The Geography of Europe's Brain Business Jobs: 2020 Index

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Summary: Half a million new Brain Business Jobs created each year in Europe, mainly in ICT and advanced services

The study *The Geography of Europe's Brain Business Jobs* measures the share of 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 third edition of the index expands the definition of Brain Business Jobs to include the pharmaceutical industry, and couples quarterly employment data with structural business statistics in order to obtain recent year data. The study finds significant shifts in knowledge-intensive jobs in 31 European countries and 278 regions within these countries.[1] A number of interesting findings emerge:

- **Half a million Brain Business Jobs added annually.** Knowledge-intensive jobs are growing steadily in Europe. In total, 3.4 million additional Brain Business Jobs have been added between 2012 and 2019 to the economies of the EU-member states and Switzerland, Norway and Iceland. This represents an increase of nearly half a million Brain Business Jobs per year. Of these 1.3 million have been created in ICT, 1.0 million in advanced services, 740 000 in tech and 314 000 in creative professions. If current trends continue, both ICT and advanced services will eventually outperform tech as the dominant knowledge-intensive sectors.

1 Regional analysis includes 29 countries, as data of high quality does not exist yet for Switzerland and Ireland.

- **Nordic nations are top performers.** Sweden has the highest share of working age population employed by knowledge-intensive firms in the European Union; gradually catching up to Switzerland that is the leading European nation. Denmark, Iceland, Finland and Norway also have high shares of Brain Business Jobs, making the Nordics the leading greater region of Europe. The Swedish capital region of Stockholm has the thirds highest concentration of Brain Business Jobs in Europe, after Bratislava and the Oxford region.[2]

- **Significant catch up-effect.** An equalization is occurring. Western Europe is catching up to the Nordics in Brain Business Jobs concentration, while Eastern and Central Europe in turn is catching up to Western Europe.

- **Southern Europe, with exception of France and Malta, lags behind.** With the exception of France and Malta, Southern Europe has a lower Brain Business Jobs concentration. Malta has evolved into a hub for business, ICT and finance, but the growth of Brain Business Jobs has stagnated lately. Portugal, Cyprus and Spain are catching up, with a strong growth of knowledge-intensive jobs. Greece lags behind, but even though the Brain Business Jobs in the country are increasing, the pace of growth needs to be significantly higher in order to catch up to the rest of Europe. Italy is also far behind, but has a stronger growth than Greece.

- **Brain Business surge in Central and Eastern Europe.** In 2014, France, Belgium and Austria had higher concentration of Brain Business Jobs compared to Hungary, Latvia, Czechia and Slovenia. Since then, the four Central and Eastern European countries have surpassed France, Belgium and Austria in Brain Business Jobs concentration. Lower cost of labour and significant share of young people investing in higher education lead to a Brain Business surge in Central and Eastern European nations. While a significant share of talents leave to work in Western and Northern Europe, those individuals who stay drive up the Brain Business concentration. A puz-

2 The Oxford region refers to Berkshire, Buckinghamshire and Oxfordshire.

zle is why Belgium, which hosts the European Union capital region of Brussels, does not perform better.

- **Rapid growers found throughout Europe.** The traditional geographical divides in knowledge-intensive jobs concentration are giving way to a more competitive landscape, where countries with growth-oriented policies and lower wage levels experience a rapid development. In Latvia and Hungary, the concentration of Brain Business Jobs has grown with more than a third (37 and 34 percent respectively) between 2014 and 2019. The rapid growers in Southern Europe are Cyprus and Portugal. In both countries, the concentration of Brain Business Jobs has grown by 29 percent. The fastest growing Western European country is Ireland, with 19 percent increase over the same period. Sweden, the rapid grower in the Nordics, has experienced a Brain Business Jobs concentration growth of 14 percent (see table 1).

- **London fastest growing region.** On a regional basis, the most significant increase of Brain Business Jobs has occurred in London, which has added 25 Brain Business Jobs per 1 000 working age inhabitants compared to two years earlier. London has thus surpassed Paris in Brain Business Jobs concentration. While in France knowledge-intensive jobs are strongly focused to the capital region, in the UK several strong regions besides London exist, such as the Oxford region, which after Bratislava has the second highest concentration of Brain Business Jobs in Europe.

- **Bratislava builds on leading position.** Bratislava is the European region that has the highest total share of Brain Business Jobs per capita, as fully 19 percent of the working age population of the region is employed in knowledge-intensive businesses. Bratislava builds on an already strong position by having the second highest rate of increase in knowledge-intensive jobs, adding 21 Brain Business Jobs per 1 000 working age inhabitants compared to two years earlier. The Slovakian capital region succeeds by combining cluster effect with competitive wages for knowledge workers.

- **Sofia, Prague and Bucharest strengthen position as new Brain Business Hubs.** The third fastest rate of Brain Business Jobs growth is found in Sofia, followed by Prague and Bucharest. The five regions with strongest rise in knowledge-intensive jobs are all capital regions, and four of them are in the East/Central European greater region. Supply of talent, coupled with competitive wages, drives economic activity to the region. Firms are increasingly mobile in Europe, shifting knowledge production to countries with lower cost for talents and advantageous taxation rules. Additionally, it is increasingly common that firms in Northern and Western Europe subcontract part of knowledge-intensive work to partner firms in East and Central European capital regions. Brain Business Jobs are thus growing through co-operation, as well as competition, between knowledge-intensive hubs throughout Europe.

Figure 1. Share of workforce in Brain Business Jobs

Above 8 %	6.0 to 8.0 %	4.5 to 5.9 %	Below 4.5 %
Switzerland	Iceland	France	Spain
Sweden	Ireland	Slovakia	Greece
Denmark	Finland	Lithuania	Italy
Netherlands	Hungary	Portugal	Croatia
Luxembourg	Norway	Cyprus	Poland
United Kingdom	Slovenia	Bulgaria	Romania
Germany	Estonia		
	Latvia		
	Czechia		
	Austria		
	Belgium		
	Malta		

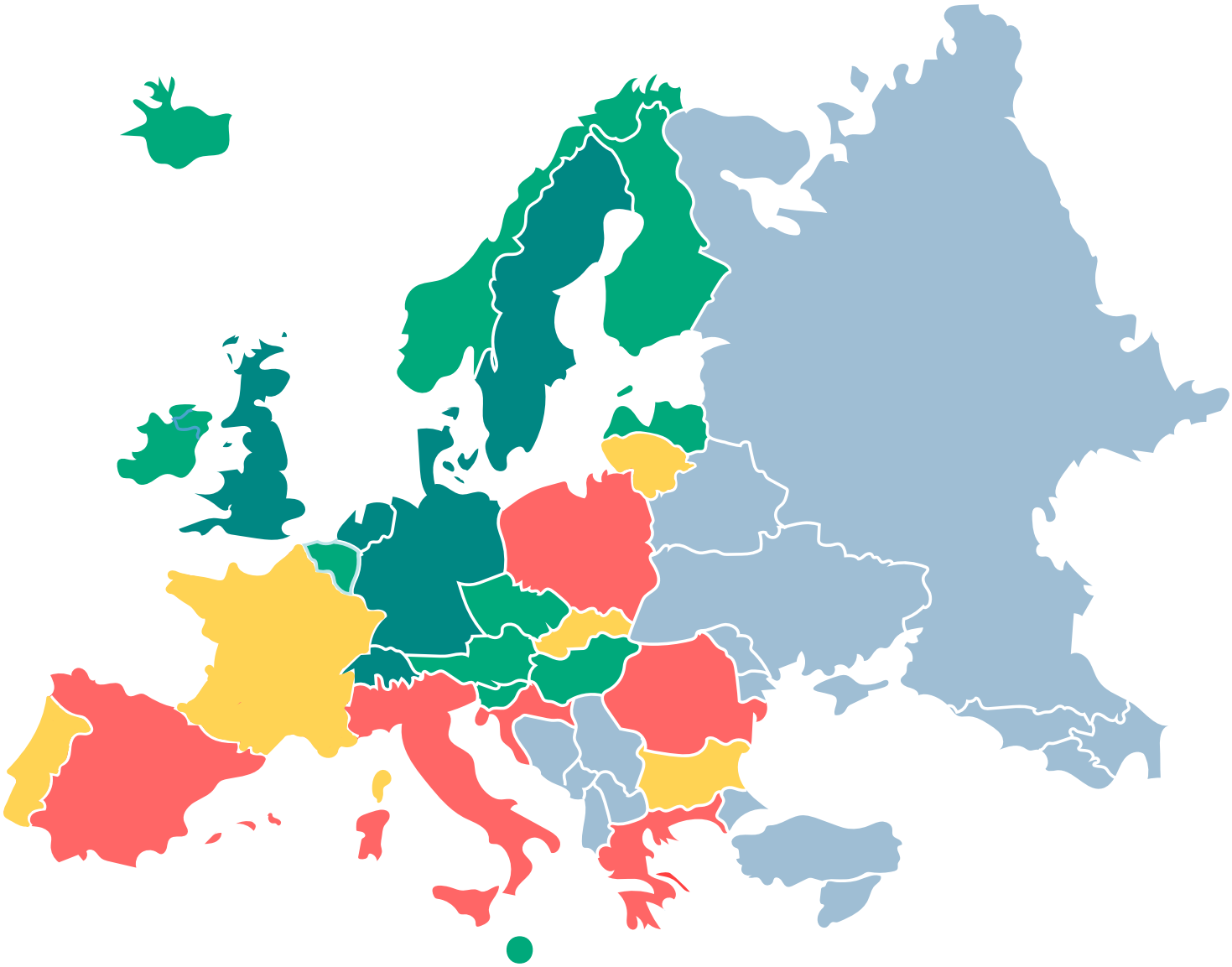

Table 1. Rate of change in Brain Business Jobs concentration (per 1 000 working age inhabitants) between 2014 and 2019

Latvia	37.0%
Hungary	33.6%
Slovakia	32.9%
Poland	29.3%
Romania	29.2%
Portugal	28.8%
Cyprus	28.7%
Bulgaria	28.6%
Lithuania	28.5%
Slovenia	22.0%
Czechia	22.0%
Spain	21.3%
Ireland	18.8%
Germany	16.3%
Estonia	15.8%
Sweden	14.2%
Croatia	13.4%
Italy	13.1%
United Kingdom	12.2%
Netherlands	11.9%
Belgium	8.7%
France	8.1%
Austria	7.7%
Norway	7.2%
Greece	5.8%
Switzerland	4.9%
Finland	4.8%
Malta	2.9%
Luxembourg	2.7%
Denmark	-0.4%
Iceland	-4.2%

Structural business statistics for years 2014-17 and quarterly business statistics for years 2018-19 (based on Q2 data for each year).

