is the link between brain business jobs, on a regional level, and unemployment? This year's index studies the link on brain business jobs concentration, during the year 2018, and the unemployment on regional level, for 2019. In both cases, the most recently available data source is used. The dataset includes all regions except three, for which unemployment data is not available through Eurostat. Figure 7 shows the link between unemployment and brain business jobs concentration, among 281 European regions. The region with the highest concentration of brain business jobs, the Slovakian capital region of Bratislava, on the other hand has a low unemployment rate of 2.4 percent. Among the Eastern/ Central European countries, and the Southern European countries, a strong link is found between high brain business jobs concentration and low unemployment.

Figure 7. Unemployment and BBJ concentration, strong link in 280 European regions



Brain business jobs (BBJ) concentration, per 1000 citizens in working age, based on structural business accounts for 2018, is compared to the 2019 unemployment rate (15-74 y). Source for both data: Eurostat. The link between high share of BBJ and low unemployment is driven by Eastern/Central and Southern European regions.

Among the Eastern and Central European countries, and the Southern European countries, a strong link is found between high brain business jobs concentration and low unemployment. The same clear link is however not found in the Western and Northern European countries. The data shows that for regions with low levels of brain business jobs, the link between unemployment and brain business jobs concentration is both clear and strong, while the same is not true for regions that have a higher concentration of knowledge-intensive employment. The capital regions of Western and Northern European regions for example sometimes combine high rates of brain business jobs per capita with quite high levels of unemployment.

In figure 8, the European regions are divided in three groups, depending on the concentration of brain business jobs per capita. The first group of regions, with up to 50 brain business jobs per 1 000 working age population, shows a strong and clear link between knowledge-intensive jobs concentration and unemployment. For these regions, 28 percent of the variation of unemployment can be explained by differences of brain business jobs concentration, according to a straight-forward linear fit to data, including outliers. For the other two groups of regions, with 51-100 and 101+ respectively, concentration of brain business jobs per 1 000 working age population, weaker and not statistically significant links exist. This analysis shows that strengthening brain business jobs in those regions which have limited knowledge-intensive sectors can be part of the strategy for reducing unemployment on the regional level, throughout Europe.

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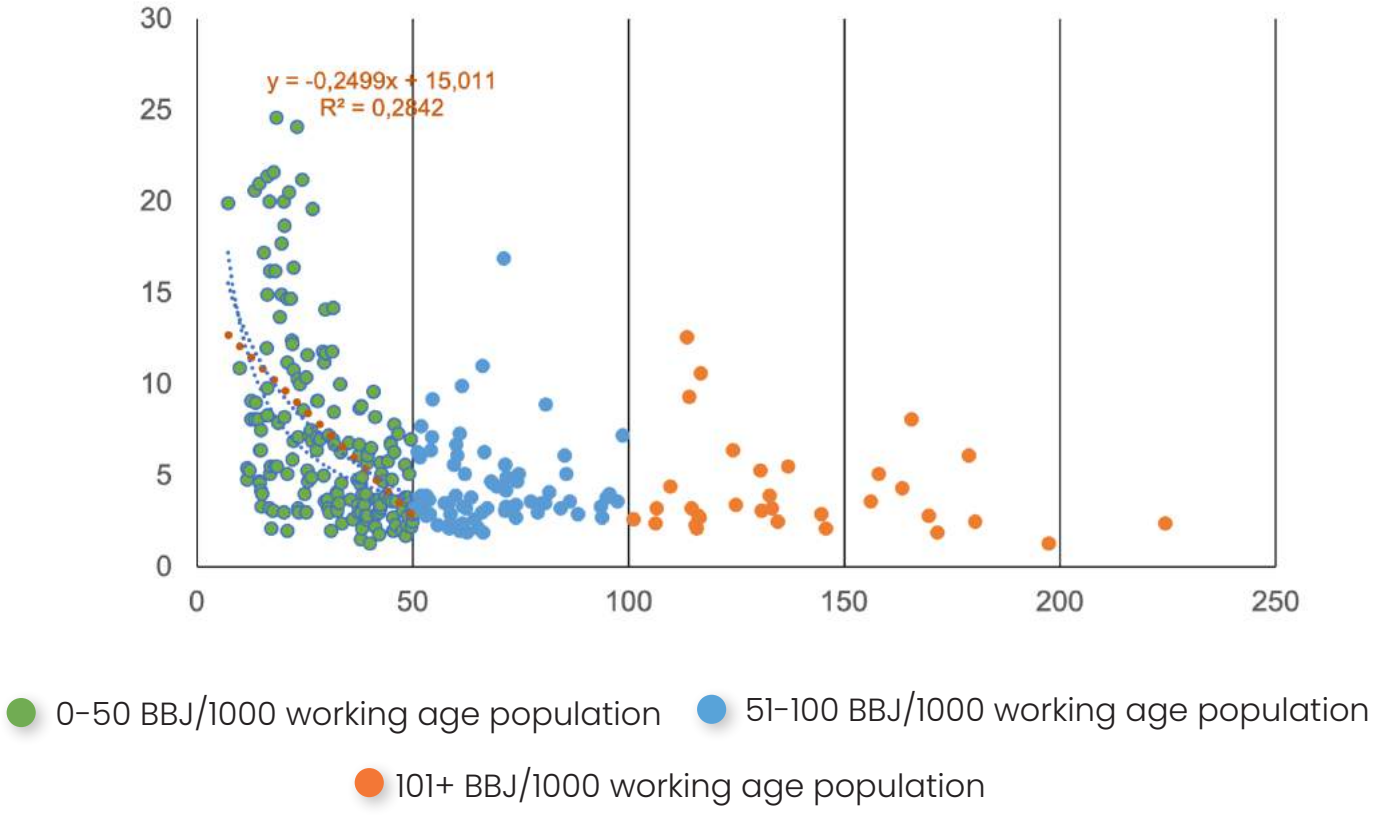
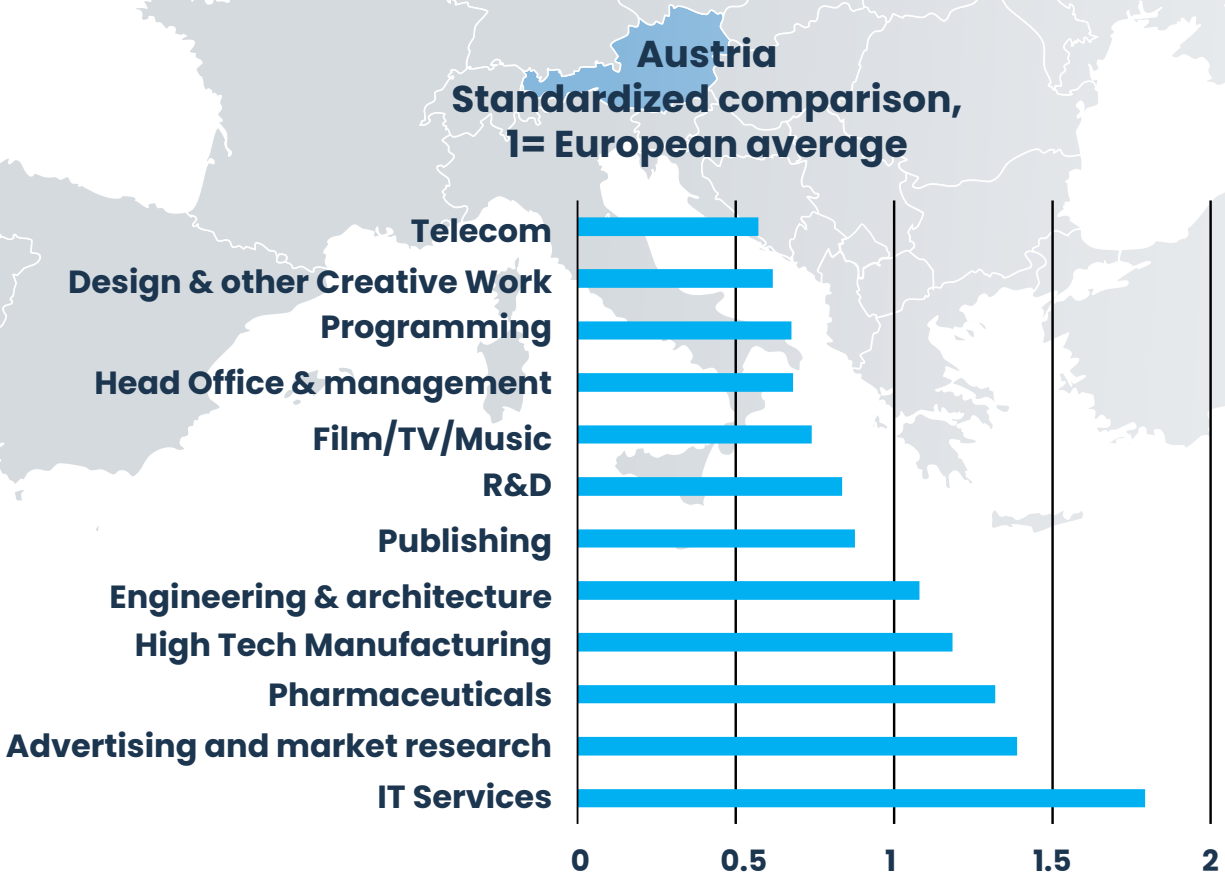
Figure 8. Link between unemployment and BBJ driven by regions with low BBJ concentration



Brain business jobs (BBJ) concentration, per 1000 citizens in working age, based onstructural business accounts for 2018, is compared to the 2019 unemployment rate (15-74 y). Source for both data: Eurostat. The link between high share of BBJ and low unemployment is driven by Eastern/ Central and Southern European regions.

Country Analysis:
Austria

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Austria experienced a loss of 7 000 brain business jobs during 2020. As a result, the concentration of the working age population employed by knowledge-intensive firms fell slightly, from 6.0 percent in 2019 to 5.9 in 2020.



The long-term trend is however a steady rise in knowledge-intensive employment. Between 2012 and 2020, Austria added more than 25 000 brain business jobs. Out of these, 18 200 have been created in the tech-sector, 14 900 in ICT and 3 000 in creative professions. However, Austria has during the same period lost close to 11 000 knowledge-intensive jobs in advanced services.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Austria has several strengths. The main strength is in IT-services, followed by advertising and market research and pharmaceuticals. The country also has a high concentration of jobs in high-tech manufacturing, and engineering & architecture. Austria is behind the rest of Europe when it comes to areas such as telecom, design, film/TV/music as well as programming. Overall, creative professions are the weakness of Austria while its strength lies in tech.

The strongest region in Austria is the capital region of Vienna. Here, 11.4 percent of the working age population is employed in brain business jobs, which is nearly twice the national average. Vienna is a leading European brain business hub. Examples of innovative start-ups in the region are GoStudent, a digital school connecting students to teachers in a virtual learning environment, HelloBello which offers freshly cooked human-grade food tailored to each dog's nutritional needs via a subscription service, and Adverity which is an intelligent marketing analytics platform enabling data-driven marketers to make better decisions and improve performance. Other strong regions are Tirol and Salzburg, both with 6.5 percent of the working age population employed in brain business jobs. Examples of innovative start-ups in Tirol are Gronda, which operates an online community for professionals in the hotel industry, and ViraTherapeutics which develops anti-cancer therapeutics based on oncolytic viruses. In Salzburg, innovative start-ups include Openlaws, a legal information system with features for personalization and visualization, and NativeWaves which provides streaming solutions for broadcast, e-Sports, events, and cinema.

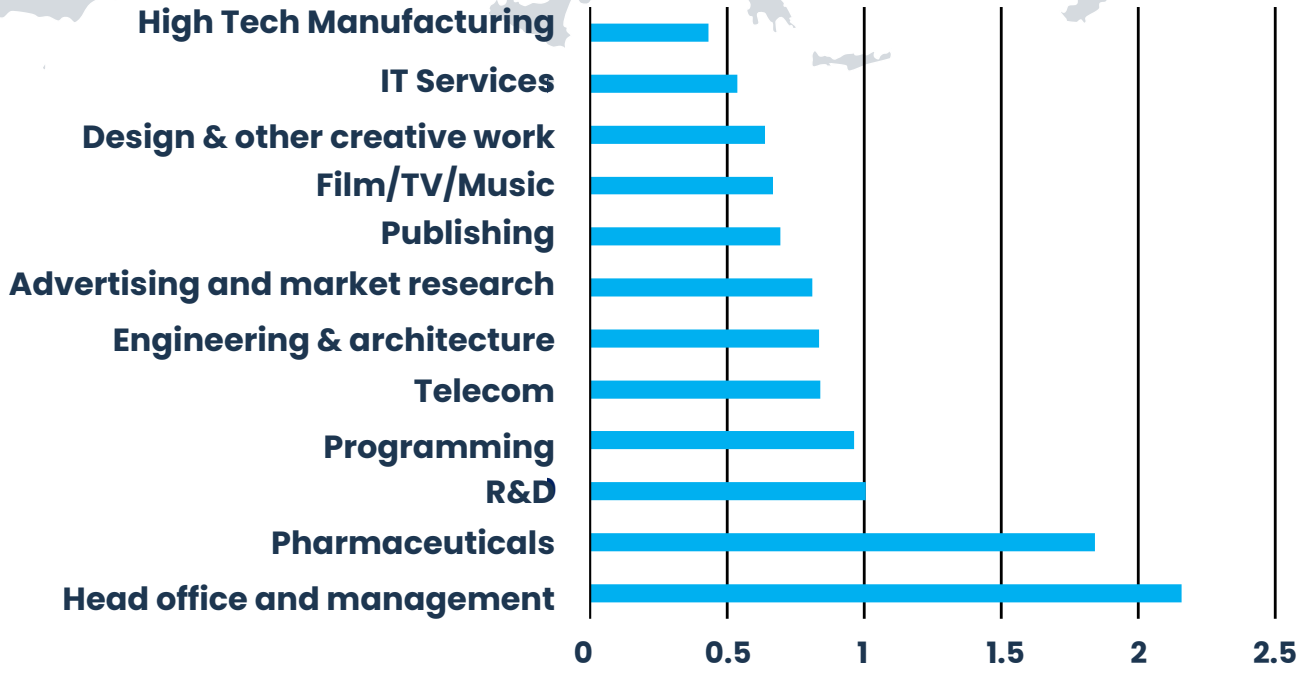
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Austria, the Tirol region which has the highest concentration of brain business jobs besides Vienna, also has the lowest level of unemployment among Austrian regions. The Burgenland region, which has the lowest share of brain business jobs, on the other hand has among the higher unemployment levels in the country.

Geographical proximity to the Central European countries, which are rapidly catching up in brain business jobs concentration, creates an opportunity for knowledge-intensive firms to thrive in Austria. Vienna has a historic tradition as a Central European knowledge hub and is often described as the best city to live in Europe. Yet, growth-oriented reforms are needed for Austria in general and Vienna to reach its potential.

Country Analysis:
Belgium

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Belgium has however experienced a gain of 5 300 brain business jobs during 2020. As a result, the concentration of working age population employed in knowledge-intensive firms increased slightly, from 6.7 percent in 2019 to 6.8 in 2020.

Belgium
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Belgium added 100 500 brain business jobs. Out of these, 42 300 have been created in advanced services, 28 600 in ICT, 19 900 in tech and 9 700 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Belgium relies strongly on head offices & management, where it has a concentration of brain business jobs more than twice as high as the European average. This is in fact the highest rate in all of Europe. The country is also strong in pharmaceuticals. High tech manufacturing and design & other creative professions as well as IT services are comparative weaknesses of Belgium.

The strongest region in Belgium is the province Brabant Wallon, with a strong pharmaceutical sector. Here, 13.7 percent of the working age population is employed in brain business jobs, more than twice the national average. Brabant Wallon is one of the leading European brain business hubs. Examples of innovative start-ups in the region are Aerospacelab, which provides geospatial intelligence based on proprietary satellite data and other sources, and Digiteal, which offers a digital personal assistant to manage e-invoices and perform online payments. The second highest concentration is found in the capital region of Brussels, in which 11.4 percent of the working age population is employed in brain business jobs. Examples of innovative start-ups in the Brussels region are Nodalview, which combines smartphone technology, AI and cloud computing to produce high-quality visuals for real estate properties, and Cowboy, a designer and manufacturer of innovative electric bikes for urban riders.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Belgium, the highest unemployment is found in the Hainaut region, which has the second lowest concentration of brain business jobs.