Case study #1: Why Sweden is catching up to Switzerland as Brain Business Jobs leader

Sweden and Switzerland are often mistaken for each other, at least by Americans and other people outside of Europe. It is not just the names that are similar. While the two nations are quite different, and situated in different parts of Europe, they do share a cold climate and in adaptation to this climate also display similar cultural attributes. Both Switzerland and Sweden have developed highly organized cultures with emphasis on personal responsibility and working ethics. Government and private institutions are typically strong in the two countries, which have well-educated populations. These common attributes can explain why Switzerland and Sweden are the two leading countries in Europe in terms of Brain Business Jobs per capita.

At first glance, the economic policies of Switzerland and Sweden might be seen as opposites. Switzerland is a low tax nation and Sweden a high tax one. This in turn is linked to higher level of prosperity in Switzerland. Yet, Sweden has since the 1980s implemented numerous economic liberalization reforms. Since the turn of the millennium, Swedish taxes have also been reduced. The liberalizations have fostered a start-up culture, with the Swedish capital region of Stockholm developing into a Nordic miniature version of Silicon Valley. Spotify and Klarna are two examples of highly successful new companies founded in Sweden.

In both countries, well-secured property rights, including intellectual property rights, encourage productive enterprises. While Switzerland is the Brain Business Jobs leader of Europe, this is due to a strong reliance on the tech sector—with Switzerland being strong in high-tech manufacturing, engineering, pharmaceuticals as well as R&D. However, the growth of Brain Business Jobs largely occurs in ICT and advanced services. Also in creative professions the rate of growth is higher than in the tech sector (see table 2).

Therefore, Sweden which has overall strengths in all four sectors is gradually catching up to Switzerland. In order to keep the top spot, the Brain Business Jobs of Switzerland need to diversify.

Brain Business Jobs are key for development—and highly mobile

The pace of economic development is slowing in Europe, as well as globally. Yet, at the same time the world is experiencing impressive technological and societal development. Digitalization, automation, advances in biotechnology and formation of sophisticated service firms are fundamentally changing the business landscape. The countries and regions that prosper are those that are open to global exchange and foster knowledge-intensive enterprises. Old business structures, which have not adapted to the forces of globalization and digitalization, have either fallen behind or risk doing so in the next economic downturn.

Although economic growth is low in most of Europe, a strong shift towards higher share of employment in knowledge-intensive businesses is occurring in most of Europe. Those regions and countries that compete with knowledge-intensive jobs are also likely to better endure a future global recession. This third 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 278 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.[3]

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. As shown in table 2 the most rapid rate of increase of Brain Business Jobs has occurred in advanced services, followed by ICT, creative professions and lastly tech.

Tech remains the dominant Brain Business Jobs sector. Yet, given the current trends, ICT and advanced services will eventually outpace tech. It remains to be seen how the pace of development changes in the respective sectors, and how automation affects the number of jobs associated with each. Currently, digitalization and the shift towards the service economy are the dominant factors affecting Brain Business Jobs development. In total, Europe has added 3.4 million Brain Business Jobs between 2012 and 2019, out of which 1.3 million in ICT, 1 million in advanced services, 740 000 in tech and 314 000 in creative professions.

Table 2. Growth of Brain Business Jobs in Europe

	Per 1000 working age individuals						
	2014	2015	2016	2017	2018	2019	
All	54.1	55.9	59.2	59.6	61.2	62.6	*15.7*
Tech	18.0	18.4	18.8	19.1	19.6	19.9	*10.3*
ICT	15.8	16.4	17.2	17.9	18.4	18.8	*19.2*
Advanced services	11.7	12.4	14.0	13.4	13.8	14.2	*20.9*
Creative professions	8.5	8.7	9.1	9.2	9.5	9.7	*13.4*

The share of Brain Business Jobs differs markedly across Europe. At one end of the spectrum are Switzerland, Sweden and Denmark, in which between 8.9 and 10.6 percent of the working age population are employed in Brain Business Jobs. On the other is Romania and Poland 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, significant changes in the geographical distribution is occurring. Western Europe is catching up to the Nordics in Brain Business Jobs concentration, while Eastern and Central Europe in turn is catching up to Western Europe. The shifts in the knowledge-intensive landscape of Europe are dramatic and worthwhile for investors, as well as policymakers, to take note of.

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This year's index adds pharmaceuticals as a Brain Business Jobs category, giving a boost to Switzerland that already in previous indexes was rates as the number one European country in terms of Brain Business Jobs concentration. Yet the rate of increase is slow in Switzerland, while Sweden is catching up. Switzerland is relying strongly on the tech sector including research and development and pharmaceuticals. Sweden has more broadly dispersed strengths, being a leading nation in all four categories. In a time when the tech sector is growing slower than ICT, advanced services and creative professions in terms of Brain Business Jobs, Switzerland has fallen behind and might soon be overtaken by Sweden. Denmark and Iceland are the only two countries, amongst those 31 studied in this report, in which concentration of Brain Business Jobs has fallen between 2014 and 2019. The

concentration has fallen slightly (-0.4 percent) in Denmark and more strongly (-4.2 percent) in Iceland. Finland and Norway have experienced increase (4.8 and 7.2 percent respectively) in Brain Business Jobs concentration, compared to 14.2 percent in Sweden.

Southern Europe is the region with the lowest national concentration of Brain Business Jobs. In this region Malta and France stands out by having a relatively high, and rapidly increasing, share of knowledge-intensive jobs. While France has for long had a strong knowledge sector, the progress of Malta is more surprising. This small Mediterranean island has growth friendly policies in form of low taxes, few regulations and a positive start-up culture, which all combine to boost development. Attracting businesses such as online gaming, artificial intelligence, cryptocurrency and medical marijuana, Malta is on its way to become a free market port of Europe, similar to Hong Kong, Singapore and Dubai. Economic growth has however brought with it rising rental costs, which in turn has led to some programming jobs shifting from Malta to Portugal, Cyprus and other nations.

A strong divide has existed in Europe in terms of development between the Western part and Central and Eastern Europe. Today we are seeing the eroding effects of this divide. In 2014, France, Belgium and Austria had higher concentration of Brain Business Jobs than Hungary, Latvia, Czechia and Slovenia. Since then, the four Central and Eastern European countries have surpassed their Western counterparts in Brain Business Jobs concentration. Lower cost of labour and significant share of young people investing in higher education lead to a Brain Business surge in Central and Eastern European nations. While a significant share of talents do leave to work in Western and Northern Europe, those individuals who stay drive up the Brain Business concentration. It is noticeable that while the capital regions of many individual countries have strong concentration of knowledge-intensive jobs, the capital region of the EU, Brussels, is not on top.

The traditional geographical divides in knowledge-intensive jobs concentration are giving way to a more competitive landscape, where countries

with growth-oriented policies experience a fast development. In Latvia and Hungary, the concentration of Brain Business Jobs has grown with more than a third between 2014 and 2019. The top-ten list of rapid growers includes eight Central and Eastern European nations, as well as the Southern catch up-nations of Portugal and Cyprus (see table 1). The first Western European nation to appear on the growth ranking is Ireland, coming in as the 13th country with the highest growth, while the first Nordic nation is Sweden ranked as the 16th country with the highest growth. Clearly, equalization in terms of knowledge job concentration is a strong force in Europe.

Table 3. National Ranking of Brain Business Jobs

All brain business sectors, jobs per 1 000 working age population								
2019 Rank		2014	2015	2016	2017	2018	2019	% change 2014-19
1	Switzerland	101	100	99	103	105	106	4.9%
2	Sweden	90	91	94	96	100	102	14.2%
3	Denmark	90	91	85	87	88	89	-0.4%
4	Netherlands	78	80	82	84	87	88	11.9%
5	Luxembourg	82	82	83	82	84	85	2.7%
6	United Kingdom	73	76	88	80	80	81	12.2%
7	Germany	68	70	74	76	78	80	16.3%
8	Iceland	78	77	80	79	78	74	-4.2%
9	Ireland	62	65	70	70	72	73	18.8%
10	Finland	68	68	69	67	70	72	4.8%
11	Hungary	53	56	60	63	67	71	33.6%
12	Norway	65	67	66	66	68	70	7.2%
13	Slovenia	54	56	58	61	64	66	22.0%
14	Estonia	57	59	60	63	63	65	15.8%
15	Latvia	48	52	57	60	63	65	37.0%
16	Czechia	53	55	59	62	63	65	22.0%

17	Austria	60	60	60	62	63	64	**7.7%**
18	Belgium	57	58	61	58	59	61	**8.7%**
19	Malta	58	64	67	68	61	60	**2.9%**
20	France	55	55	56	56	58	59	**8.1%**
21	Slovakia	44	49	50	53	55	58	**32.9%**
22	Lithuania	43	46	49	52	54	55	**28.5%**
23	Portugal	38	40	42	45	48	49	**28.8%**
24	Cyprus	38	41	44	46	48	49	**28.7%**
25	Bulgaria	36	39	42	45	46	46	**28.6%**
26	Spain	36	39	41	42	43	44	**21.3%**
27	Greece	41	37	38	39	43	43	**5.8%**
28	Italy	38	39	40	41	42	43	**13.1%**
29	Croatia	37	37	39	40	42	42	**13.4%**
30	Poland	31	33	36	37	39	40	**29.3%**
31	Romania	30	31	33	34	37	38	**29.2%**

The regional data shows even greater shifts in the knowledge-intensive business landscape of Europe. The main finding is, as evident already in the two previous versions of this index, that 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 emerges as the number one region in Europe in terms of the concentration of Brain Business Jobs. The explanation lies in the fact that many amongst the new generation growing up in Central and Eastern Europe work hard to learn those knowledge's which are in hot demand in the marketplace, such as programming and engineering. While the countries as a whole 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.

Bratislava is the European region that has the highest total share of Brain Business Jobs per capita, as fully 19 percent of the working age population of the region is employed in knowledge-intensive businesses. Bratislava builds on an already strong position by having the second highest rate of

increase in knowledge-intensive jobs, adding 21 Brain Business Jobs per 1 000 working age inhabitants compared to two years earlier.

On a regional basis, the most significant increase of Brain Business Jobs has occurred in London, which has added 25 Brain Business Jobs per 1 000 working age inhabitants compared to two years earlier. London has thus surpassed Paris in Brain Business Jobs concentration. London thus outpaces Paris in knowledge-intensive jobs concentration. In the index of the previous year Paris was ahead of London, as France much like the Eastern and Central European nations has a strong concentration of knowledge-intensive jobs in the capital region. Besides London, the UK has several other strong regions, most notably the Oxford region which is number two in all of Europe. Stockholm, the capital city of Sweden, follows Bratislava and the Oxford region. It has been home to the rise of many knowledge-intensive firms, in ICT, advanced services, creative profession as well as tech—becoming somewhat of a small Silicon Valley of the Nordics.

The third fastest rate of Brain Business Jobs growth per capita is found in Sofia, followed by Prague and Bucharest. The five regions with strongest rise in knowledge-intensive jobs are all capital regions, and four of them are in the East and Central European region that competes by having a growing number of knowledge workers and lower wages as well as advantageous taxation rules. It is notable that Bucharest, the capital region of Romania that as a nation has the lowest share of Brain Business Jobs per capita, performs so strongly. It is evident that the Eastern and Central capital regions, such as Bratislava, Sofia, Prague and Bucharest, are the new hotbeds of Brain Business Jobs. It is likely that these regions will increasingly be linked to the strong Nordic and Western European Brain Business hobs, such as London, the Oxford Region, Paris and Stockholm.

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Table 4. Regional Ranking of Brain Business Jobs

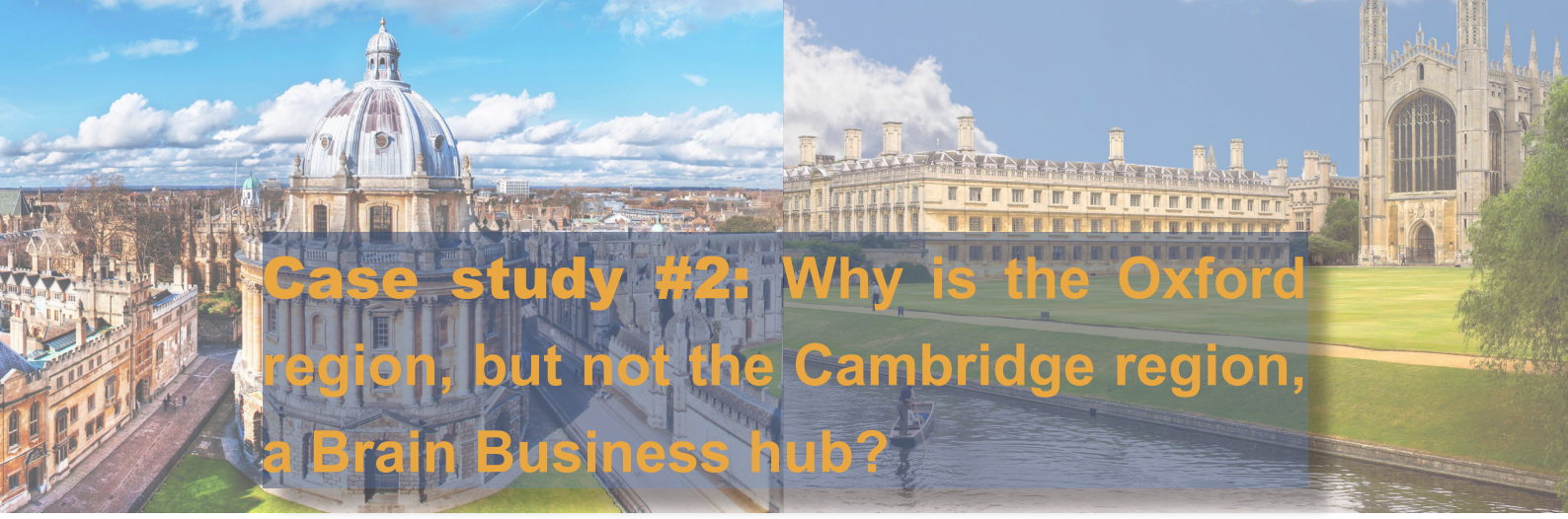
Rank	Region	All brain business sectors, jobs per 1 000 working age population
1	**Bratislava**	189.6
2	Berkshire, Buckinghamshire and Oxfordshire	178.6
3	**Stockholm**	178.0
4	**Prague**	177.7
5	**London**	173.1
6	**Paris**	166.6
7	**Budapest**	164.7
8	**Copenhagen**	149.4
9	Hamburg	146.8
10	Oberbayern	142.5
11	Prov. Brabant Wallon	136.0

12	Utrecht	132.8
13	**Oslo**	128.0
14	**Amsterdam**	124.2
15	**Bucharest**	122.9
16	Darmstadt	121.6
17	Köln	112.9
18	North Eastern Scotland	112.6
19	**Berlin**	111.6
20	**Helsinki**	107.6
21	**Brussels**	107.6
22	Bedfordshire and Hertfordshire	107.5
23	**Madrid**	107.0
24	Surrey, East and West Sussex	106.3
25	**Vienna**	105.4

26	Stuttgart	103.0
27	**Sofia**	101.4
28	Cheshire	101.3
29	Hampshire and Isle of Wight	99.0
30	Mittelfranken	92.3
31	Gloucestershire, Wiltshire and Bristol/ Bath area	91.3
32	**Ljubljana**	91.2
33	Karlsruhe	91.1
34	Prov. Vlaams-Brabant	88.6
35	Lisbon	86.4
36	**Luxembourg**	85.2
37	Västsverige	84.2
38	**Iceland**	80.4

39	Tübingen	80.2
40	Noord-Brabant	78.9
41	**Warsaw**	78.9
42	Prov. Antwerpen	78.5
43	Düsseldorf	77.6
44	Sydsverige	77.6
45	Greater Manchester	77.2
46	Zuid-Holland	76.9
47	Bremen	75.7
48	Comunidad Foral de Navarra	73.5
49	Herefordshire, Worcestershire and Warwickshire	72.8
50	North Yorkshire	70.5

Capital regions marked in **blue.** Smaller countries such as Iceland and Luxembourg make up single NUTS2 regions and are marked in **green.** Regional data not available for Ireland and Switzerland. Regional data is based on the 2016 distribution of Brain Business Jobs.



Case study #2: Why is the Oxford region, but not the Cambridge region, a Brain Business hub?

The UK region in which the Oxford region is situated, has the second highest concentration of Brain Business Jobs in Europe.[4] While the Slovakian capital region of Bratislava does have a somewhat higher share of Brain Business Jobs per capita, the knowledge firms in the Oxford region are typically higher up in the business hierarchy than those in Bratislava, with many knowledge firms in Bratislava supplying services to firms in Britain and other parts of Western Europe. The Oxford Region can with this distinction in mind be seen as the strongest knowledge hub of Europe, followed closely by Stockholm (see table 4).

The outstanding performance comes as no surprise. According to the World University Rankings 2019, the University of Oxford is ranked as the number one university in the world. University of Cambridge comes on second place globally. With the exception of Imperial College London (ranked 9th), all other of the top-10 universities on the ranking are in the US.[5] Clearly, the UK benefits from having top-ranking universities and the rest of Europe needs to boost top universities in order to compete with the UK and the US.

However, while the University of Cambridge is only somewhat smaller than the University of Oxford, the East Anglia region in which Cambridge is situated is not a Brain Business leader. The reason is that Oxford and surrounding cities have evolved knowledge-intensive business clusters. Although numerous knowledge-intensive businesses do exist in the city of

4 This is based on comparison of 278 European regions, which make up 29 out of the 31 countries in this index. Regional data of high quality does still not exist for Switzerland and Ireland. It is likely that the Swiss and Irish capital regions will claim top positions, once it becomes possible to study them separately in future versions of this index.

5 Times Higher Education (2019).

Cambridge itself, the surrounding area is largely rural. It is sometimes said that Oxford is a city with a top university in it, while Cambridge is more of a top university with a city around it.

This distinction shows that academic excellence in itself is not the only thing needed to foster a knowledge economy. Knowledge-intensive enterprises need to grow profitable in close proximity to knowledge hubs. This is the condition for forming strong Brain Business hubs.

Competing for Brain Business Jobs

The shifts in the world economic landscape have been tremendous over the last decades. One example is the massive economic development in China. The country, which has become a leading manufacturing sector of the world and now invests heavily in industrial development in Africa, had towards the end of the 20th century a weak level of production and accompanying this a rate of extreme poverty at the same or even higher level than Sub-Saharan Africa at the time. While the majority of the Chinese population at the time were very poor, today a growing middle class populates the country. India is similarly to China opening up to the market economy, with a more democratic system. These two countries, which together are approaching a population of three billion people, are becoming increasingly important trade partners and competitors to the rest of the world. Currently they are shifting from basic and mid-level industries to fostering many advanced ICT, tech and service companies. Eastern and Central Europe did not experience the same level of poverty as China or India during the decades of central economic planning, but have likewise caught up significantly to the rest of the world since the shift towards free-markets.