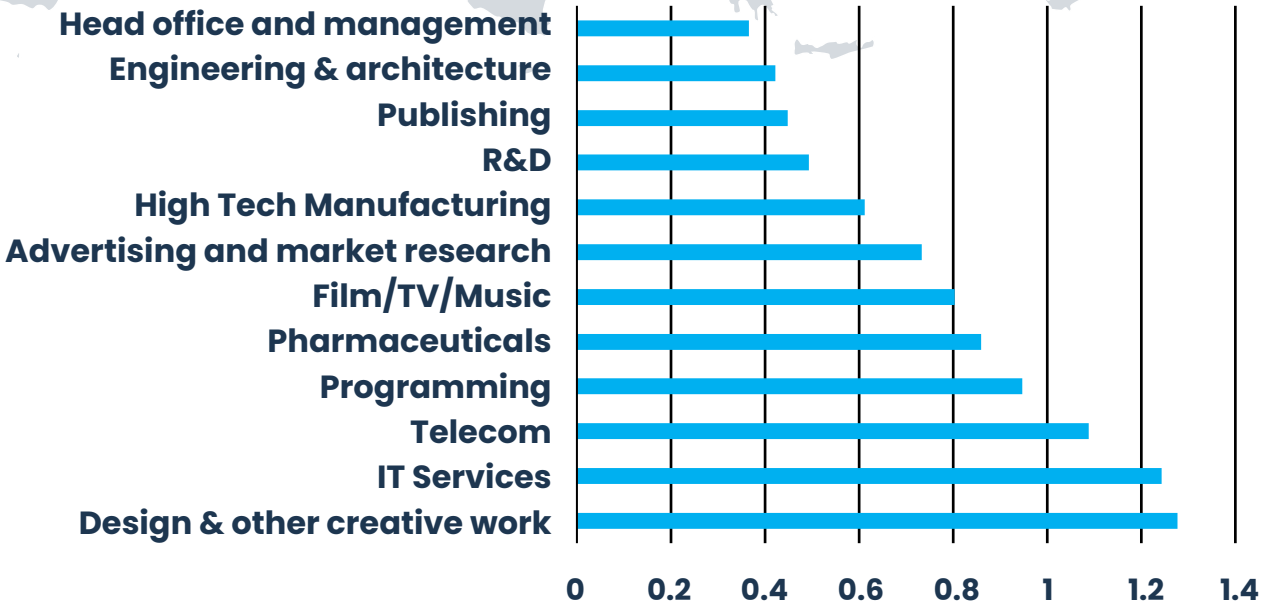
The challenge for Belgium is to stimulate knowledge-intensive businesses and utilize the benefit of having the EU capital region. Cost of employment for talents is a hinder for

employment of knowledge-workers, linked to the high levels of taxation. The capital regions of Eastern and Central European nations are experiencing a significant growth in brain business jobs, by combining access to talent with competitive wages. Belgium needs to foster increased cooperation with the growing brain business hubs in Eastern and Central Europe and implement reforms that boost the competitiveness of Belgian knowledge-intensive firms.

Country Analysis:
Bulgaria

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Bulgaria experienced a loss of 5 800 brain business jobs during 2020. As a result, the concentration of working age population employed in knowledge-intensive firms decreased slightly, from 4.9 percent in 2019 to 4.8 in 2020.

Bulgaria
Standardized comparison,
1= European average



The long-term trend is however a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Bulgaria added 42 500 brain business jobs. Out of these, 31 000 have been created in ICT, 6 300 in creative professions, 3 200 in advanced services and 2 000 in tech.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Bulgaria has strength in design & other creative professions, IT-services as well as telecom. In fact, the concentration of highly knowledge-intensive jobs in these sectors is higher in Bulgaria than the European average. Weaknesses are found in head offices & management, engineering, R&D as well as publishing.

The strongest region in Bulgaria is the capital region of Sofia. Here, 11.6 percent of the working age population is employed in brain business jobs, which is more than twice the national average. Sofia is one of the leading brain business hubs of Europe, with a concentration of knowledge-intensive employment higher than even Vienna and Brussels. Examples

of innovative start-ups in the region are Nasekomo, which produces animal feed from organic waste using bioconverting insects, and Phos, which is offering a phone-agnostic software POS. The region Severoiztochen has the second highest concentration of employees in knowledge-intensive firms (2.2 percent), followed by Yuzhen tsentralen (2.0 percent)

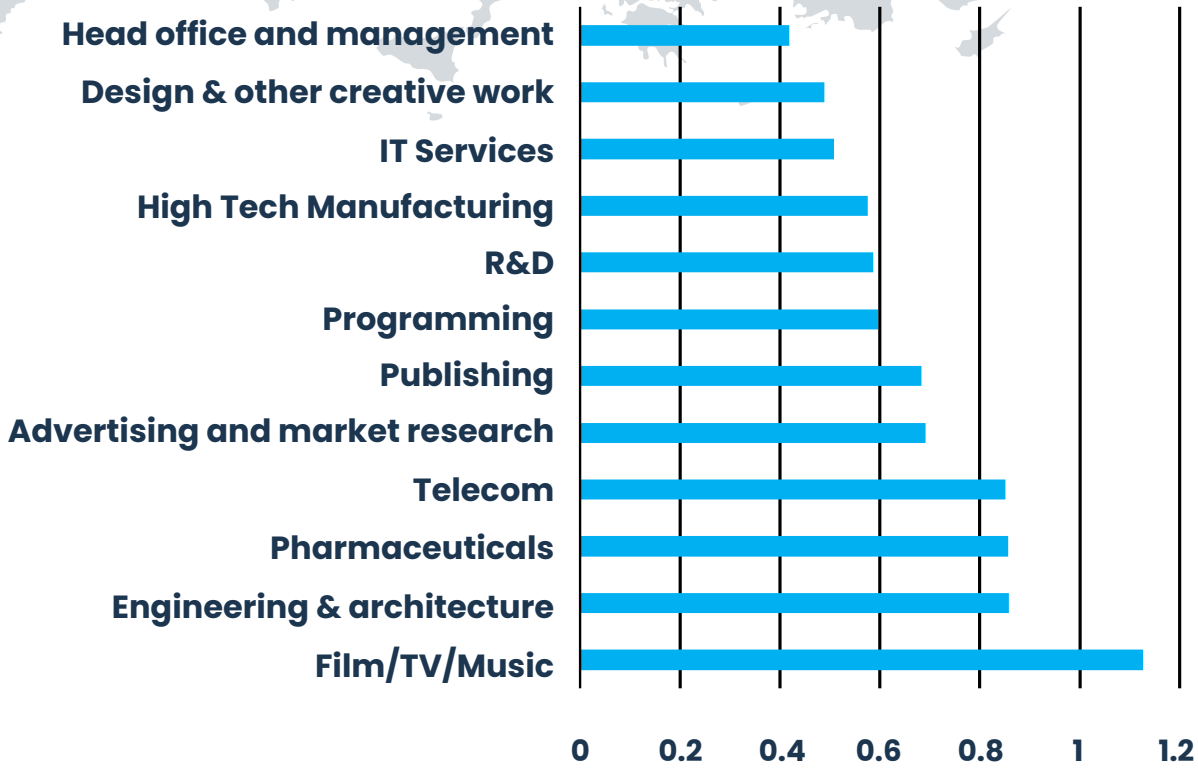
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Bulgaria, the highest unemployment is found in the Severozapaden region, which has the lowest concentration of brain business jobs. The Sofia region has lower unemployment than the rest of the regions of the country, and by far the highest concentration of brain business jobs.

Bulgaria has a stronger concentration of knowledge-intensive jobs than Romania, Greece, Poland, Italy, Croatia and even Spain. The country has considerable opportunity to continue catching up to the leading European nations, granted that reforms, including anti-corruption policies and investments in higher education, are introduced to boost the business climate.

Country Analysis:
Croatia

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Croatia experienced a loss of 1 000 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has remained at 4.3 percent, same as in 2019.

Croatia
Standardized comparison,
1= European average



The long-term trend is however a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Croatia added 3 900 brain business jobs. Out of these, 9 300 have been created in ICT, and a further 4 300 in tech. At the same time, 9 600 jobs have been lost in advanced services and 100 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Croatia has a strength in film/TV/music. In this field, the country has a higher share of brain business jobs than the European average. Also, in telecom, pharmaceuticals, and engineering & architecture Croatia have strengths. The country however has a low share of employment in head offices & management firms, design & other creative work firms as well as IT services. A boost in programming-related activities is needed for Croatia to prosper, in a time when IT and communication services is a driver for knowledge-intensive jobs in Europe.

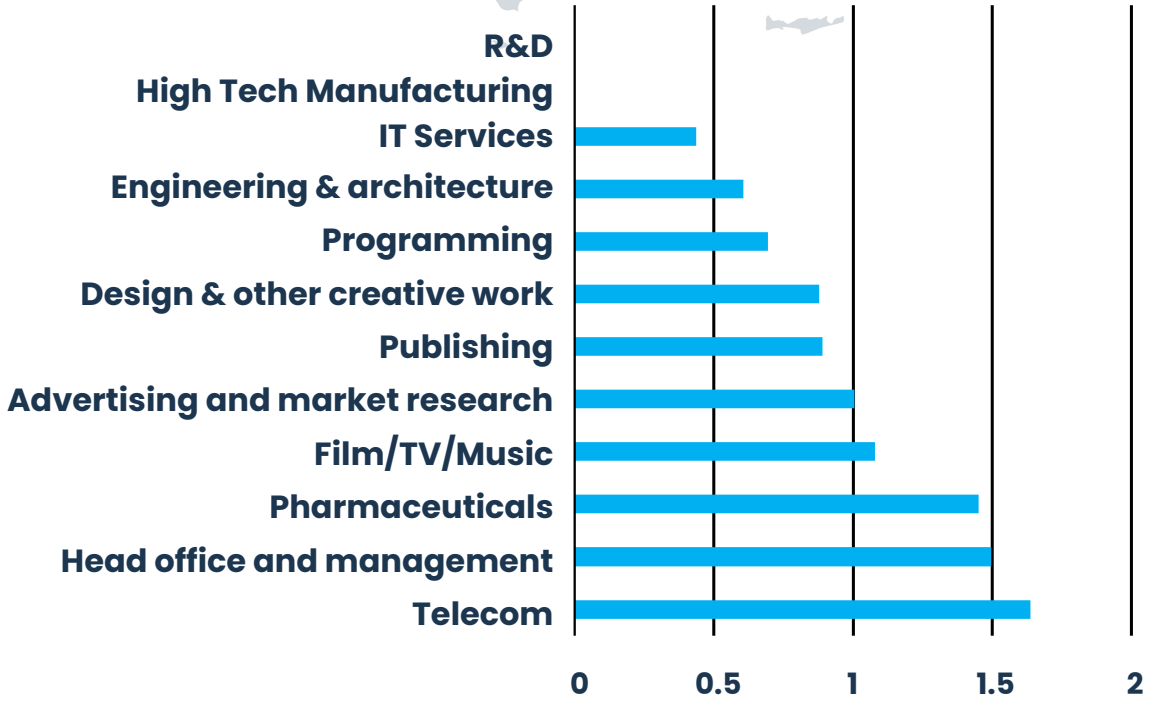
Croatia is made up of two large regions according to European Union classification. The first is where the capital region of Zagreb is located. In this region, 4.5 percent of the working age population works brain business jobs. Examples of innovative start-ups in the Zagreb region are Gideon Brothers, which tries to solve industrial problems with autonomous mobile robots powered by AI and visual perception, and Worig which provides secure down payment options and verifiable credit scores for the rental market. The second region is Jadranska Hrvatska, where 2.8 percent of the working age population works in brain business jobs.

A strong current trend is that the capital regions of the Eastern and Central European nations are growing to be some of the leading brain business hubs in Europe. Several of the top-ranking regions, with highest concentration of brain business jobs, are in fact today found in Eastern and Central Europe. Croatia has good potential to foster brain business jobs but needs to focus on policy reform to achieve this. Policies that encourage advanced services, including head office location decisions, are needed for Croatia to grow strong with knowledge-intensive jobs.

Country Analysis:
Cyprus

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Cyprus has countered this trend, by adding 750 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has increased slightly, from 5.6 percent in 2019 to 5.7 in 2020.

Cyprus
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Cyprus added 10 700 brain business jobs. Out of these, 4 400 have been created in advanced services, 3 600 in ICT, 1 400 in tech and 1 300 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

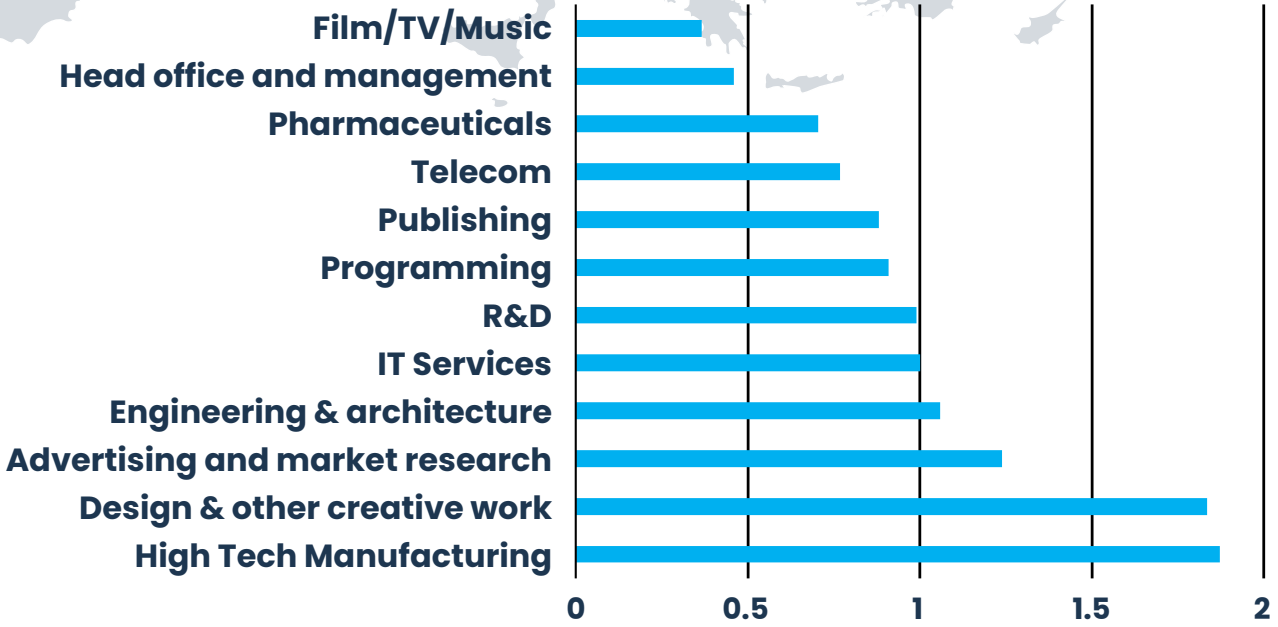
Compared to the rest of Europe, Cyprus has a strong presence in telecom. Also, in pharmaceuticals and head offices & management the island nation has a competitive edge compared to other parts of the continent. Specialized research and development and high-tech manufacturing is not present in the region, which can be attributed to the relatively small size of Cyprus. Cyprus needs to build upon its competitive policy regime by encouraging growth in IT services and programming. During a time when digitalization is a strong driver for change, growth in this sector is key to long-term success. Much like Malta, Cyprus grows rely on a competitive business climate combined with a presence in IT and communication. Examples of innovative start-ups in

Cyprus include Simple, an AI-powered intermittent fasting platform, and ePlane, an e-commerce platform designed to bring together buyers and sellers in the aerospace industry.

Country Analysis:
Czechia

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Czechia lost 13 300 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased slightly, from 6.6 percent in 2019 to 6.4 in 2020.

Czechia
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive employment. Between 2012 and 2020, Czechia added 62 000 brain business jobs. Out of these, 30 500 have been created in ICT, 15 300 in creative professions, 10 900 in tech, and 5 300 in advanced services.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production value, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Czechia has several strengths. The main strength lies in high-tech manufacturing followed by design & other creative professions. In these two areas, Czechia has nearly double the concentration of brain business jobs compared to the European average. Czechia has in fact the highest concentration of working age population employed in design firms in all of Europe, with Netherlands a close second. The weaknesses exist in film-TV-music, head offices & management and pharmaceuticals.