China as well as India have a much older tradition of enterprise, banking and market-based economic practices than Europe, surpassed only by the Middle East where enterprise and market economy were originally invented some 4 000 years ago. Similarly, in Europe, the Eastern and Central and Southern parts have not always been less developed than the Northern and Western parts. Indeed, throughout much of civilized history, the level of economic development was higher in Southern, Eastern and Central Europe than in the Western and Nordic parts. The current shifts in development eastwards is part of a global catch-up, wherein Western economies are challenged by new competitors. The other, more optimistic, side of the coin is that Western economies are given the opportunity to grow through trade with new partners. Countries such as Sweden, which are open to these new global opportunities, are able to capitalize by growing their own knowledge-intensive sectors.

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At the same time that the global marketplace is broadening by including the majority of the world population, technological change is occurring at a faster pace than previously. Robotization, artificial intelligence and the move towards an increasingly service-based economy are fundamentally changing the nature of jobs. Research suggests that firms starting or investing in an innovative region succeed better than those that invest in other areas. For example, a meta-analysis of studies conclusively indicates that firms that locate in innovative clusters become more innovative themselves and that choosing matching clusters matters.[6] Another line of research corroborates that firms achieve higher productivity growth in regions with greater start-up activity.[7] In this context, all regions aspire to become hotbeds for innovation and creativity.

Only few however succeed to stand out as hotbeds for knowledge-intensive businesses. For investors, businesses and people choosing where to live and work, identifying regions that promise bubbly, innovative growth can be crucial. Start-ups and technological breakthroughs are more likely to succeed in regions that become magnets for entrepreneurs as well as for talented and creative engineers and other specialists. The success of these indi-

6 See Fang (2015).

7 For example, Holtz-Eakin and Kao (2003) show that variations in the birth rate and the death rate for firms are related to positive changes in productivity. Audretsch and Fritsch (2002) found that regions with a higher startup rate exhibited higher growth rates. See also Folster (2000) as well as Braunerhjelm and Borgman (2004) established a positive impact of entrepreneurs on regional growth measured as labour productivity.

viduals spills over to wages, housing wealth and quality in public services.

It is crucial to distinguish between the regions and countries that already are hotbeds for knowledge-intensive sectors, and those that are likely to become hotbeds over the coming years. The latter are more promising for investors and entrepreneurs, since the wages and costs of doing business is typically lower in upstart regions. Typically, regulatory regimes and tax systems are also more conductive to investment and businesses in upstart regions. Skilled individuals might instead choose regions that are already hotbeds, since the wages tend to be higher there. Some talented workers might also prefer upstart regions, drawn there by lower costs of living and the lower tax levels often found outside of Northern and Western Europe. A number of countries, such as Malta and Estonia, today show that fast catch-up is possible by relying on competitive policy regimes.

The data and analysis provided in this report will help answer questions such as: What parts of Europe have the largest concentration of people working in programming? In which countries do jobs in research and development abound? Where are the design centres of Europe? These questions are not only relevant for the business community and those seeking employment abroad, but finding answers offers insights for policy makers who wish to gain a better understanding of the new geography of jobs in Europe.

A detailed description of Brain Business Jobs in Europe, per sector, is provided in table 5. The strongest tech sector, by a wide margin, is found in Switzerland. Denmark, Sweden and Germany, three countries with a strong engineering tradition, have the other top spots. Hungary and Czechia are two Central European countries with a strong tech sector. The South European nations have overall weak tech sectors. Greece does perform relatively well, with almost as high concentration of tech sector Brain Business Jobs as France.

The highest concentration of ICT Brain Business Jobs is found in Luxembourg, followed by Sweden, Latvia, Iceland, Ireland and the UK. Malta performs strongly among the Southern European countries, with two and a

half times as many ICT jobs per working age population than Greece. Otherwise, the Southern European countries, as well as the Eastern and Central European countries of Poland and Croatia, have relatively weak ICT sectors. Switzerland also notably, given its position as the European Brain Business Jobs leader, has relatively low share of employees in specialized ICT companies.

Netherland has the highest concentration of advanced services, as the country attracts many company head offices. Belgium capitalizes on Brussels position as EU capital by similarly attracting many head offices, while Sweden on third position attracts not only domestic but also increasingly international business head offices. The UK, which in London has a leading hub for innovation, business and finance, is the major European country with high share of advanced service Brain Business Jobs. Norway, Finland and Iceland have relative to their overall performance relatively few advanced service jobs. Malta, which offers competitive legislation and taxation, has a relatively high concentration of head offices. Cyprus, with similar business-friendly climate, also performs well.

Sweden stands out as the only country with a top five spot in all Brain Business Jobs categories, illustrating that many countries are specialized rather than having strengths in all categories.

Iceland is the creative sector Brain Business Jobs leader, followed by Denmark, Sweden and Norway. Finland is the only Nordic country not at the top of creative sector jobs. The UK and Netherlands also have relatively high share of creative professions, while Switzerland, Luxembourg and Ireland have relatively weak creative sectors. Sweden stands out as the only country with a top five spot in all Brain Business Jobs categories, illustrating that many countries are specialized rather than having strengths in all categories.

Table 5. Detailed Brain Business Jobs Ranking

(Jobs per 1 000 working age population)

Cumulative ranking		All knowledge-intensive sectors	Tech sector ranking	Tech sector per capita	rank
1	Switzerland	106.4	1	55.5	11
2	Sweden	102.2	3	30.2	2
3	Denmark	89.3	2	31.6	9
4	Netherlands	87.6	11	22.0	7
5	Luxembourg	84.6	15	18.2	1
6	United Kingdom	81.4	13	20.6	6
7	Germany	79.5	4	29.8	15
8	Iceland	74.5	16	18.1	4
9	Ireland	73.4	7	24.7	5
10	Finland	71.6	6	25.5	8
11	Hungary	71.3	5	25.9	16
12	Norway	70.2	9	23.4	12
13	Slovenia	66.2	12	21.0	18
14	Estonia	65.4	14	18.3	10
15	Latvia	65.4	24	13.7	3
16	Czechia	64.5	8	24.0	17
17	Austria	64.1	10	22.2	21
18	Belgium	61.5	19	15.9	23
19	Malta	59.7	27	12.3	13
20	France	59.0	17	17.9	22
21	Slovakia	58.4	20	15.4	19
22	Lithuania	54.8	23	14.1	20
23	Portugal	49.3	26	13.4	27
24	Cyprus	49.1	31	9.4	24
25	Bulgaria	46.5	30	10.4	14
26	Spain	44.0	22	14.7	30
27	Greece	43.0	18	17.7	31
28	Italy	42.8	25	13.5	25
29	Croatia	41.8	21	14.7	29
30	Poland	40.0	28	10.9	28
31	Romania	38.1	29	10.8	26

ICT ing	ICT per capita	Advanced services ranking	Advanced services per capita	Creative professions ranking	Creative professions per capita
	23.2	5	19.4	20	8.2
	33.2	3	22.1	3	16.7
	24.3	12	15.8	2	17.6
	25.4	1	26.8	6	13.4
	43.2	11	15.9	25	7.3
	26.9	4	20.5	5	13.4
5	20.4	6	19.0	13	10.3
	27.4	22	10.2	1	18.8
	27.2	14	14.3	26	7.1
	25.4	21	10.4	11	10.3
6	20.0	15	14.0	9	11.4
2	22.4	27	8.5	4	15.9
3	18.4	9	17.3	14	9.4
0	23.4	20	11.8	8	11.9
	27.6	18	13.6	10	10.6
7	18.8	23	9.7	7	12.0
	17.1	7	17.4	24	7.4
3	16.6	2	23.8	30	5.2
3	22.0	10	16.9	18	8.5
2	17.1	16	13.8	12	10.3
0	18.2	8	17.4	23	7.5
0	18.1	19	13.5	15	9.0
7	14.1	17	13.6	19	8.2
4	15.4	13	15.6	16	8.7
4	21.1	31	6.5	17	8.5
0	12.9	26	8.7	22	7.7
	9.1	24	9.4	28	6.8
5	14.6	30	6.6	21	8.1
0	13.1	29	7.0	27	7.0
3	13.9	25	8.9	29	6.4
6	14.3	28	7.9	31	5.1

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, advanced services and creative professions. These broad fields are in the data analysis divided into twelve subfields, as shown below. These, in turn, fall into a large number of subcategories.

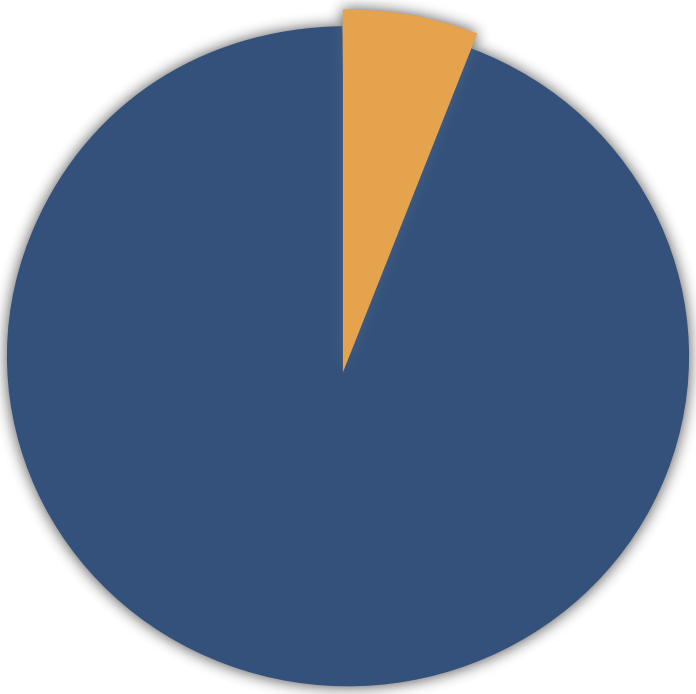
Table 6. Division of Brain Business Jobs

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

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. The source of the data is structural business statistics, published by the European statistics agency Eurostat.[8] 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 business.