The strongest region in the country is the capital region of Prague. Here, 19.7 percent of the working age population is employed in brain business jobs, which is three times

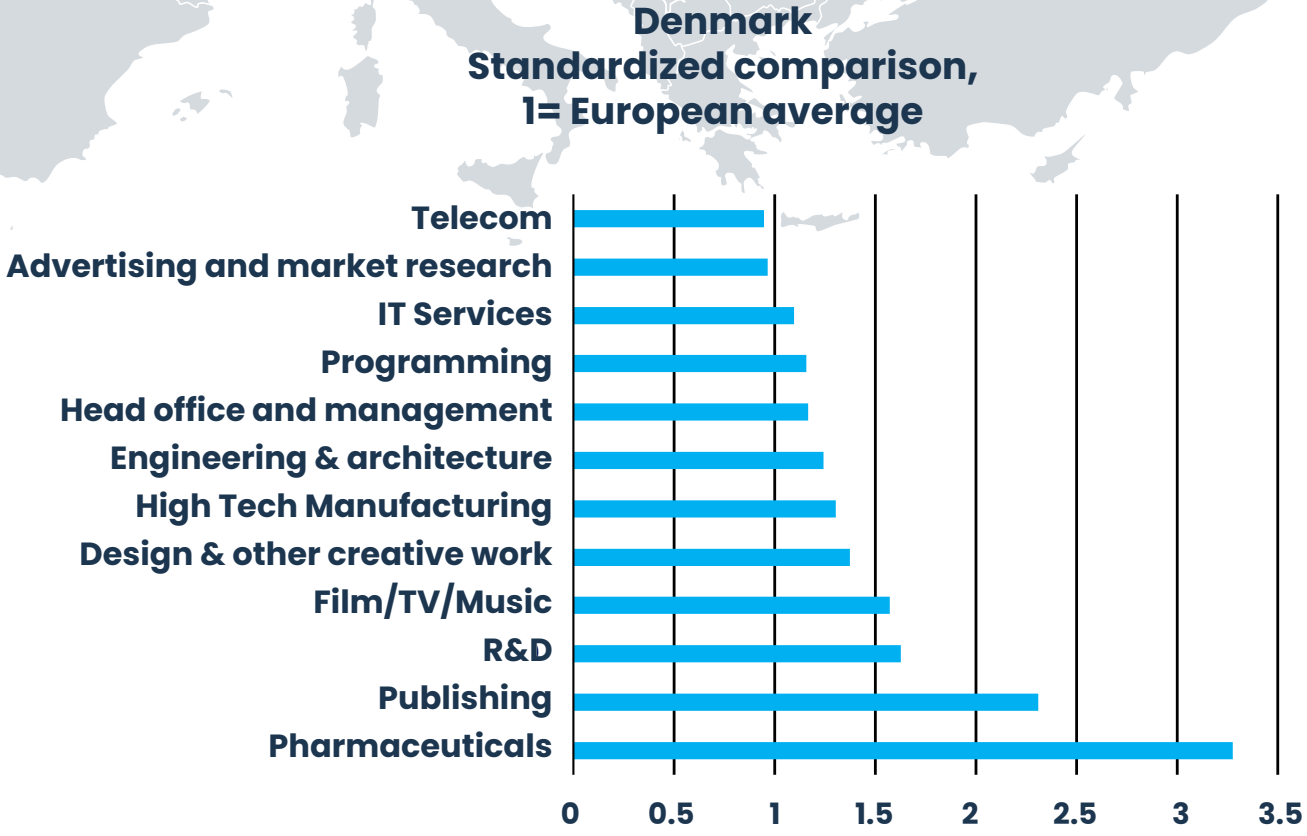
the national average. Out of 283 European regions, Prague has the second highest concentration of brain business jobs amongst the working age population. Prague is second only to Bratislava, and ahead even of Paris and London in brain business jobs concentration – but not in total number, given the much higher populations of the Paris and London regions. Examples of innovative start-ups in the Prague region are GAMEE, a social gaming network that connects friends across casual-style games and gaming tournaments, and Spaceti, an estate firm focused on enhancing the satisfaction, productivity, and well-being of people in buildings. Another strong brain business region is Jihovýchod, where 6.6 percent of the working age population are employed in brain business jobs. Besides Prague, Jihovýchod is the only Czech region with a higher brain business jobs concentration than the national average.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Czechia, the lowest concentration of brain business jobs is found in the Severozápad region, which has the second highest unemployment level in the country. The Prague region ha the by far highest share of brain business jobs, and in fact the lowest level of unemployment, alongside the Střední Cechy region.

The challenge for Czechia is to keep its impressive growth trajectory and to continue to develop Prague as a brain business hub and to expand the success to other parts of the country. Eastern and Central European capital regions are each year gaining in competitiveness. Besides Prague, Bratislava, Budapest, Warsaw and Bucharest are also strong, and rapidly growing, brain business job hubs.

Country Analysis:
Denmark

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Denmark lost 3 200 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased slightly, from 8.8 percent in 2019 to 8.7 in 2020.



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Denmark added 10 900 brain business jobs. Out of these, 12 200 have been created in creative professions, and 8 000 in advanced services, while in tech the number of knowledge-intensive jobs has fallen by 5 400 and in ICT by 3 900.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Denmark has several strengths. The main strength is in pharmaceuticals, where Denmark alongside Switzerland and Ireland has the strongest concentration of knowledge jobs in Europe. Publishing and R&D are other strengths. The concentration of publishing employment is higher than all other European nations, with Norway a close second. Denmark is also strong in film/TV/music and design & other creative professions. The weaknesses exist in telecom and in advertising and market research. The high tax levels of Denmark might explain why head offices are less than eager to locate to this otherwise leading knowledge-nation.

The strongest region in Denmark is the capital region of Copenhagen. Here, 15.8 percent of the working age population are employed in brain business jobs, which is nearly twice the national average. Examples of innovative start-ups in the Copenhagen region are Lunar, a digital challenger bank that offers a mobile-based banking app that helps consumers manage their personal finances, and Pleo, which offers smart payment cards for employees for them to buy things they need for work, while keeping the companies in control of spending. The second strongest knowledge region is Midtjylland, where 7.2 percent of the working age population is employed in brain business jobs. Examples of innovative start-ups in Midtjylland include Bright Star Studios, a video games development studio working on next generation online role-playing games, and Reflectly which has created a mindfulness app driven by AI, in the form of a mindfulness companion.

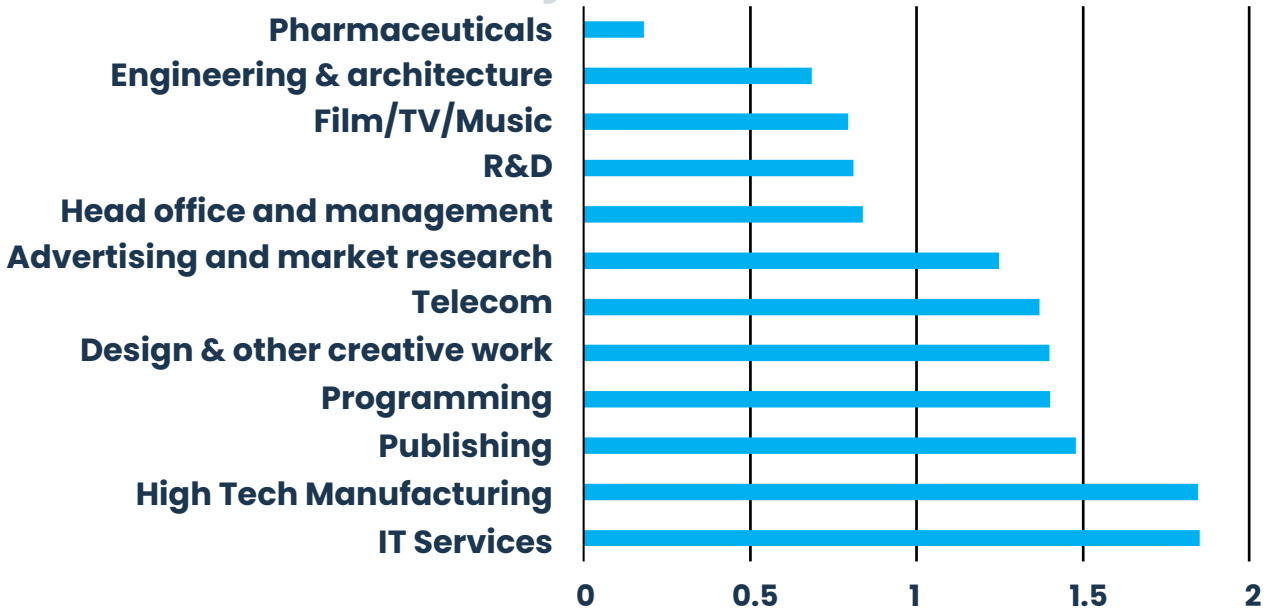
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Denmark, regional variations of unemployment are small and there is no strong link between unemployment and brain business jobs concentration. The lack of such a link is typical of the Nordic countries.

The challenge for Denmark is to compete for brain business jobs, in a time where much of the growth is happening in the capital regions of Eastern and Central European countries, which combine talent supply with low costs for employing the talents. Denmark has a strong leading position as a knowledge nation but needs to combine this with policies that reduce firm costs of hiring knowledge workers.

Country Analysis:
Estonia

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Estonia has gone against this trend, by adding 2 300 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has increased, from 7.1 percent in 2019 to 7.5 in 2020.

Estonia
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Estonia added 14 800 brain business jobs. Out of these 10 100 have been created in ICT, 2 800 in creative professions, and 2 100 in advanced services. During the same time, knowledge-intensive occupation in the tech sector has been reduced by 200.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

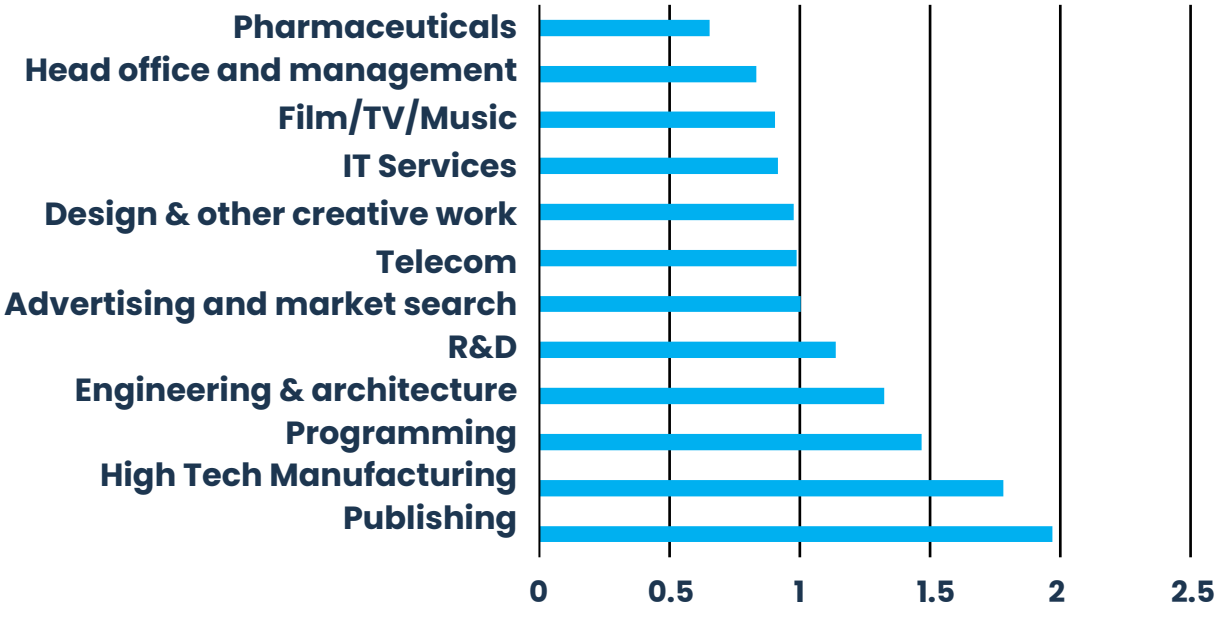
Compared to the rest of Europe, Estonia has several strengths. The main strength is in IT-services, and high-tech manufacturing, where Estonia has nearly twice the concentration of brain business jobs than the European average. The main weakness is pharmaceuticals followed by engineering & architecture. Examples of innovative Estonian start-ups is Solve.Care, which offers solution for health care delivery and coordination, and Mercuryo, which offers cryptocurrency payment solutions. Strengthening research and development is important for to Estonia continuing growing as a leading European knowledge hub.

Currently, much of the growth is happening in the capital regions of Eastern and Central European countries, which combine talent supply with low costs for employing the talents. As a nation, Estonia has the highest concentration of knowledge-intensive jobs in relation to the working age population amongst the Eastern and Central European countries. The concentration of brain business jobs in Estonia is almost that of Finland (7.9 percent) and is likely to catch up to Finland in the coming years. The challenge is that Tallin, due to its small size, lacks some of the large scale benefits of other brain business hubs, with larger populations. Tallinn still however succeeds as a leading brain business hub and is internationally unique in achieving this despite the relatively limited population.

Country Analysis: Finland

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Finland has gone against this trend, by adding 18 100 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has increased, from 7.3 percent in 2019 to 7.9 in 2020.

Finland
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Finland added 34 700 brain business jobs. Out of these 23 600 have been created in ICT, 8 600 in advanced services, and 4 300 in creative professions. During the same time, knowledge-intensive occupation in the tech sector has been reduced by 1 800.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Finland has many strengths in knowledge-intensive enterprise activity. The main strengths are in publishing and high-tech manufacturing, where the concentration of brain business jobs is nearly twice that of the European average. Another strength is programming. Weaknesses exist in pharmaceuticals, film/TV/music, and head offices & management.

The strongest region in Finland is the capital region of Helsinki. Here, 12.4 percent of the working age population is employed in brain business jobs, which is nearly twice the national average. Examples of innovative start-ups in the re-

gion are AppFollow, which offers a platform to help drive mobile app growth and increase customer loyalty, and Vario which develops hardware and software for industrial use.

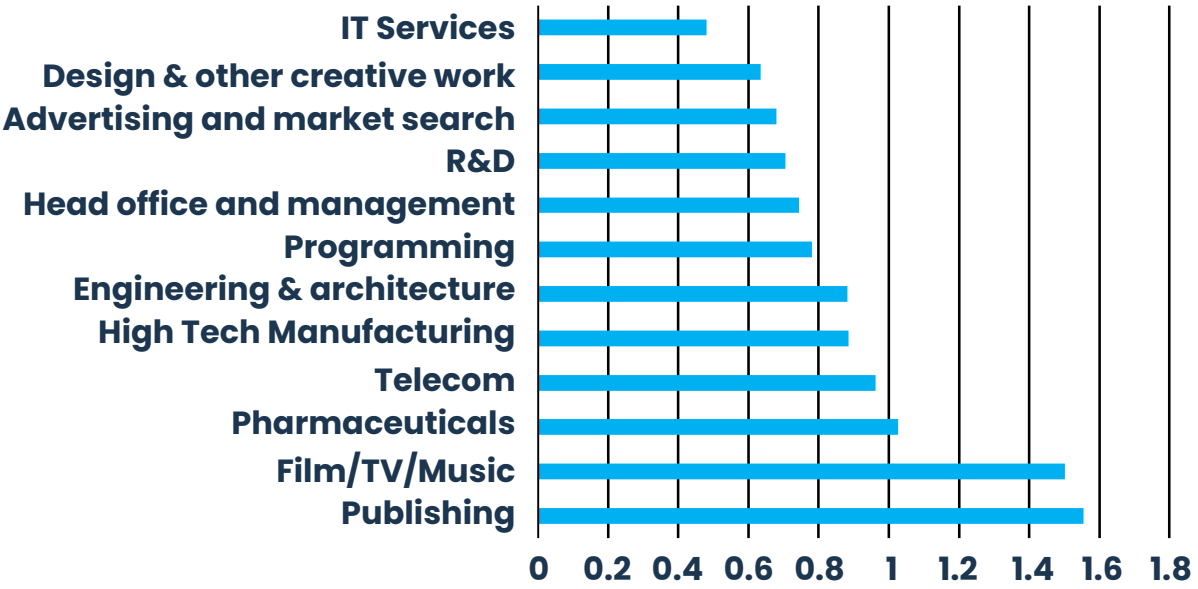
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Finland, the concentration of brain business jobs is similar among the various regions, with exception of the Helsinki region, and the variation of unemployment rate is also limited between the regions.

Finland has a strong current growth of brain business jobs, which allows for it to catch-up with Sweden which currently has the highest share of any European Union economy. Currently, much of the growth is happening in the capital regions of Eastern and Central European countries, which combine talent supply with low costs for employing the talents. Finland is a strong knowledge economy, but also needs to have competitive wages and taxes to continue outpacing the rest of Europe in brain business jobs growth.