National and regional data for 31 countries is included in this study. These countries are the 28 EU member-states plus Switzerland, Norway and Iceland. Regional data is based on the 2016 distribution of Brain Business Jobs, while national data ranges from 2014 to 2019. 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 2, 6.3 percent of the working age population of the 31 studied European countries fit the definition of Brain Business Employees.

Figure 2. The Brain Business Workers of Europe



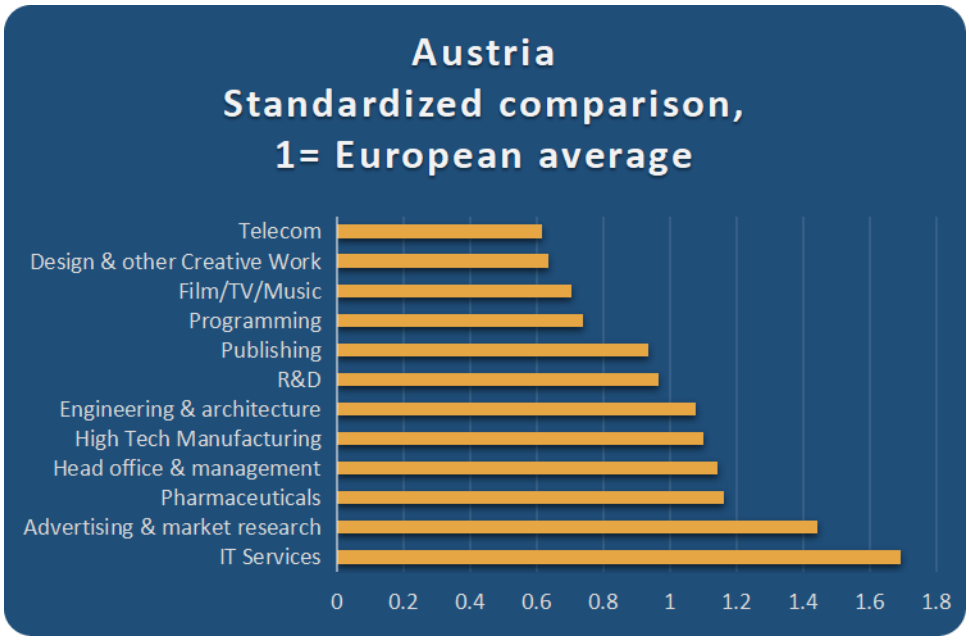
313 million working-aged individuals live in the 31 European countries studied in this report

19.6 million of which fit the definition of Brain Business Employees.

Country Analysis: Austria

In Austria, the number of employment in knowledge-intensive firms has grown from 295 800 in 2012 to 350 600 in 2019. Out of the 54 800 new Brain Business Jobs, 36 percent have been created in the tech sector, 29 percent in ICT, a further 29 percent in advanced services and the remaining 6 percent in creative professions.

Compared to the rest of Europe, Austria has a number of strengths. The main strength is in IT-services, followed by advertising and market research and pharmaceuticals. The country also has a strong concentration of head offices as well as high-tech manufacturing and engineering. On the other hand, 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 is the weakness of Austria while its strength lies in advanced services and tech.



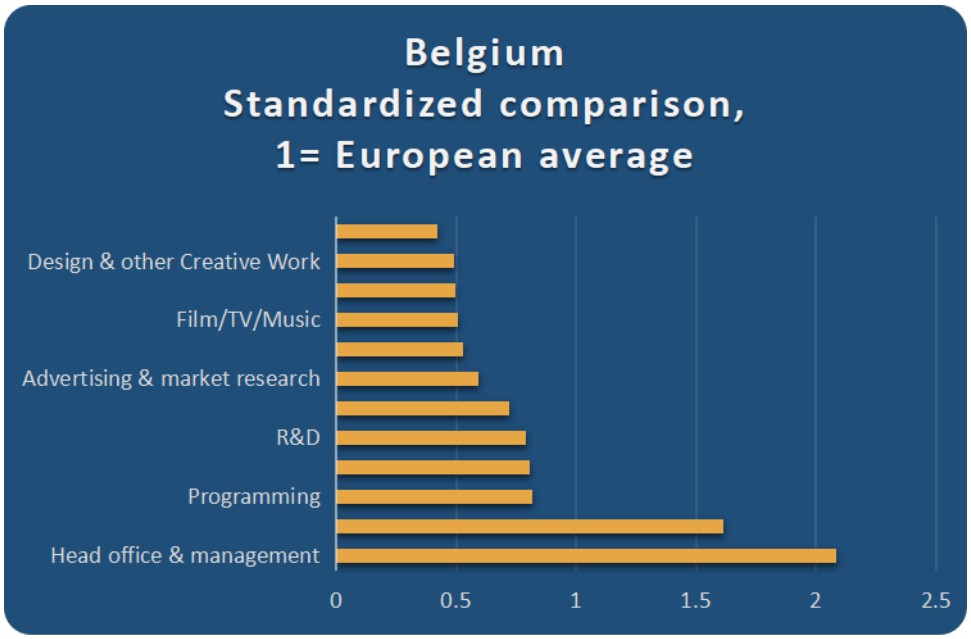
The strongest region in Austria is the capital region of Vienna. Here, 10.5 percent of the working age population is employed in Brain Business Jobs, which is nearly twice the national average. Other strong performers are Tirol, Steiermark and Salzburg (6,3, 5,7 and 5.7 percent respectively). The lowest share of Brain Business Jobs is found in Burgenland (2.8 percent) and Niederösterreich (3.5 percent).

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 in particular to reach its potential.

Country Analysis: Belgium

In Belgium, the number of employees of the most knowledge-intensive firms has increased from 355 800 in 2012 to 412 100 in 2019, according to the latest available structural business information. The main growth has occurred in advanced services, which grew by fully 38 500 during this period. ICT firm occupation grew by 9 800 and the tech sector by 8 300, while creative sector employment fell by 300.

Belgium relies very 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.



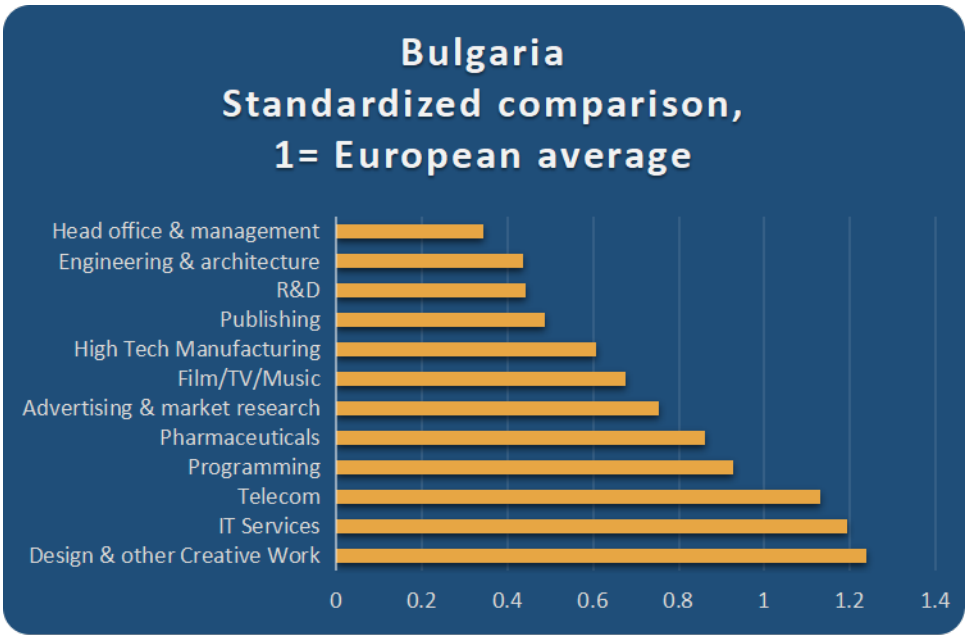
The strongest region in Belgium is the province Brabant Wallon, with a strong pharmaceutical sector. Here, 13.6 percent of the working age population is employed in Brain Business Jobs, more than twice the national average. The second highest concentration is found in the capital region of Brussels, in which 10.8 percent of the working age population is employed in Brain Business Jobs. Other strong performers are the province Vlaams-Brabant (8.9 percent), and province Antwerpen (7.9 percent). The lowest share of Brain Business Jobs is found in the province of Luxembourg (1.3 percent) and the province of Hainaut (2.4 percent).

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 challenge in Belgium, linked to the high levels of taxation.

Country Analysis: Bulgaria

In Bulgaria, the number of employees of the most knowledge-intensive firms has grown from 155 200 in 2012 to 194 600 in 2019. Out of the 39 400 new Brain Business Jobs, fully 73 percent have been created in ICT, 12 percent in creative professions, 8 percent in the tech sector and 7 percent in advanced services.

Compared to the rest of Europe, Bulgaria has strength in design & other creative professions, IT-services as well as telecom, programming and the pharmaceutical sector. 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.



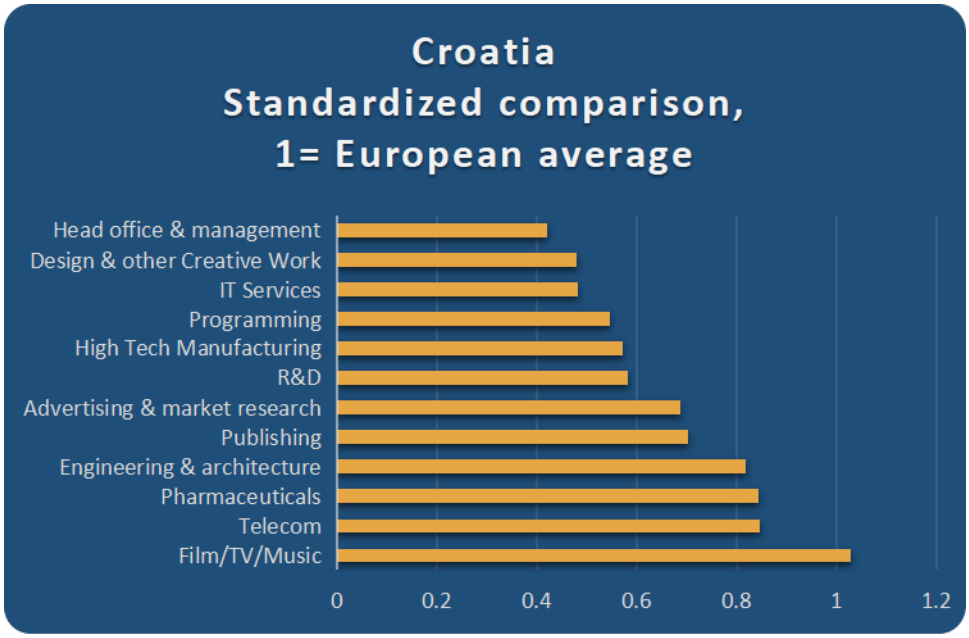
The strongest region in Bulgaria is the capital region of Sofia. Here, 10.1 percent of the working age population is employed in Brain Business Jobs, which is more than twice the national average. The region Yugozapadna i yuzhna tsentralna Bulgaria has the second highest concentration (6.9 percent). At the bottom is Severozapaden with merely 0.9 percent of working age population employed in Brain Business Jobs.