Country Analysis:
France

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. In France, the number of brain business jobs has been unchanged during 2020, and the concentration of working age population employed in knowledge-intensive firms has remained at 5.6 percent.

France
Standardized comparison,
1= European average



Between 2012 and 2020, France experienced a reduction of 25 500 brain business jobs. In creative professions, 60 800 jobs have been added, while in advanced services the number of jobs has been reduced by 142 600. In ICT 58 200 jobs have been added during the same period, while those in tech have been reduced by 1 900.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, France is particularly strong in publishing. Other strengths exist in film/TV/music, and pharmaceuticals. In a time when much of the development of brain business jobs is occurring in the ICT-sector, France needs to strengthen IT services and programming, as well as design & other creative work.

Paris is a strong knowledge-intensive hub, as fully 1.2 million brain business jobs exist in the capital region—a majority of knowledge-intensive jobs of France. No single region in Europe has as many brain business jobs as Paris. The number in London is in comparison 923 000. In fact, Paris

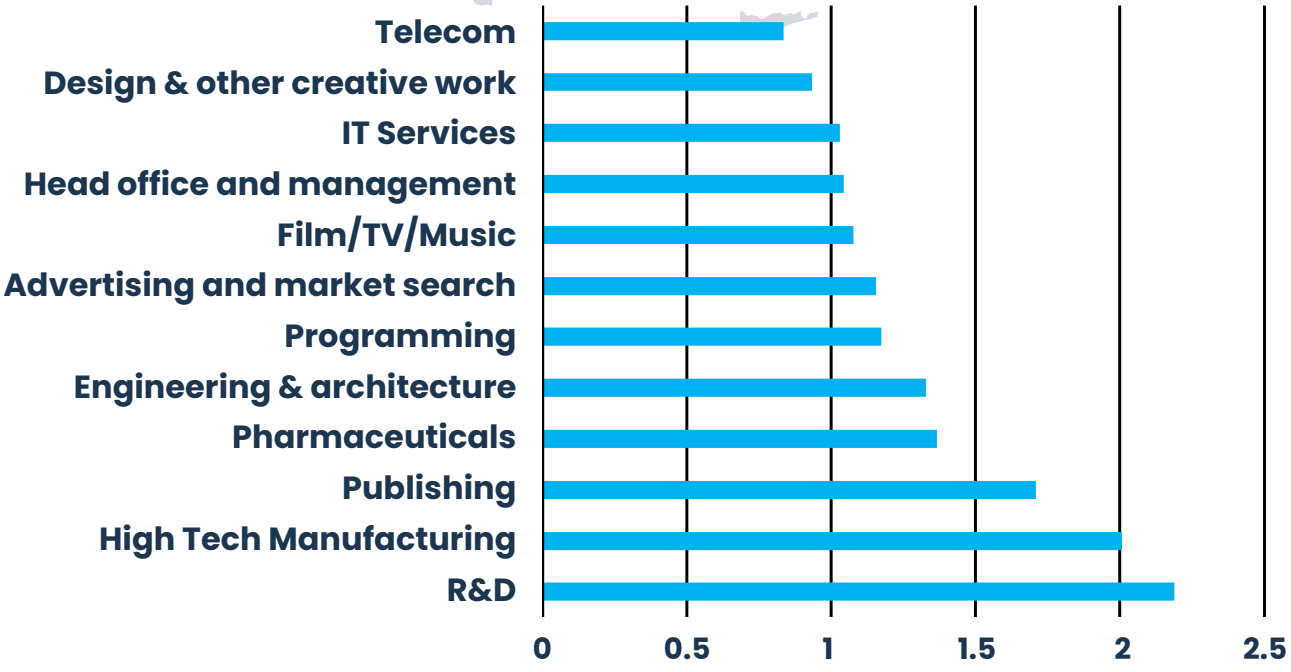
has more brain business jobs than most European countries. This is explained by the fact that Paris combines a high percentage of highly knowledge-intensive jobs with having a large population. Examples of innovative start-ups in Paris include Luko, which provides insurance and security technology, Yubo, a social platform aimed at the younger generation, and Livestorm, a video communication platform that connects teams to promote, host, and analyse online events

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. This also holds true for the French regions. France stands out as being the most centralized of the larger European countries. In the UK and in Germany for example, strong Brain Business centres exist also outside of the capital regions. A challenge for France is to encourage knowledge-intensive jobs growth also outside of the strong Paris region.

Country Analysis:
Germany

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Germany lost 25 600 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased slightly, from 8.2 percent in 2019 to 8.1 in 2020.

Germany
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Germany added 1 070 000 brain business jobs. Out of these, 425 000 have been created in ICT, 378 400 in tech, 147 000 in creative professions and 119 600 in advanced services.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Germany has several strengths. The main strength is in R&D and high-tech manufacturing. In these fields, the concentration of brain business jobs in Germany is double that of the European average. On the other hand, Germany is behind the rest of Europe when it comes to telecom, design & other creative work.

Most countries have brain business jobs focused to the capital region. Germany however has numerous top-ranking regions. One such region is Oberbayern, with innovative start-up companies such as ATAI Life Sciences which offers a biotech platform for mental health disorders, and Isar Aerospace which offers access to space for small and medi-

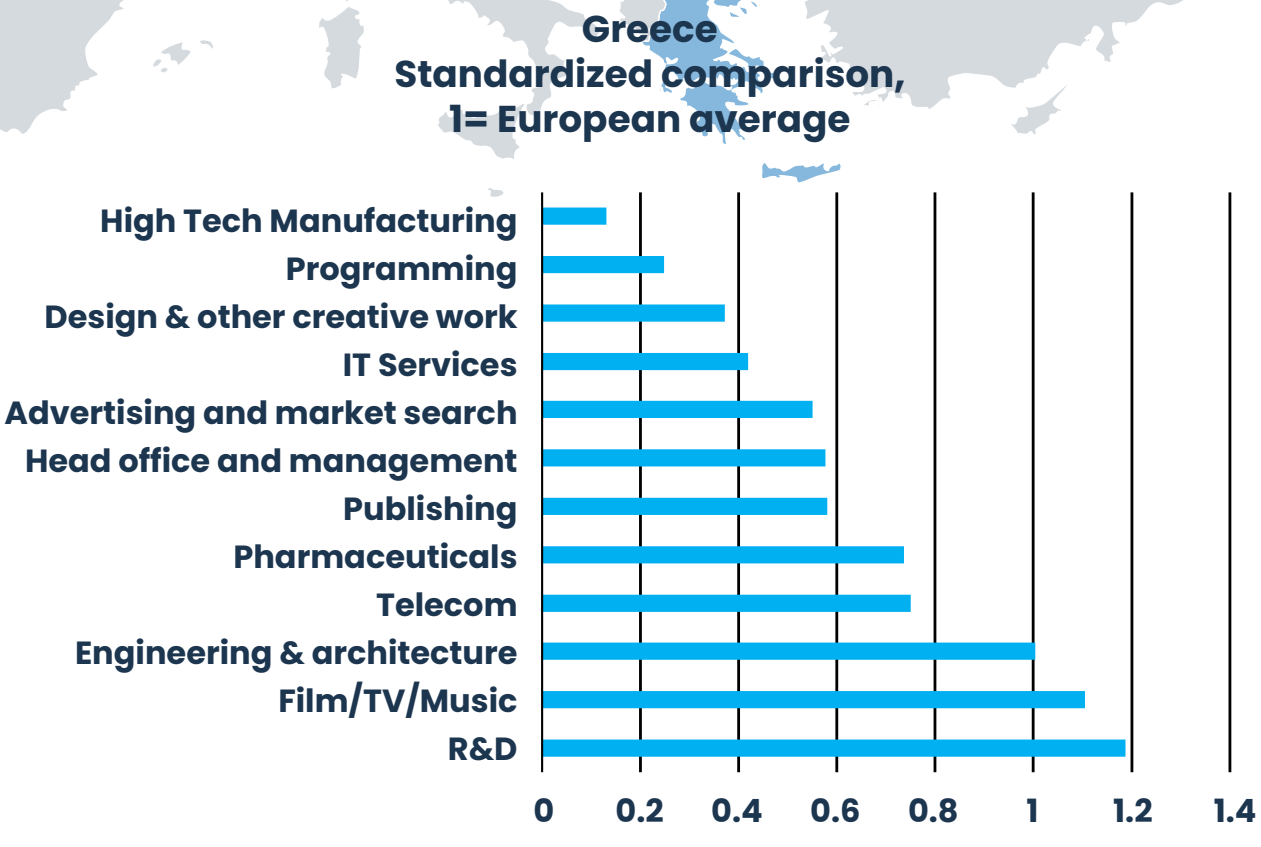
um satellites. Another leading German region is Hamburg, with innovative start-up companies such as NAGA, a fintech company, and Claimsforce, an insurance platform that provides solutions to automate the claims management process. Yet another leading brain business jobs centre of Germany is Darmstadt, with start-up companies such as Alcan Systems, which develops a new class of low-cost smart antenna systems, and Spacenus, which offers an AI platform that use cameras and satellite imagery for agriculture.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Germany, there is a clear link between high concentration of brain business jobs and lower unemployment than the national average.

No part of Europe has as many leading brain business jobs centres as Germany. Yet Germany still needs to boost knowledge-intensive jobs growth, to catch up to leading countries such as Switzerland and Sweden. Competition from the Central and Eastern European countries, which grow by relying on growing talent supply and lower wages, is increasing. Growth-boosting reforms, including lowering of the tax levels, are needed for Germany to realize its full potential in knowledge-intensive sectors.

Country Analysis:
Greece

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Greece lost 8 200 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased slightly, from 3.9 percent in 2019 to 3,8 in 2020.



The long-term trend is a slow rise in knowledge-intensive firm employment. Between 2012 and 2020, Greece added 7 200 brain business jobs. The number of jobs in advanced services has remained unchanged, while those in ICT have grown by 8 900. The number of creative professions in Greece has fallen by 18 500 since 2012, while those in tech have grown by 16 800.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Greece has strengths in R&D and film/TV/music. On the other hand, Greece is behind the rest of Europe when it comes to areas such as high-tech manufacturing and programming. The Athens region, which is the strongest brain business hub of Greece, has a number of innovative start-ups, such as Spotawheel, a tech-driven used cars dealership platform, and DeepSea Technologies which is an AI-powered vessel optimisation system for the maritime industry.

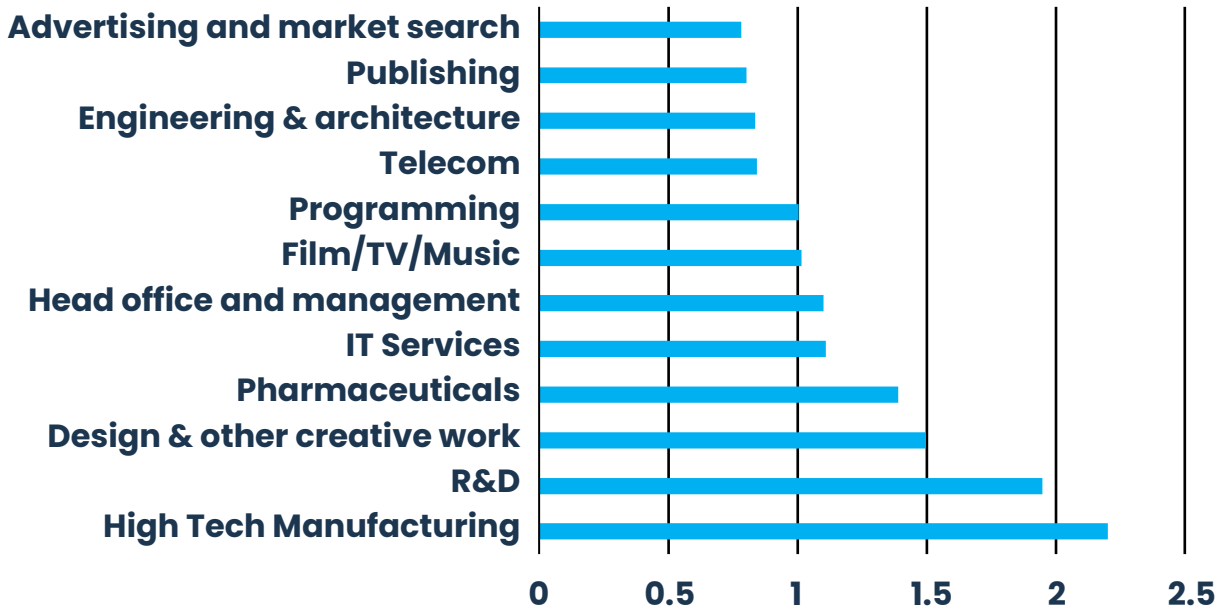
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Greece, the highest unemployment level is found in Dytiki Makedonia which has amongst the lowest shares of brain business jobs in the country.

Greece can, similarly as Malta and Cyprus, foster strong knowledge-intensive sectors. For this opportunity to be realized, improvements in regulatory and tax systems are needed, as well as a boost in the education sector. Stimulating brain business jobs growth can help Greece maintain its talent supply, and to attract talents from abroad.

Country Analysis:
Hungary

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Hungary lost 4 500 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has remained at 7.2 percent in 2020, which is the second highest rate in the Eastern and Central European region, next to Estonia.

Hungary
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Hungary added 105 200 brain business jobs. Out of these, 40 400 have been created in ICT, 24 100 in advanced services, 22 300 in tech, and 18 400 in creative professions. On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Hungary is a top performer when it comes to high-tech manufacturing. The concentration of brain business jobs in this sector is more than twice the European average. Another strength is R&D, where Hungary now has close to twice the concentration of the average European country. On the other hand, Hungary has a lower concentration than the rest of Europe when it comes to areas such as advertising & market research and telecom.

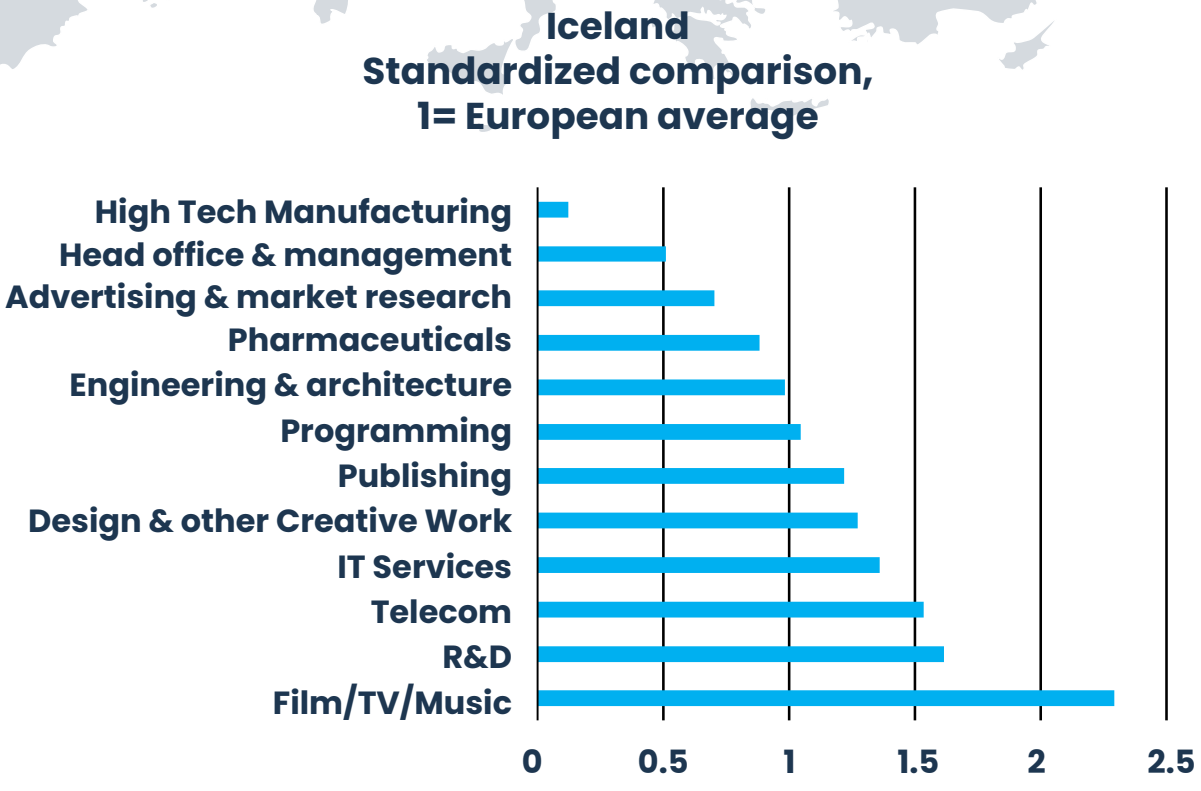
The strongest region in Hungary is the capital region of Budapest. Budapest in fact has the third highest concentration of brain business jobs per capita in Europe, in comparison of 283 regions. Only Bratislava and Prague have a higher share than Budapest. Stockholm, Paris, London, and Copenhagen all have a lower concentration of brain business jobs than

Budapest, although Stockholm has nearly the same concentration. The strong performance of Budapest is in line with the rapid changing landscape of brain business jobs, with growth of these jobs in the capital regions of Eastern and Central European countries. Budapest has several innovative start-up companies, such as Banzai Cloud which offers cloud native solutions for enterprises, Shapr3D which provides computer-aided design services, and Almotive which is a developer of automated driving technologies.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Hungary, a strong link exists between unemployment and brain business jobs. The Észak-Alföld region has for example the lowest rate of brain business jobs (alongside Dél-Alföld), and the highest regional unemployment rate. While Hungary overall has impressive performance in terms of knowledge-intensive jobs, growth of such jobs outside of the capital region is needed to boost the performance of the country as a whole and to lower regional unemployment levels.

Country Analysis: Iceland

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Iceland lost 750 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased from 7.1 in 2019 to 6.6 in 2020. Iceland also ranks amongst the top-50 European regions in brain business jobs concentration.



The long-term trend is a slow decline in knowledge-intensive firm employment. Between 2012 and 2020, Iceland experienced a reduction of 450 brain business jobs. Creative professions jobs have been reduced by 350 during the period, while those in advanced services have been reduced by 180. ICT employment has risen by 100, while that of the tech sector has remained unchanged.

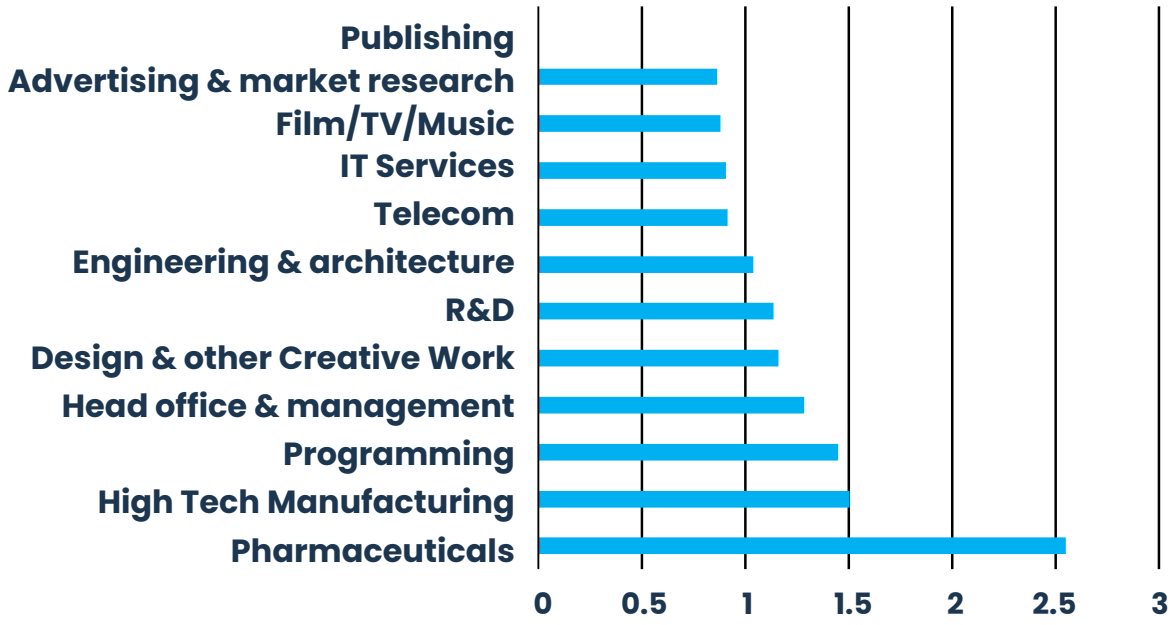
On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Iceland has several strengths. The main strength is film/TV/music, followed by R&D. However, Iceland lags in high tech manufacturing as well as head office & management. Iceland has a number of innovative start-ups, such as Authenteq which provides real-time identity verification for blockchain, built on the principles of privacy by design, and Laki Power, a research and development company focused on eco-friendly power solutions.

Country Analysis:
Ireland

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Ireland has gone against the stream, by adding 600 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has however fallen slightly, from 7.8 percent in 2019 to 7.7 in 2020, since working age population has risen more rapidly than brain business jobs. Ireland is gradually catching up to the UK (8.1 percent) in brain business jobs concentration.

Ireland
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Ireland added 75 000 brain business jobs. Out of these, 29 000 have been created in ICT, 22 000 in tech, 18 800 in advanced services and 5 300 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Ireland has several strengths. The main one is pharmaceuticals, and additionally also high-tech manufacturing. Ireland lags in areas such as advertising and market research, as well as IT services. The Irish capital region Dublin has numerous innovative start-ups, such as FoodMarble, a digital digestive health company that finds foods that are most compatible with a unique digestive system, and Immedis, a specialist provider of enterprise technology solutions for global payroll and mobility tax services.

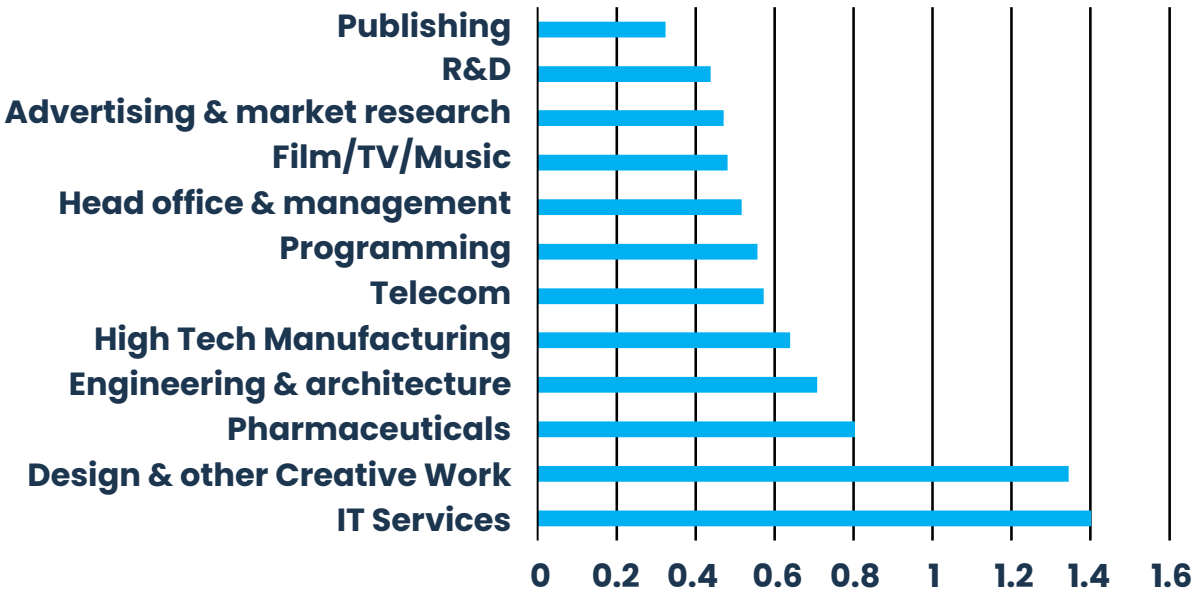
If the growth of brain business jobs in Ireland continues during the coming years, the country can eventually gradually catch-up to and even surpass the UK in knowledge-in-

tensive jobs concentration. The competition for brain business jobs is however intense in Europe, driven largely by availability of talent and cost of recruiting talent.

Country Analysis:
Italy

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Italy has gone against the stream, by adding 3 200 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has remained unchanged, at 4.3 percent.

Italy
Standardized comparison,
1= European average



The long-term trend is a gradual rise in knowledge-intensive firm employment. Between 2012 and 2020, Italy added 118 700 brain business jobs. In the tech sector, employment has fallen by 11 400 during this period, while it has increased by 8 000 in creative professions, by 55 300 in ICT and by 66 800 in advanced services.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Italy has several strengths. The main strength is in IT-services, followed by design & other creative work. On the other hand, Italy has a lower concentration than the rest of Europe when it comes to areas such as publishing and R&D.

The highest concentration of knowledge-intensive jobs in Italy is found in Lombardia. Examples of innovative start-up companies in the region include AideXa, a challenger bank for SMEs, and BOOM, a photo-tech firm that provides on-demand photographic solutions at scale for clients in different parts of the world. The second highest concentration

of brain business jobs is found in Rome, where start-ups include Vikey, a vacation home rental management solution, and Slymetrix, which offers data-driven optimization solutions for e-commerce.

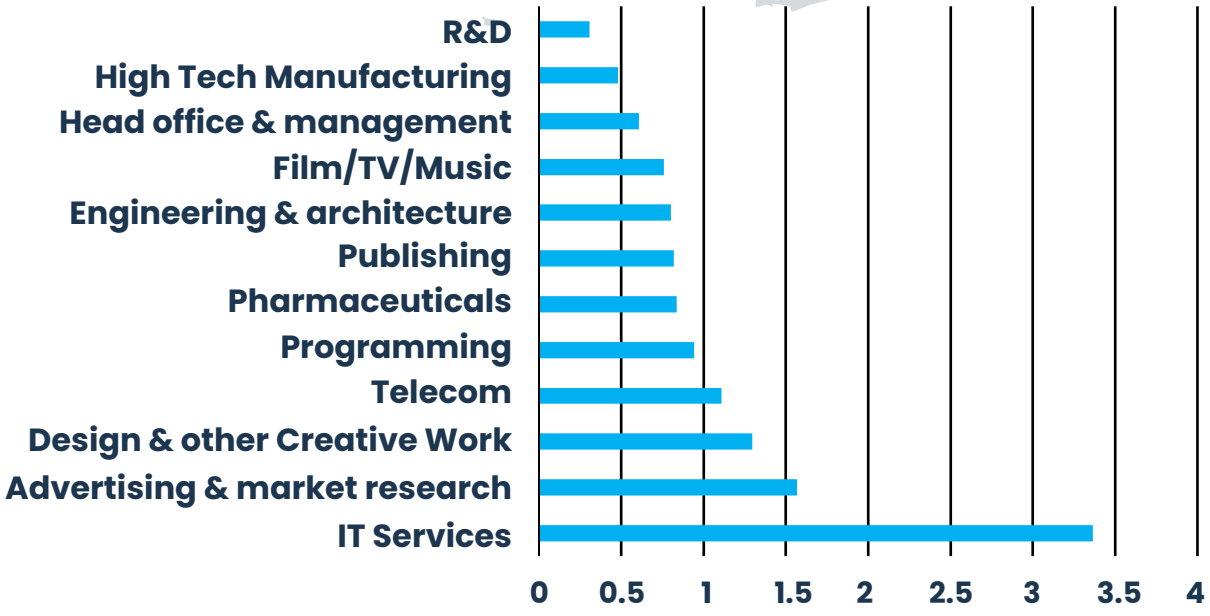
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Italy there is a strong link between high share of brain business jobs and low unemployment. The regions of Italy with double digit unemployment levels, Sardegna, Basilicata and Puglia, all have low shares of brain business jobs per capita.

The challenge for Italy is to continue growing with knowledge-intensive occupations, improving strengths in areas that are already strong such as IT services and design and in currently weak areas such as R&D. Another challenge is to promote knowledge-intensive job creation outside of the regions that are already strong, reducing the currently significant geographical differences.

Country Analysis:
Latvia

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Latvia lost 6 300 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 6.8 percent in 2019 to 6.4 in 2020.

Latvia
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Latvia added 21 800 brain business jobs. Out of these, 12 600 have been created in ICT, 3 200 in advanced services, 3 100 in the tech sector and 2 900 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Latvia has a dominating position in IT services, with a concentration of brain business jobs in this field more than three times as high as the European average. This is, in fact, the highest share in all of Europe. Another strength is advertising and market research. Latvia however lags in areas such as R&D and high tech manufacturing.

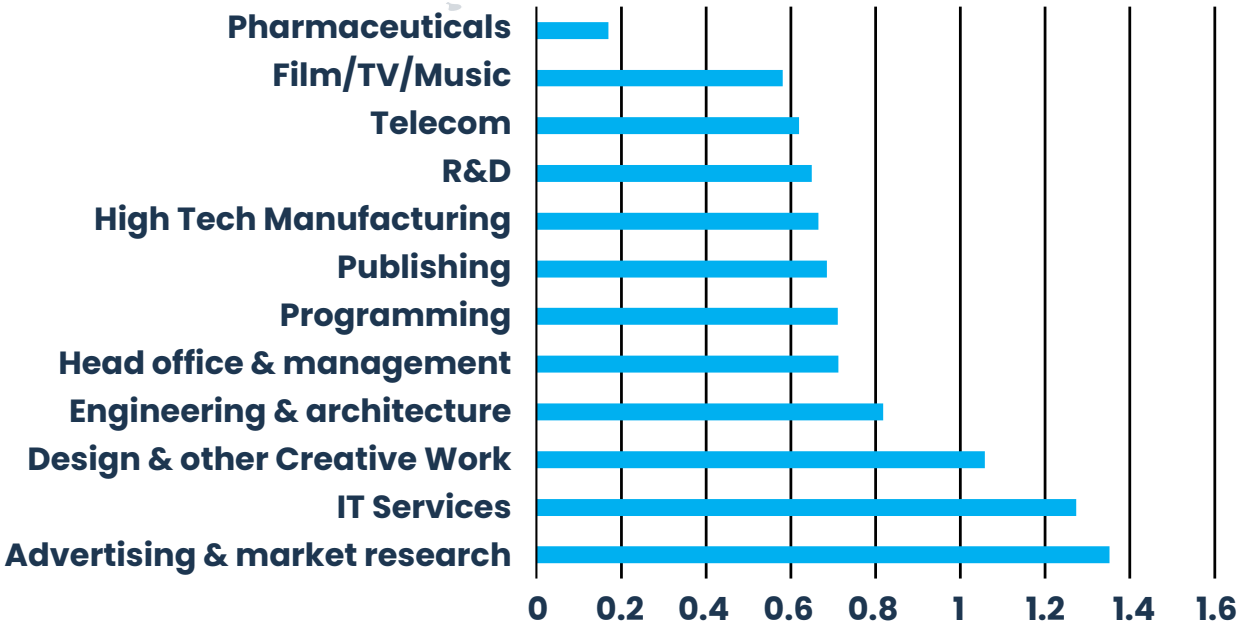
Latvia has several innovative start-up firms, such as F3 which develops a social app for asking questions and creating answers, with all content disappearing in 72 hours, and

Nordigen, which is building a transaction analytics tools for banks and lenders. Latvia's challenge is to continue adding brain business jobs, and to integrate further with neighbouring Estonia, which is a strong brain business jobs hub.

Country Analysis:
Lithuania

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Lithuania lost 1 300 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 5.2 percent in 2019 to 5.1 in 2020.