Bulgaria has a stronger concentration of knowledge-intensive jobs than Romania, Poland, Croatia, Italy, Greece and 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

In Croatia, the number of employees of the most knowledge-intensive firms has grown slightly from 100 900 in 2012 to 102 400 in 2019. While the total number of Brain Business Jobs remain largely unchanged, there has been a significant shift in composition. The number of knowledge-intensive jobs in the tech sector has risen by 3 100 and in ICT by 7 800. At the same time, advanced service occupations has fallen by fully 9 400 while creative professions have remained largely unchanged.

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. The country however has a low share of employment in head offices & management firms, design & other creative work firms, IT services and programming. A boost in programming-related activities is needed in order for Croatia to prosper, in a time when IT and communication services is a driver for knowledge-intensive jobs in Europe.

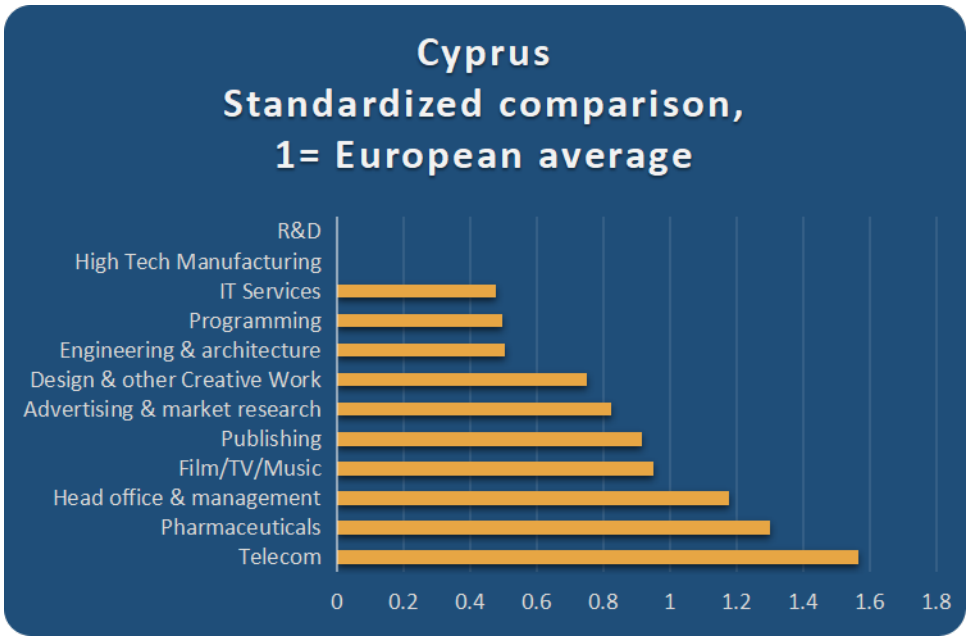


Croatia is made up of two large regions according to European Union classification. The first is where the capital region of Zagreb is located. In this region, 4.6 percent of the working age population works in Brain Business Jobs. The second region is Jadranska Hrvatska, where the same rate is 2.9 percent. Due to the significant reduction of advanced service occupation, Croatia is not experiencing the same catch-up of Brain Business Jobs that characterizes the Central and Eastern European group of nations. Policies that encourage advanced services, including head office location decisions, are needed for Croatia to grow into a leading European Brain Business Jobs centre.

Country Analysis: Cyprus

In Cyprus, the number of employees of the most knowledge-intensive firms has grown from 20 800 in 2012 to 24 900 in 2019. Out of these 6 100 jobs, 42 percent have been created in advanced services, 29 percent in ICT, 16 percent in creative professions and 14 percent in the tech sector.

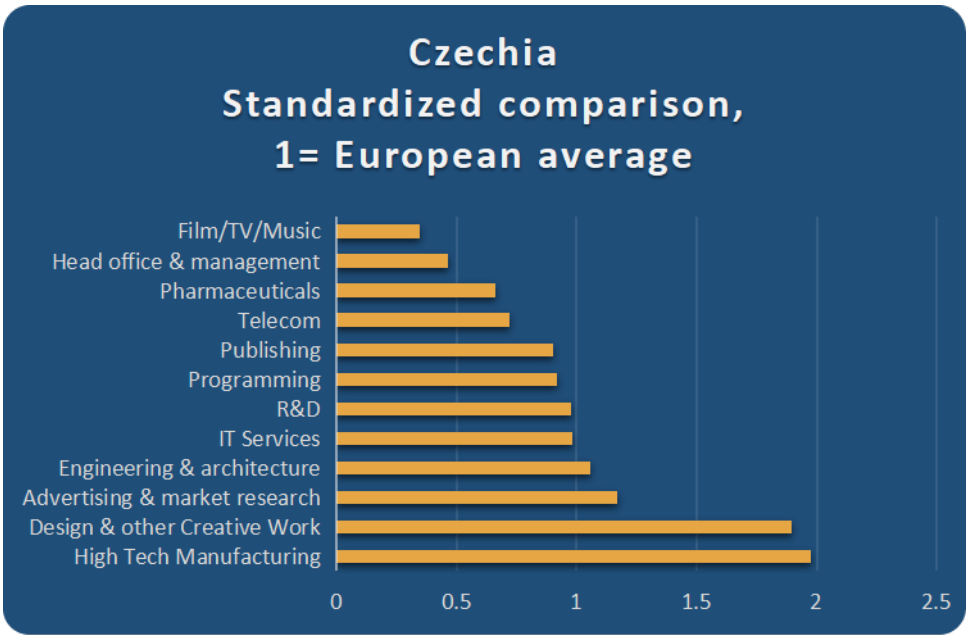
Compared to the rest of Europe, Cyprus has a strong presence in telecom. Also in pharmaceuticals, head offices & management the island nation has a competitive edge compared to other parts of the continent. Specialized research and development and high-tech manufacturing is not present in the region, 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 relying on competitive business climate combined with a presence in IT and communication.



Country Analysis: Czechia

In Czechia, the number of employees of the most knowledge-intensive firms has grown from 345 400 in 2012 to 413 100 in 2019. Out of these 67 700 new Brain Business Jobs, 41 percent have been created in ICT, 26 percent in the tech sector, 25 percent in creative professions and 8 percent in advanced services.

Compared to the rest of Europe, Czechia has a number of strengths. The main strength is 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. Also in advertising & market research and engineering & architecture, Czechia has a higher share of Brain Business Jobs than the European average. The weaknesses exist in film-TV-music, head offices & management, pharmaceuticals and telecom.



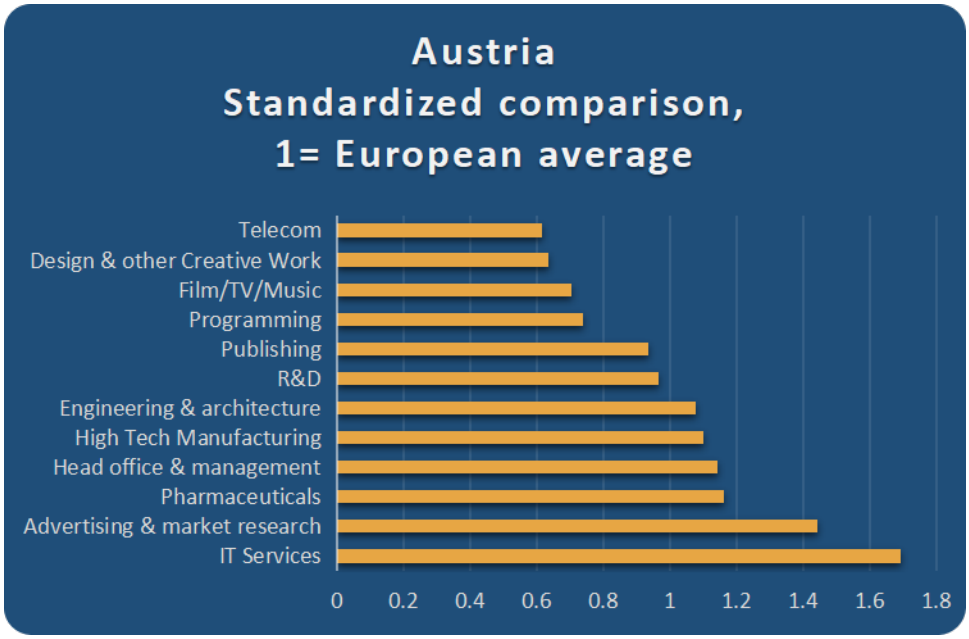
The strongest region in the country is the capital region of Prague. Here, 17.8 percent of the working age population is employed in Brain Business Jobs, which is three times the national average. Other strong performers are Jihovýchod (6.2 percent), Severovýchod (4.5 percent) and Moravskoslezsko (4.4 percent). The lowest share of Brain Business Jobs is found in Severozápad (2.3 percent).