Lithuania
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Lithuania added 19 700 brain business jobs. Out of these 8 400 have been created in ICT, 4 200 in the tech sector, 4 000 in advanced services and 3 100 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

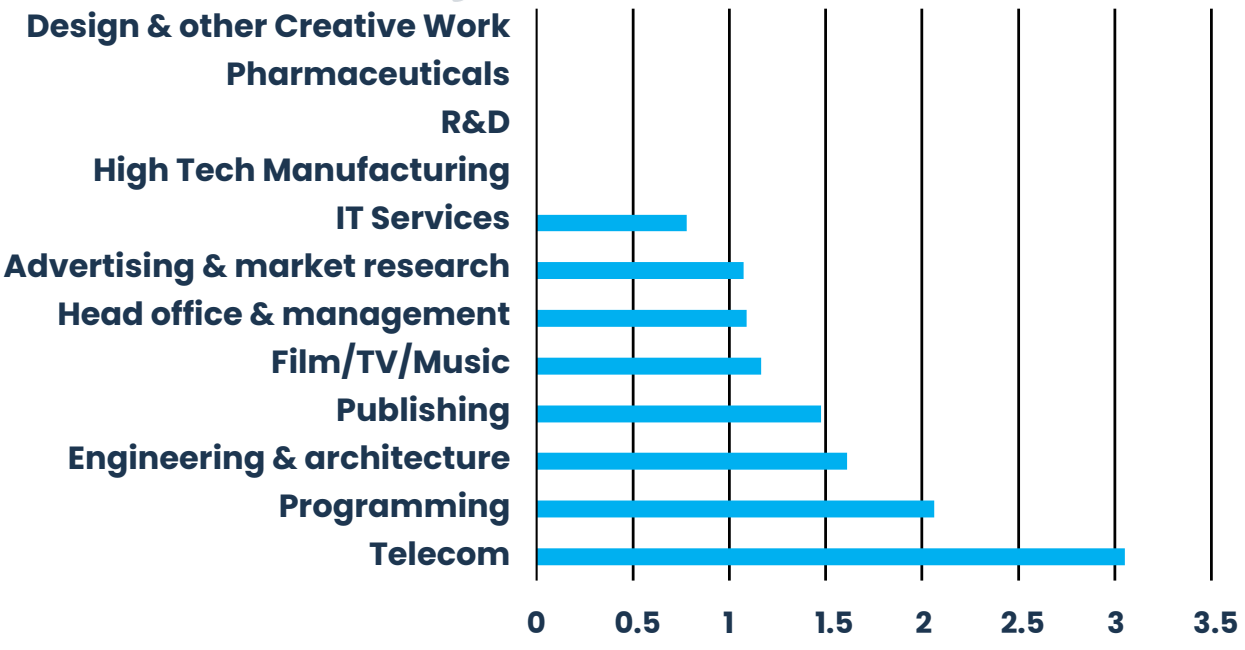
Compared to the rest of Europe, Lithuania has several strengths. The main strengths are in advertising and market research and IT services. On the other hand, Lithuania has a lower concentration than the rest of Europe when it comes to areas such as pharmaceuticals and film/TV/music.

Example of innovative start-ups in the country are Bankera, a bank for blockchain, and GoRamp, a platform for helping logistics heads and managers manage all transportation orders in one cloud service. Lithuania and the other Baltic nations are rising European stars in terms of knowledge-intensive jobs growth and can take advantage of trade with each other as well as the innovative Nordic region.

Country Analysis:
Luxembourg

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Luxembourg has gone against the stream, by adding 800 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has remained the same, at 8.7 percent.

Luxembourg
Standardized comparison,
1= European average



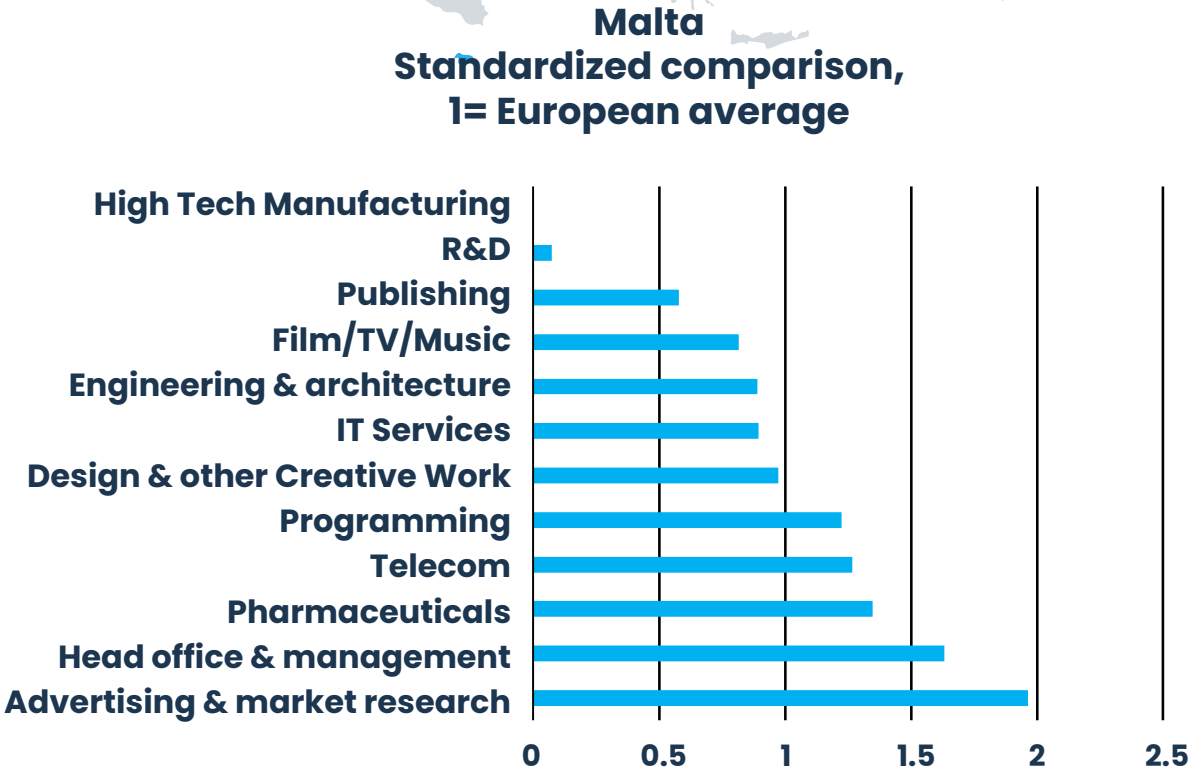
The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Luxembourg added 8 000 brain business jobs. Out of these 5 000 have been created in ICT, 1 500 in the tech sector, 1 000 in advanced services and 400 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Luxembourg has several strengths. The main strength is in Telecom, in which the share of brain business jobs of Luxembourg is more than three times the European average. In the Telecom sector, no other of the European countries comes close to having the concentration of knowledge-intensive jobs as Luxembourg. Luxembourg is also strong in programming. Examples of innovative start-ups in Luxembourg include Tokeny Solutions, an end-to-end compliant platform to issue, manage and transfer securities on the blockchain, and Kleos Space, which develops a geolocation intelligence data service, based on satellite data.

Country Analysis: Malta

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Malta lost 1 000 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 7.7 percent in 2019 to 7.2 in 2020. The concentration of brain business jobs in Malta is higher than any other Southern European nations, including France and Italy. Malta also ranks amongst the top-50 European regions in brain business jobs concentration.



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Malta added 8 400 brain business jobs. Out of these, 3 800 have been created in ICT, 3 400 in advanced services, 1 100 in the tech sector and 100 in creative professions.

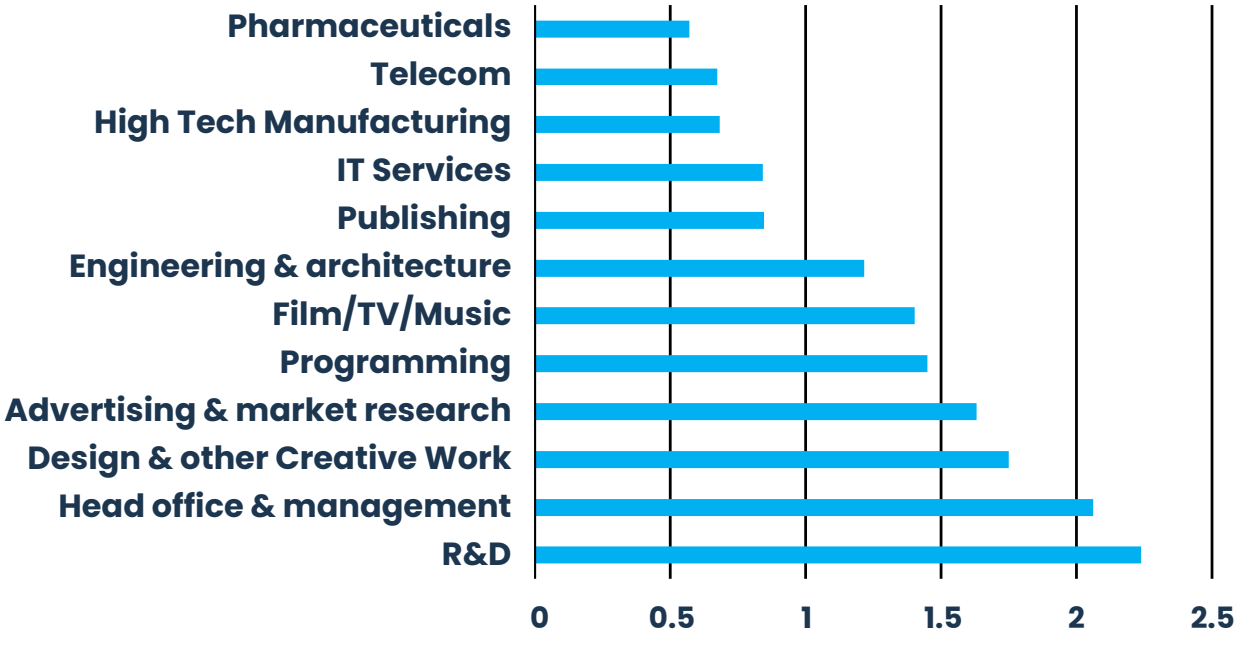
On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Malta has several strengths. The main strength is in advertising and market research, as well as head offices and management. Malta however lags in areas such as R&D. Examples of innovative start-ups in Malta include Binance Labs, a venture company investing in blockchain and crypto firms, and Quidax, a digital assets exchange that allows users to buy and sell cryptocurrency with their local currency. Malta is positioning itself to become a blockchain economy and competes with Cyprus in attracting brain business jobs.

Country Analysis: Netherlands

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Netherlands has avoided a loss, and in fact added 100 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms remains at 9.0 percent, the third highest in Europe following Switzerland and Sweden.

Netherlands
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, the Netherlands added 156 000 brain business jobs. Out of these 64 500 have been created in ICT, 43 200 in advanced services, 28 500 in the tech sector and 20 200 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, the Netherlands has strengths in R&D as well as head offices & management. In these two areas, the concentration of brain business jobs is two times the European average. No country has as high concentration of employment in research and development as the Netherlands. Closely following Belgium, the Netherlands has the second highest concentration of head office and management employment in Europe. On the other hand, the Netherlands lags the rest of Europe when it comes to areas such as pharmaceuticals and telecom.

The Uitrecht region is one of Europe's leading brain business hubs, with a concentration of brain business jobs even high-

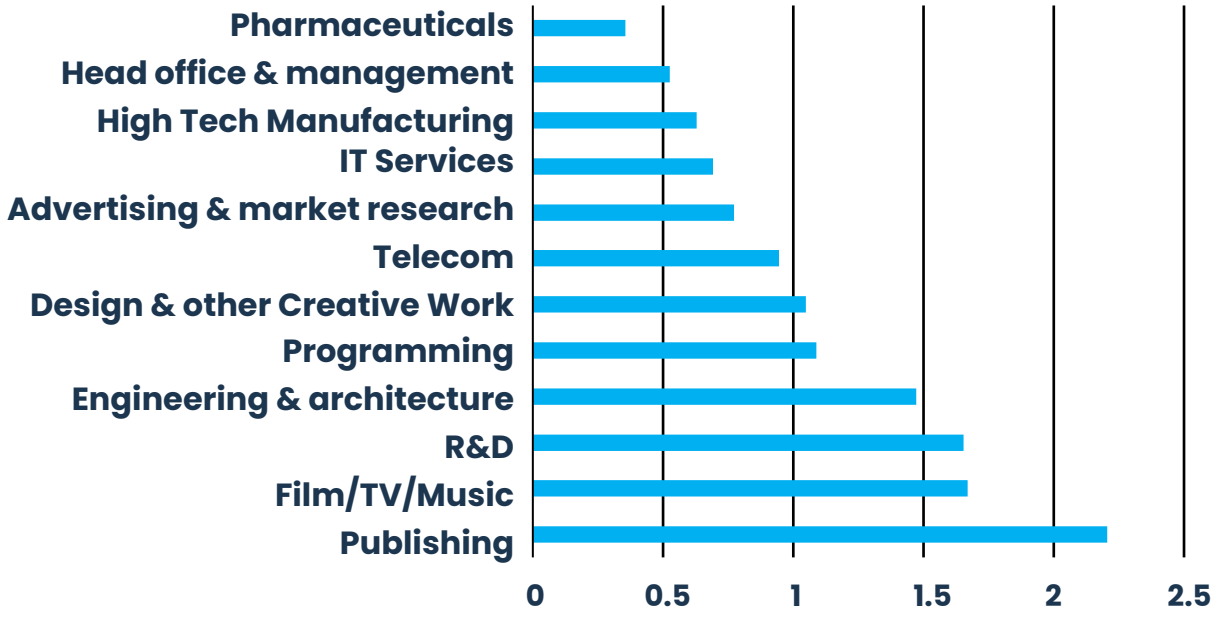
er than that of Amsterdam. Examples of innovative start-ups in Utrecht include Satelligence, which specializes in remote sensing, natural resource management, and tracking deforestation with satellite data analytics, and Lava Therapeutics, a developer of a bispecific antibody platform used to engage gamma-delta T cells for the treatment of cancer. In Amsterdam, innovative start-ups include Picnic, which operates an online platform created to provide grocery supermarket services at low prices, and Zivver, which offers a solution that secures e-mail, chat, or file transfer to prevent data leaks in the exchange of sensitive information.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Netherlands there is however not a strong link between brain business jobs concentration and unemployment. The challenge for the Netherlands is to compete with Sweden and Switzerland for the position of Europe's leading brain business jobs nation.

Country Analysis:
Norway

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Norway has gone against the stream, by adding 1 600 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has increased, from 6.9 percent in 2019 to 7.0 in 2020.

Norway
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Norway added 29 800 brain business jobs. Out of these 13 200 have been founded in ICT, 6 800 in creative professions, 6 400 in advanced services and 3 400 in the tech sector.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

In relation to the rest of Europe, Norway has a number of strengths. The main strength is in publishing, R&D and film/TV/music as well as engineering & architecture. Besides Denmark, no other European country has a higher concentration of publishing firm occupations than Norway. On the other hand, Norway has a lower concentration than the rest of Europe when it comes to areas such as pharmaceuticals and head offices & management.

TThe strongest region in Norway is the capital region of Oslo. Examples of innovative start-ups in the region are Spacemaker AI, which develops AI technology that discovers how to maximize the value building sites, Develops

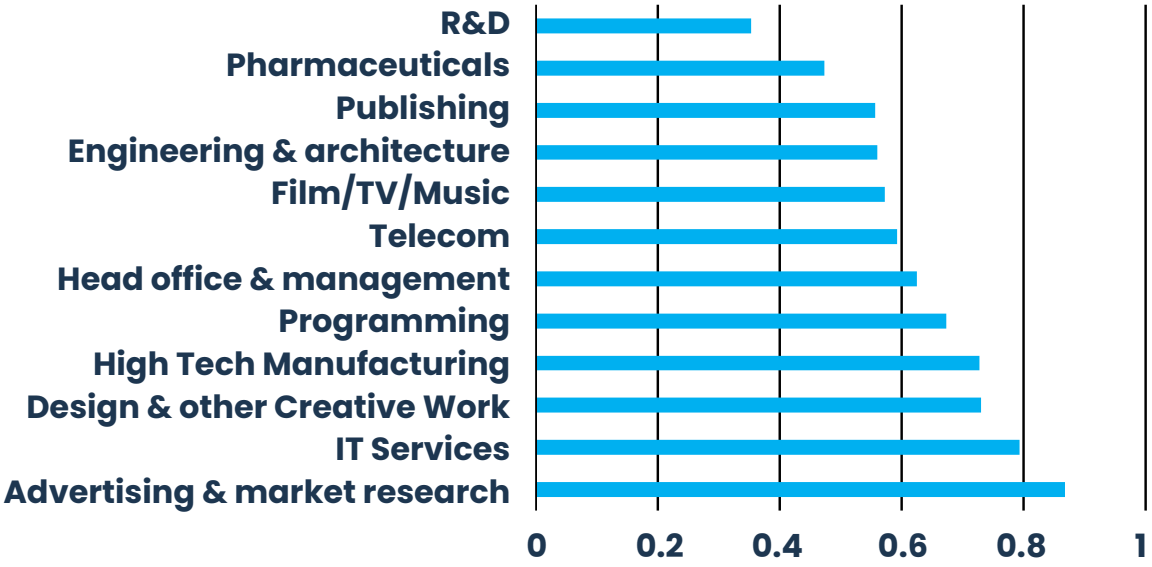
which is a digital platform connecting farm owners and other landlords of commercial property with the ideal tenants, and Dune analytics, which develops software for analysis of the cryptocurrency Ethereum.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Norway, and other Nordic nations, this is however not the case. Still, a challenge for Norway is to encourage knowledge-intensive job growth also in the outer regions, as these jobs are vital for long-term economic progress.