Amongst 278 European regions, Prague ranks as the 4th in Brain Business Jobs comparison. This places the region above leading locations such as Paris, London, Copenhagen and Oslo. In fact, the only capital region in Northern and Western Europe which has a stronger performance than Prague is Stockholm. 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.

Country Analysis: Denmark

In Denmark, the number of employees of the most knowledge-intensive firms has grown from 280 700 in 2012 to 300 641 in 2019. Brain Business Jobs have increased by 14 000 in creative professions and 9 500 in advanced services, while being reduced by 2 900 in ICT and by 600 in the tech sector.

Compared to the rest of Europe, Denmark has a number of 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, advertising and market research, IT services and head offices & management. The high tax levels of Denmark might explain why head offices are less than eager to locate to this otherwise leading knowledge-nation.



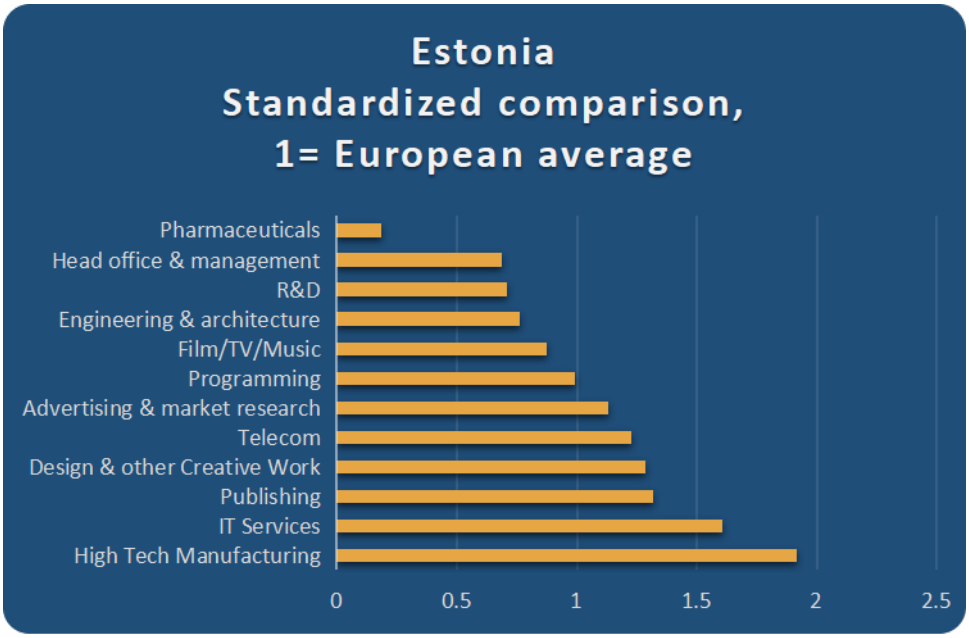
The strongest region in Denmark is the capital region of Copenhagen. Here, 14.9 percent of the working age population is employed in Brain Business Jobs, which is nearly twice the national average. The other strong performer is Midtjylland (6.8 percent). Nordjylland (4.6 percent) and Syddanmark (4.4 percent) also perform well while Sjælland is considerably below the national average (2.5 percent).

The challenge for Denmark is to stimulate knowledge-intensive businesses, and keep up with the rest of Europe in a time when Eastern and Central European nations are growing steadily. The rapid catch-up of the latter regions is explained by ample supply of talents and lower wage costs for the talents. Cost of employment for talents remains a challenge in Denmark, linked to the high levels of taxation.

Country Analysis: Estonia

In Estonia, the number of employees of the most knowledge-intensive firms has grown from 43 600 in 2012 to 51 200 in 2019. Out of these 67 700 new Brain Business Jobs, a majority of 52 percent have been created in ICT, 28 percent in creative professions, 11 percent in advanced services and the remaining 9 percent in the tech sector.

Estonia has the highest percentage of the population working in knowledge-intensive companies amongst the Baltic nations and ranks amongst the Western European and Nordic countries.



In 2014, the gap between Finland and Estonia was significant, with 6.8 percent of the working age population in Finland occupied in Brain Business Jobs compared to 5.7 percent in Estonia. By 2019, the share in Finland had increased to 7.2 percent while that in Estonia had surged to 6.5 percent. If the trend continues, Estonia will soon surpass Finland as well as Norway.

Sweden, with 10.2 percent of the working age population employed in highly knowledge-intensive enterprises, still has a commanding lead.

Compared to the rest of Europe, Estonia has a number of strengths. The main strength is in high-tech manufacturing, where Estonia has nearly twice the concentration of Brain Business Jobs than the European average. Second is IT-services, where Estonia has more than 50 percent higher concentration than the average for Europe. Publishing, design & other creative work and telecom are other strengths. The main weakness is pharmaceuticals followed by head offices & management and R&D. Strengthening research and development is key for Estonia continuing to grow as a leading European knowledge hub.

Country Analysis: Finland

In Finland, the number of employees of the most knowledge-intensive firms has grown from 213 400 in 2012 to 224 500 in 2019. Brain Business Jobs have increased by 14 400 in ICT and 2 700 in advance services. This strong growth is countered by the fact that Brain Business Jobs in creative professions have fallen by 2 800 and in the tech sector by 3 200.

Finland has many strengths in knowledge-intensive enterprise activity. The main strength is high-tech manufacturing, where the concentration of Brain Business Jobs is nearly twice that of the European average. Publishing, programming as well as engineering & architecture are other strengths. Weaknesses exist in pharmaceuticals, film/TV/music and head offices & management.

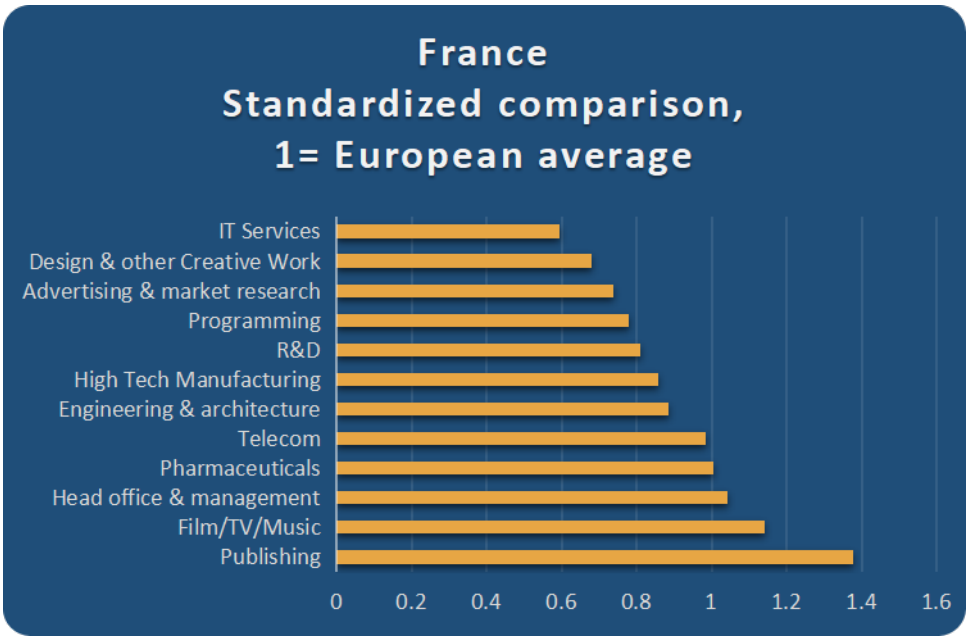
The strongest region in Finland is the capital region of Helsinki. Here, 10.8 percent of the working age population is employed in Brain Business Jobs, which is nearly twice the national average. Other strong performers are Åland (4.4 percent) and Pohjois-ja Itä-Suomi (3.9 percent). The country does not have any particularly weak regions, with the lowest performing region Etelä-Suomi still having a fairly high concentration of 3.7 percent.

The main challenge for Finland is to encourage growth of Brain Business Jobs in tech and creative professions, catching up to the falling numbers in these two sectors, while keeping up the impressive growth of ICT and advanced services. In Finland, the government as well as representatives from labour unions and the business sector have made deals in order to keep basic manufacturing wage levels competitive. Similar action, or alternatively tax reforms, might be needed for knowledge workers, since the current trend is that high wages and high taxes crowd out Brain Business Jobs.

Country Analysis: France

In France, the number of employees of the most knowledge-intensive firms has grown from 2110 300 in 2012 to 2207 700 in 2019. Brain Business Jobs have increased by 21 500 in creative professions, 63 500 in ICT and 16 800 in the tech sector. In advanced services, a reduction of 4 300 has occurred.

Paris in particular is a strong Brain Business Jobs, 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. London has in comparison total 961 628 Brain Business Jobs. In fact, only three countries, Germany, UK and France itself, outrank Paris. Italy has about the same number of Brain Business Jobs as Paris. This is explained by the fact that Paris combines a high percentage of highly knowledge-intensive jobs with having a large population.



However, while the capital region is strong, the rest of France has a low concentration. Paris has 16.7 percent of its adult aged population employed in Brain Business Jobs. The second most important region of France is Rhône-Alpes (4.9 percent), followed by Provence-Alpes-Côte d'Azur with 111,715 Brain Business Jobs (4.5 percent).