Country Analysis:
Poland

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Poland has gone against the stream, by adding 6 600 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has increased, from 4.1 percent in 2019 to 4.2 in 2020. The growth of brain business jobs in Poland is focused to the capital region. The Warsaw region is experiencing stronger growth of brain business jobs than any other region, in a comparison of 283 European regions.

Poland
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Poland added 256 200 brain business jobs. Out of these 134 100 have been created in ICT, 73 800 in advanced services, 27 200 in the tech sector and 21 200 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

The main strength of Poland is in advertising and market research, and IT-services. On the other hand, Poland lags the rest of Europe when it comes to areas such as R&D and pharmaceuticals. The strongest region in Poland is the capital of Warsaw. Examples of innovative start-up companies in the region include Packhelp, an online platform for creating and ordering custom-branded packaging in a web browser, Nomagic, which provides pick and place robotic solutions for order fulfilment, and Imnipack, a full-stack logistics company, working with the ecommerce sector.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unem-

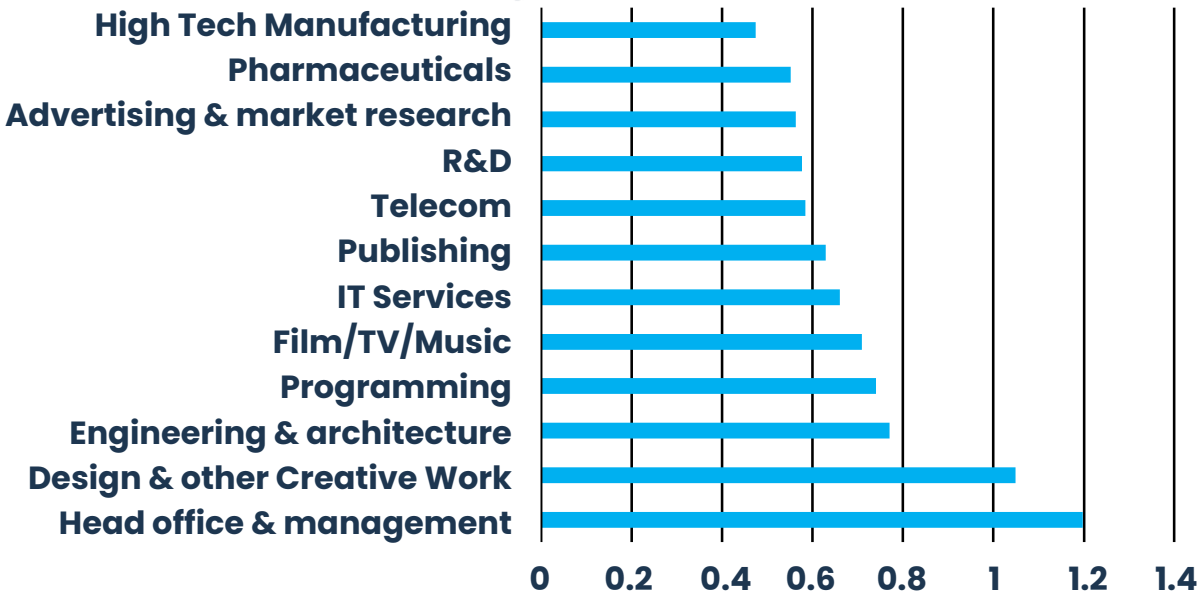
ployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. There is a clear link between higher share of employment in knowledge-intensive firms, and lower unemployment, among the Polish regions. The Mazowiecki regionalny and Lubelskie regions for example have some of the lowest shares of brain business jobs per capita, and some of the highest unemployment levels.

The challenge ahead for Poland is to maintain the growth of knowledge-intensive jobs, in the leading capital region as well as the rest of the country. Eastern and Central European nations are rapidly catching up to Western and Northern European nations in Brain Business concentration, relying on strong supply of talents and lower wage costs for the talents, as well as otherwise competitive business climate. Poland needs to make further investments in knowledge, through the education system, and improve the business climate for domestic and international firms, to continue its strong growth trajectory in knowledge-intensive jobs.

Country Analysis:
Portugal

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Portugal lost 7 900 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased slightly, from 5.2 percent in 2019 to 5.1 in 2020.

Portugal
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Portugal added 79 600 brain business jobs. Out of these 29 800 have been created in ICT, 26 700 in advanced services, 13 900 in creative professions and 9 100 in the tech sector.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Portugal has several strengths. The main strength is in head offices & management and design & other creative professions. On the other hand, Portugal does not match up with the rest of Europe when it comes to areas such as high-tech manufacturing and pharmaceuticals.

The strongest region in Portugal is the capital region of Lisbon. Examples of innovative start-up firms in the region include Virtuleap, which combines neuroscience and virtual reality to help increase attention levels, and address cognitive illnesses, and learning challenges, and HiJiffy which offers a solution that centralizes, automates, and measures all

hotel customer service activities.

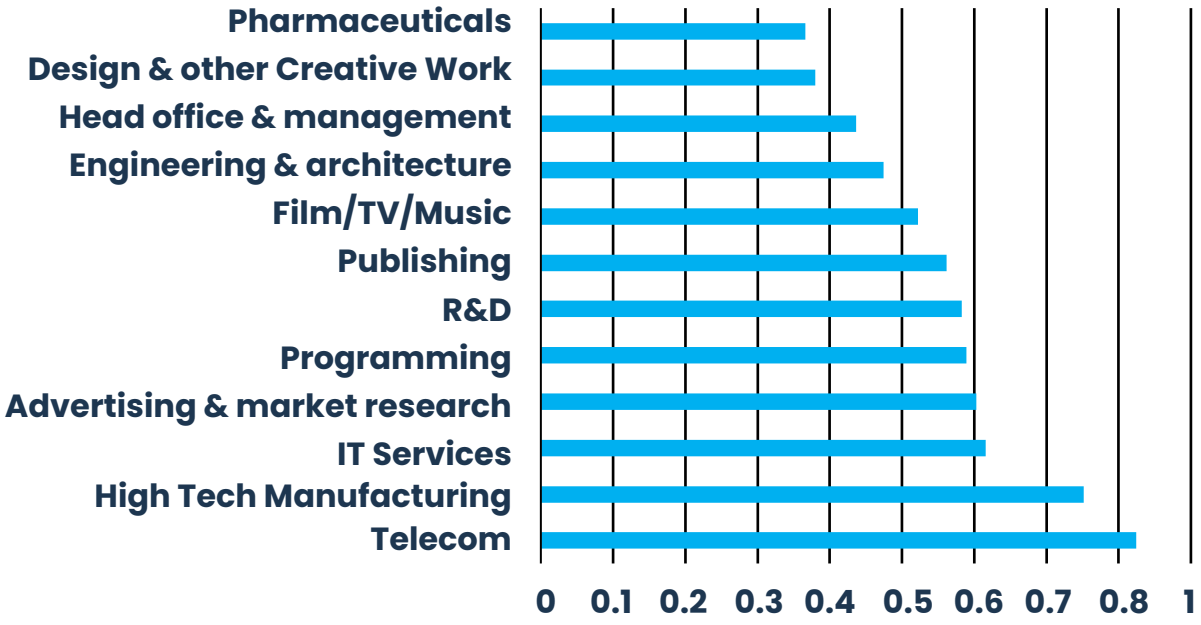
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. There is a clear link between higher share of employment in knowledge-intensive firms, and lower unemployment, among the Portuguese regions, except Lisbon which has a relatively high unemployment despite being the brain business hub of the nation.

Portugal's challenge is to foster talent supply, by upgrading the educational system, and encouraging growth particularly in IT services and programming, in a time where much of business growth is driven by digitalization. The opportunity also exists for the country to strengthen tech sector knowledge jobs, such as high-tech manufacturing and pharmaceuticals. Portugal is growing strong and can, like Malta, soon evolve into a southern European knowledge hub.

Country Analysis:
Romania

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Romania lost 28 600 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 3.8 percent in 2019 to 3.6 in 2020. The capital region of Bucharest, however, is one of the stronger brain business jobs centres of Europe, with competitive wages for knowledge workers.

Romania
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Romania added 66 500 brain business jobs. Out of these 56 800 have been created in ICT, 7 000 in the tech sector, 1 500 in creative professions and 1 200 in advanced services.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Romania has several relative strengths. The main strength is in telecom, followed by high-tech manufacturing. On the other hand, Romania has a lower concentration when it comes to areas such as pharmaceuticals and design & other creative work.

In Romania, the brain business jobs are highly focused to the Bucharest area. In this year's index, Bucharest has managed to catch up to and even surpass Amsterdam in terms of brain business jobs concentration. Bucharest is also ahead in brain business jobs concentration compared to regions such as Oslo, Berlin, Helsinki, Madrid, and Vienna. Examples of innovative start-ups in Bucharest include Soleadify,

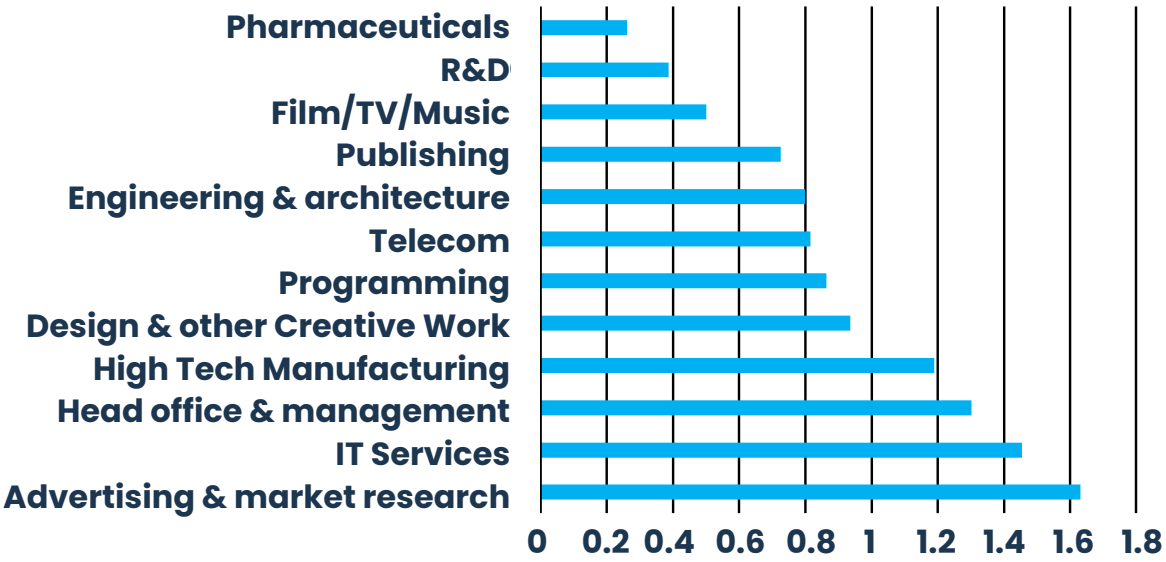
which has developed a search engine for businesses and business data, DRUID, which offers an AI-powered enterprise chatbot platform that allows easy development of chat or voice-enabled intelligent virtual assistants, and Questo, which is developing a mobile exploration game, offering mission-like city tours which you can play.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. This is also true for Romania. The Sud-Vest Oltenia, the Sud-Est and the Sud-Muntenia regions have the lowes concentration of brain business jobs and struggle with higher unemployment figures than the rest of the country. The challenge ahead for Romania is to uphold the growth of knowledge-intensive jobs, in the leading capital region as well as the rest of the country. Significant regional inequality will arise if the number of brain business jobs continue to grow in Bucharest but not in other parts of the country.

Country Analysis:
Slovakia

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Slovakia lost 5 800 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 6.4 percent in 2019 to 6.2 in 2020. Slovakia's capital region of Bratislava remains the strongest brain business hub in Europe, with higher concentration of brain business jobs per capita than any of the other 283 European regions. This is made possible by competitive wages, and increased integration with the knowledge hubs of other parts of Europe.

Slovakia
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Slovakia added 76 800 brain business jobs. Out of these 35 100 have been created in advanced services, 25 800 in ICT, 9 300 in the tech sector and 6 500 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Slovakia has several strengths. The main strength is in advertising & market research and IT-services. On the other hand, Slovakia lags behind the rest of Europe when it comes to areas such as pharmaceuticals and R&D. Examples of innovative start-up firms in Slovakia include Hilbi, which offers an artificial intelligence-enhanced, decentralized communication platform that can facilitate instant payments, and altFINS, a cloud-based platform allowing investors and traders to track and analyse digital assets across various platforms.

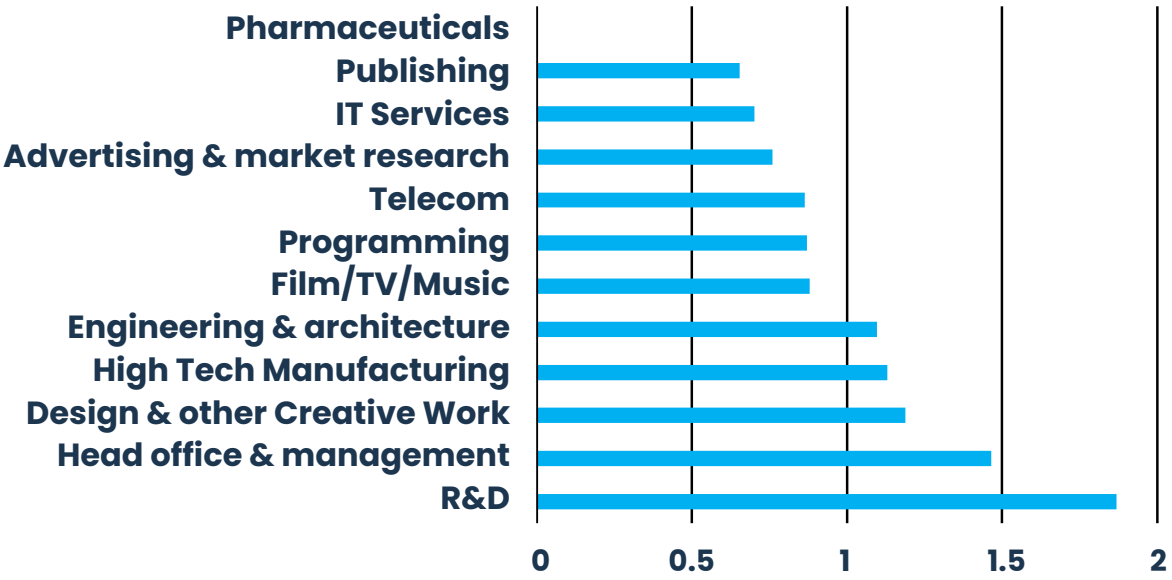
A common trend in European countries is that regions with high concentration of brain business jobs have lower un-

employment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Slovakia, there is a clear link between brain business jobs and unemployment. The Východné Slovensko region which has the lowest share of knowledge-intensive firm employment also has the highest unemployment figures in the country. Slovakia needs to expand on the advantage of having Bratislava, with the highest concentration of brain business jobs amongst 283 European regions, by also expanding the growth of knowledge jobs to the rest of the country.

Country Analysis:
Slovenia

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Slovenia lost 700 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 6.7 percent in 2019 to 6.6 in 2020.

Slovenia
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Slovenia added 16 000 brain business jobs. Out of these 6 000 have been created in advanced services, 5 600 in ICT, 2 500 in the tech sector and 1 900 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as a result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

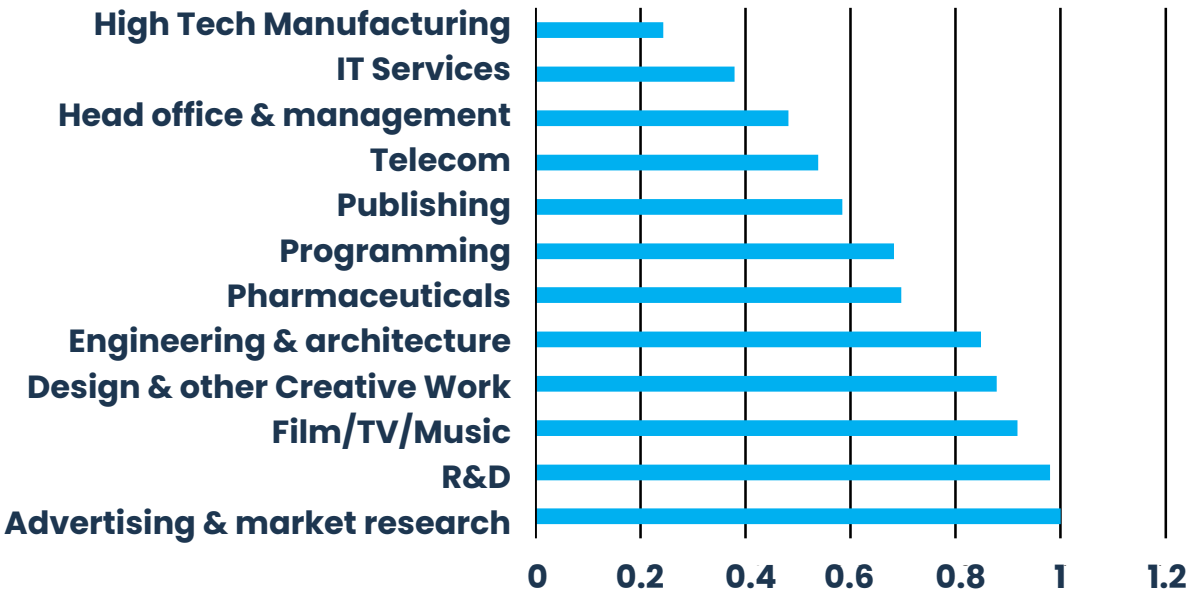
Compared to the rest of Europe, Slovenia has strengths in R&D and head offices & management. On the other hand, Slovenia lags the rest of Europe when it comes to areas such as pharmaceuticals, publishing and IT services. Example of innovative start-up firms in Slovenia are Viberate, which aims to map and standardize the global music ecosystem, and Eligma, a firm engaged in facilitating crypto payments.

The brain business jobs in Europe are increasingly found in Eastern and Central European countries which compete by having good supply of talents and competetive wage costs for the talents, combined with an overall positive business environment. The challenge for Slovenia is to continue the strong development, which requires further investments in education as well as improvements of the business climate.

Country Analysis:
Spain

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Spain lost 45 200 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 4.7 percent in 2019 to 4.5 in 2020.

Spain
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Spain added 252 000 brain business jobs. Out of these 90 300 have been created in advanced services, 80 200 in ICT, 50 500 in the tech sector and 31 000 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the other parts of Europe Spain is particularly strong in advertising & market research, followed by R&D (research and development). Spain lags in high-tech manufacturing and IT services. Madrid is one of Europe's leading brain business jobs hubs.

Examples of innovative start-ups in the Madrid region include Bipi, a car subscription startup offering consumers an alternative to car ownership, Bdeo which provides a visual intelligence solution designed to change the way customers connect with insurance companies and OnTruck, which offers companies regional merchandise transport services, through an immediate price management system.

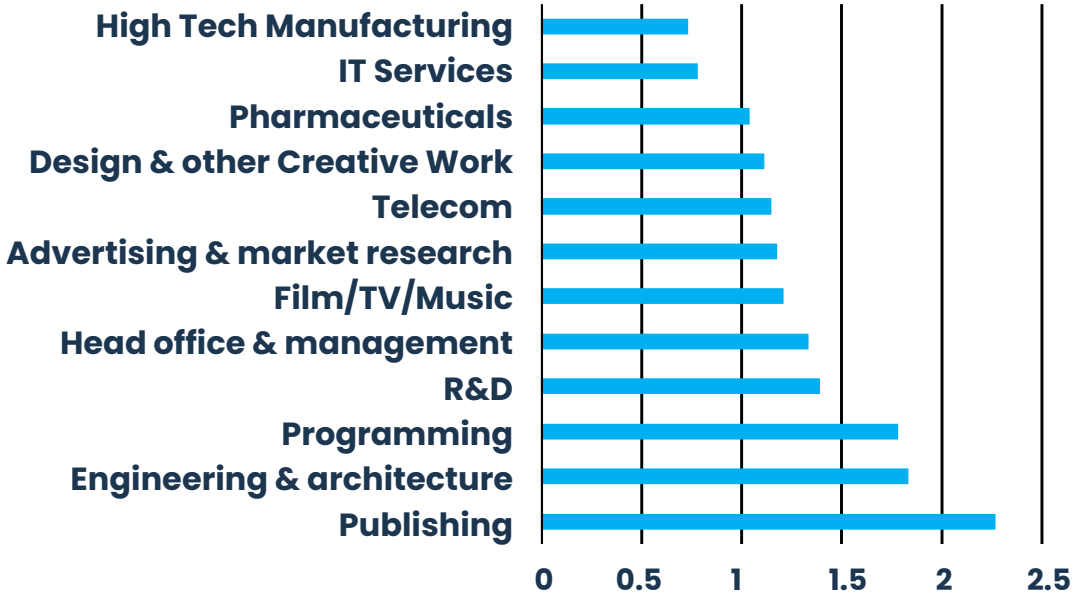
A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Spain, a clear link exists between brain business jobs concentration and unemployment. The Extremadura region, which has the second lowest brain business jobs concentration in the country, for example also has the highest level of unemployment.

The challenge for Spain is to stimulate the growth of knowledge-intensive firms, improve the level of digitalization and create opportunities of innovative firms to grow also outside of the Madrid region.

Country Analysis:
Sweden

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Sweden lost 7 100 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 9.7 percent in 2019 to 9.6 in 2020. Sweden has the highest concentration of knowledge-intensive firm employment, as share of working age population, in the European Union. Among European countries, only Switzerland has a higher share than Sweden.

Sweden
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Sweden added 68 000 brain business jobs. Out of these 52 800 have been created in ICT, 7 500 in advanced services, 7 200 in creative professions and 500 in the tech sector.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, Sweden stands out as having strengths in nearly all brain business areas, except for high-tech manufacturing and IT services. In all other nine brain business jobs areas, Sweden outpaces the average European country. This combination of depth and strength is unusual in Europe.

The strongest region in Sweden is the capital region of Stockholm. Examples of innovative start-ups in the region include VOI Technology, which owns, operates, and manages electric scooters for urban commuters, FirstVet which is a digital veterinary platform, and provides pet-owners with on-demand video consultations from qualified veterinarians, and

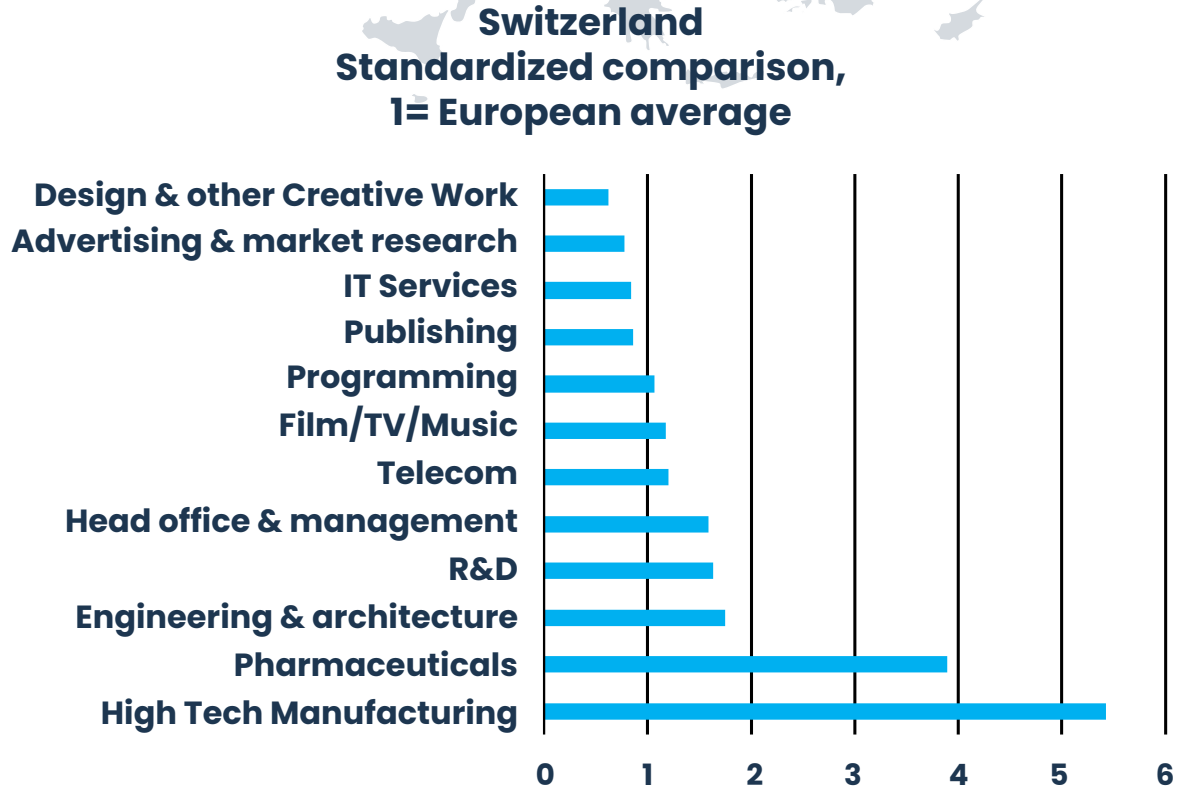
KRY which offers healthcare services via distance, based on digital meetings with health personnel.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In Sweden, there is a weak link between high concentration of brain business jobs and low unemployment on a regional level.

While Sweden is gradually catching up to Switzerland as the brain business jobs leader of Europe, the capital regions of Eastern and Central European nations are catching up to Stockholm in brain business jobs concentration. The competitive edge of the Eastern and Central European national capital regions is that they combine good access to talent with lower wage costs. Cost of labour is an important challenge for Sweden to tackle, possibly through a lowering of labour taxes.

Country Analysis:
Switzerland

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. Switzerland lost 2 400 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms remains at 10.4 percent. Switzerland is the only European country where more than 10 percent of the working age population is employed in brain business jobs, with Sweden on second place having a concentration of 9.6 percent and the Netherlands on third place having 9.0 percent.



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, Switzerland added 79 900 brain business jobs. Out of these 34 800 have been created in advanced services, 23 300 in ICT, 17 500 in the tech sector and 4 300 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

While Switzerland does have a commanding lead in brain business jobs compared to the rest of Europe, the country relies heavily on two sectors. These are high tech manufacturing, where Switzerland has five and a half times as high concentration of knowledge workers compared to the European average, and the pharmaceutical industry where Switzerland has four times the concentration of knowledge-intensive workers as the European average. In design & other creative professions and advertising & market research Switzerland lags the rest of Europe.

The overall trend in Europe is that knowledge-intensive jobs are growing mainly in ICT and advanced services, and

somewhat in creative professions, while stagnating in the tech sector, which includes high tech manufacturing and pharmaceuticals. The reliance of Switzerland on the tech sector, and comparably weaker ICT, advanced services sectors, and creative sectors, risk leading to the country stagnating compared to parts of Europe.

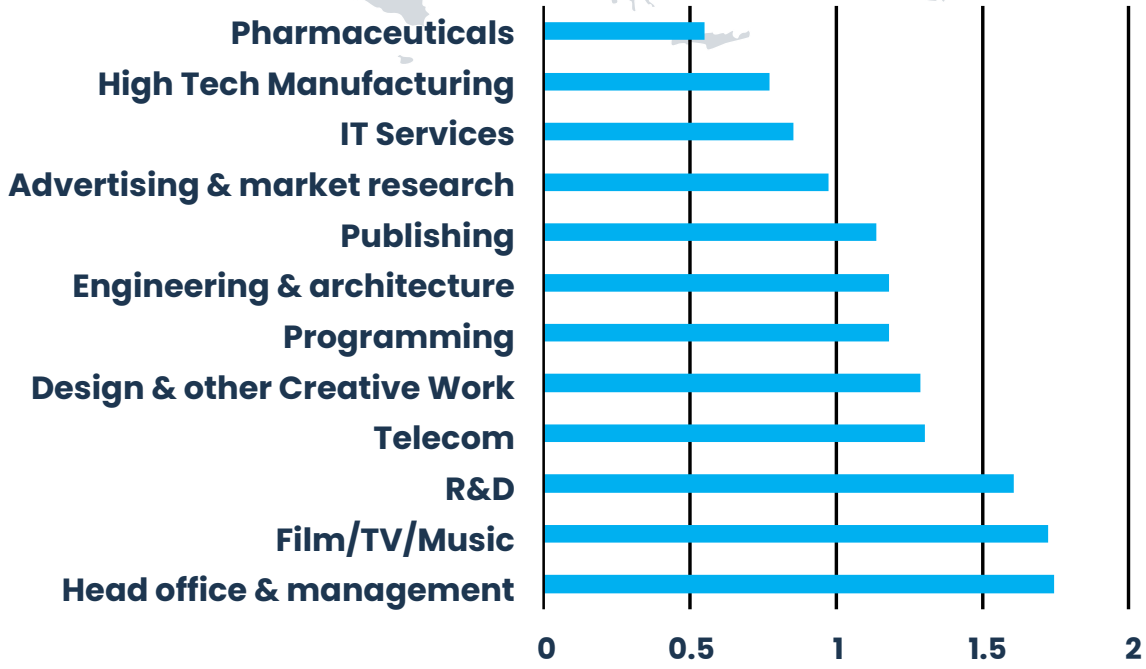
Examples of innovative start-ups in Switzerland include Polkadot, located in Zug, which develops a protocol that allows independent blockchains to exchange information, ANYbotics, located in Zürich, which is a manufacturer of four-legged robots intended for a variety of industrial uses, and GUURU, also located in Zürich, which develops an AI-powered customer service platform.

Ambitious strategies must be formulated to ensure that Switzerland builds upon its strengths. Key element of such strategies should be encouraging brain business jobs outside of the tech sector, as well as lowering the cost of talent recruitment.

Country Analysis: UK

Before 2020, Europe was experiencing an increase of brain business jobs, a term for employment in knowledge-intensive firms in tech, ICT (information and communications technology), advanced services, and creative professions. Between 2013 and 2019, on average 509 000 brain business jobs were added on a yearly basis, to the economies of the EU-member states plus the UK, Switzerland, Norway, and Iceland. In 2020 however, the number of brain business jobs in Europe fell for the first time, by nearly 167 000. The UK lost 30 200 brain business jobs during 2020. The concentration of working age population employed in knowledge-intensive firms has decreased, from 8.2 percent in 2019 to 8.1 in 2020.

United Kingdom
Standardized comparison,
1= European average



The long-term trend is a steady rise in knowledge-intensive firm employment. Between 2012 and 2020, the UK added 600 300 brain business jobs. Out of these 224 900 have been created in ICT, 209 600 in advanced services, 102 400 in the tech sector and 63 400 in creative professions.

On a European level, during 2020 knowledge-intensive companies have fared better compared to the rest of the economy. The reduction in volume production of companies in the tech-sector, as result of the corona crisis, was for example only half of the reduction in all manufacturing. Advanced services similarly experienced only half the reduction in production volume compared to all services. The ICT sector stands out by slightly increasing its volume of production, which is explained by the fact that many businesses turned to digital solutions due to social distancing measures. Creative professions have however seen a significant reduction in production values, as parts of the film/TV/music sectors have experienced difficulties in keeping up production during the pandemic.

Compared to the rest of Europe, the UK has several strengths. The main strength is in head offices & management, followed by film/tv/music and R&D. On the other hand, the UK is behind the rest of Europe when it comes to areas such as pharmaceuticals, high-tech manufacturing and IT services.

The strongest region in the UK in terms of concentration is Berkshire, Buckinghamshire, and Oxfordshire. Examples of innovative start-ups in this Oxford region include Navenio, a software company that provides location positioning services for indoor environments through its mobile app, and Oxwash, which is developing a clinical-grade laundry/dry cleaning service with space age technology. London is an-

other leading European brain business hub, with considerably more brain business jobs than Oxford, but slightly lower concentration per working age population. Examples of innovative start-ups in London include Railsbank, a unique open-banking and compliance platform, and Hopin, a live virtual events platform that enables attendees to connect, learn, and interact.

A common trend in European countries is that regions with high concentration of brain business jobs have lower unemployment, except for capital regions which sometimes combine high unemployment with high concentration of knowledge-intensive jobs. In the UK, there is a weak link between high concentration of brain business jobs and low unemployment on a regional level.

The UK has the highest brain business jobs concentration amongst larger European nations. Still, the country faces the challenge of boosting knowledge-intensive sectors, for it to catch up to leading smaller nations such as Switzerland, Sweden, and the Netherlands.

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