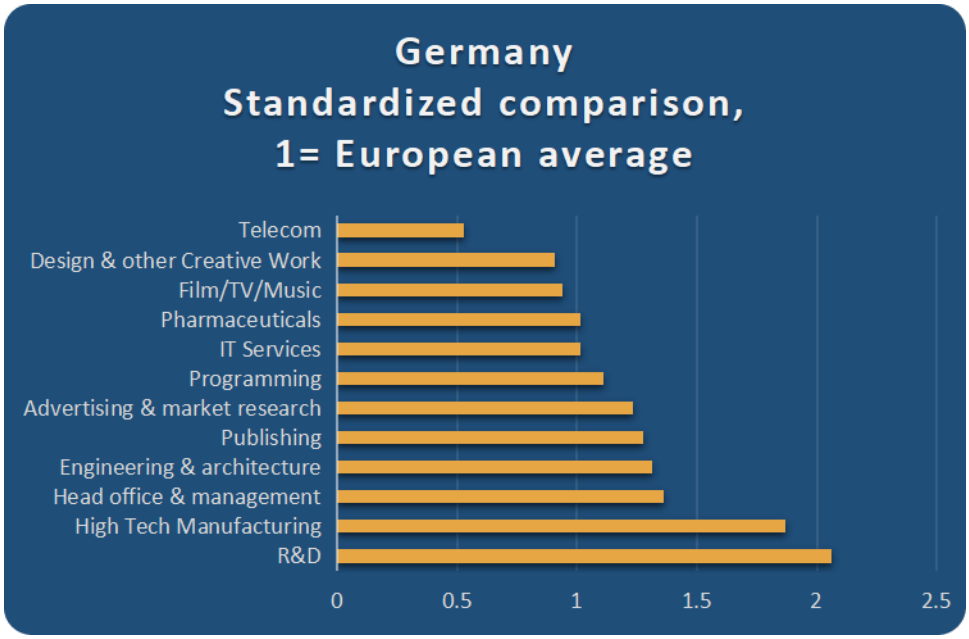
Compared to the rest of Europe, France is particularly strong in publishing. Other strengths exist in film/TV/music, head offices & management and pharmaceuticals. In a time when much of the development of Brain Business Jobs is occurring in the ICT-sector, France needs to strengthen IT services and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

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

In Germany, the number of employees of the most knowledge-intensive firms has grown from 2 970 000 in 2012 to 3 960 000 in 2019. Out of the 97 400 new Brain Business Jobs, 35 percent have been created in the tech sector, 32 percent in advanced services, 27 percent in ICT and the remaining 6 percent in creative professions.

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. Head office & management, engineering & architecture and publishing are other strengths. On the other hand, Germany is behind the rest of Europe when it comes to telecom, design & other creative work, film/TV/music as well as pharmaceuticals. Key for the progress of Germany is to strengthen telecom and programming, in an age driven by digitalization.



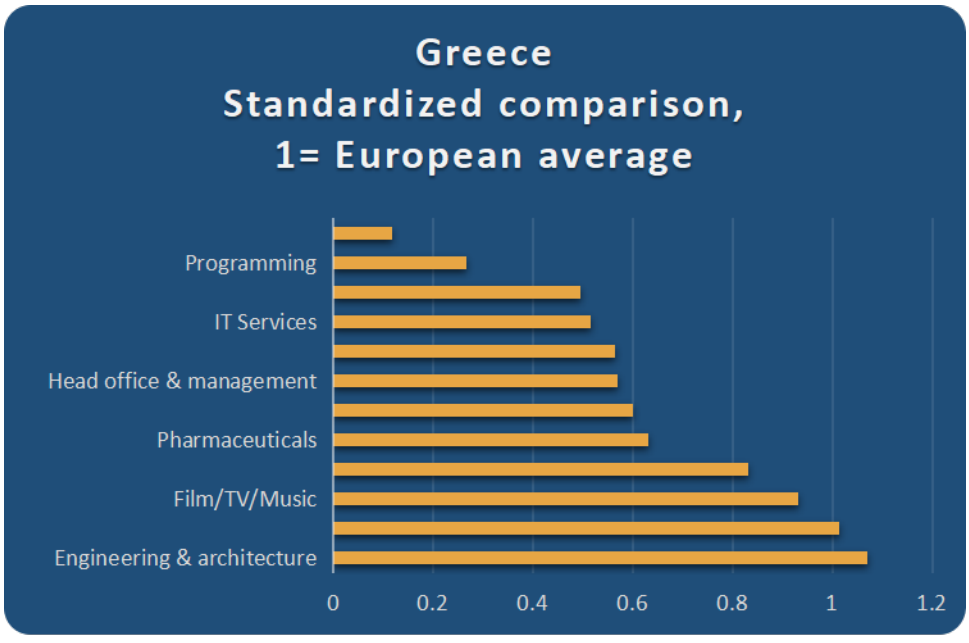
Most countries have Brain Business Jobs focused to the capital region. Germany however has numerous top-ranking regions. One such region is Hamburg, with 165 721 Brain Business Jobs, or 14.7 percent of the working age population. This high concentration is ranked at 9th place amongst 278 European regions. Oberbayern, which has 403 774 Brain Business Jobs, 14.2 percent of the workforce, ranks as having the 10th highest concentration in Europe. Köln has 306 084 Brain Business Jobs (11.3 percent) and ranks as the 17th position in European regions, followed by Berlin at 19th position, with 248 407 Brain Business Jobs (11.2 percent). Stuttgart and Mittelfranken are other examples of knowledge-intensive hubs.

No part of Europe has as many leading Brain Business Jobs centres as Germany. Yet Germany still needs to boost knowledge-intensive jobs growth, in order 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 and growing. 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

In Greece, the number of employees of the most knowledge-intensive firms has grown from 232 200 in 2012 to 270 115 in 2019. Brain Business Jobs have increased by 26 900 in the tech sector, 15 700 in ICT and 9 800 in advanced services. At the same time, a reduction of 14 500 occupations has occurred in creative professions.

Compared to the rest of Europe, Greece has strengths in engineering and architecture and R&D. On the other hand, Greece is behind the rest of Europe when it comes to areas such as high-tech manufacturing and programming.



The strongest region in Greece is the capital region of Athens. Here, 6.5 percent of the working age population is employed in Brain Business Jobs, close to twice the national average. The share of knowledge-intensive workers is 2.6 percent in Kriti as well as in Kentri-

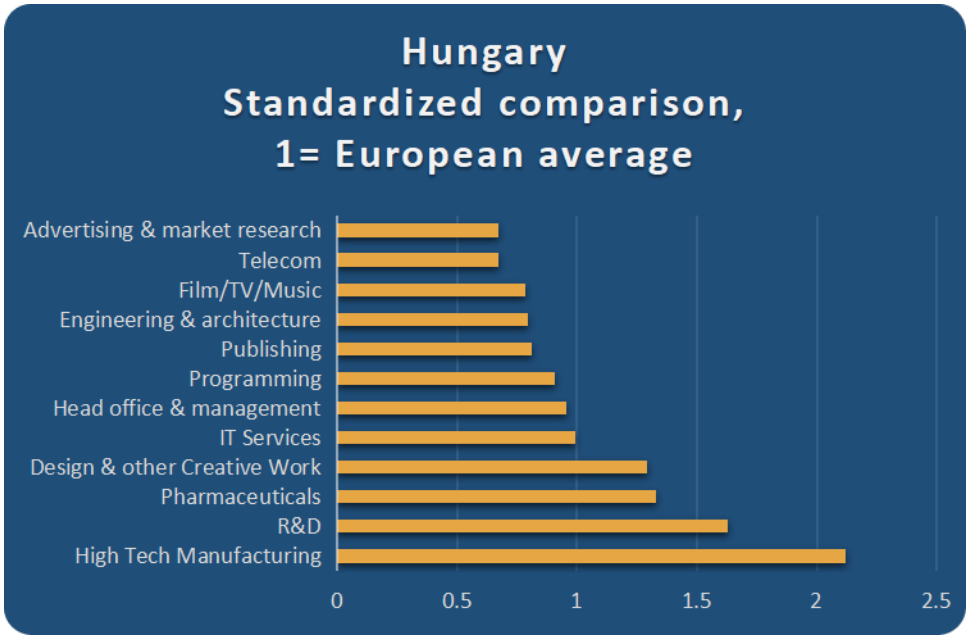
ki Makedonia, and 2.5 percent in Ipeiros. The lowest share of Brain Business Jobs is found in Sterea Ellada and Thessalia (both 1.8 percent).

Greece has the opportunity to, similarly as Malta, 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

In Hungary, the number of employees of the most knowledge-intensive firms has grown from 321 300 in 2012 to 424 900 in 2019. Out of the 103 600 new Brain Business Jobs, 32 percent have emerged in ICT, 27 percent in the tech sector, 24 percent in advanced services and the remaining 17 percent in creative professions.

Hungary ranks highly in knowledge-intensive jobs concentration, surpassing other Central and Eastern European countries. The concentration of Brain Business Jobs is even slightly higher than Norway, an impressive feat. The strong rise of Brain Business Jobs in Hungary is a prime example of the rapid changes in the geography of successful enterprise in Europe.



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 more than 50 percent higher concentration of Brain Business Jobs than the European average. Also in pharmaceuticals, design & other creative work and IT services Hungary has a stronger than average performance. On the other hand, Hungary has a lower concentration than the rest of Europe when it comes to areas such as advertising and market research and telecom.

The strongest region in Hungary is the capital region of Budapest. Here, 182 493 individuals, corresponding to 16.5 percent of the working age population, has Brain Business Jobs, which is more than twice the national average. Budapest has a slightly higher Brain Business Jobs concentration than Copenhagen, Oslo, Amsterdam, Berlin, Helsinki, Brussels, Madrid and Vienna.

In Pest there are 41 142 Brain Business Jobs (5.4 percent of the working age population), compared to 4.1 percent in Közép-Dunántúl. At the bottom we find Észak-Alföld and Dél-Alföld, with 3 and 2.8 percent respectively of the working age population employed in highly knowledge-intensive enterprises. While Hungary overall has impressive performance, growth of Brain Business Jobs outside of the capital region is needed to boost the performance of the country as a whole.

Country Analysis: Iceland

In Hungary, the number of employees of the most knowledge-intensive firms has grown from 15 040 in 2012 to 15 960 in 2019. Out of the 920 new Brain Business Jobs, 35 percent have their origin in creative professions, 30 in ICT, 26 in advanced services and the remaining 9 percent in the tech sector.

Compared to the rest of Europe, Iceland has several strengths. The main strength is film/TV/music. In this sector, Iceland has three and a half times the concentration of employment than the European average. This is by far the highest share in Europe. Iceland is also highly developed in R&D, telecom, design & other creative work and IT services—with 50 percent higher rate of employment in these sectors compared to the rest of Europe.

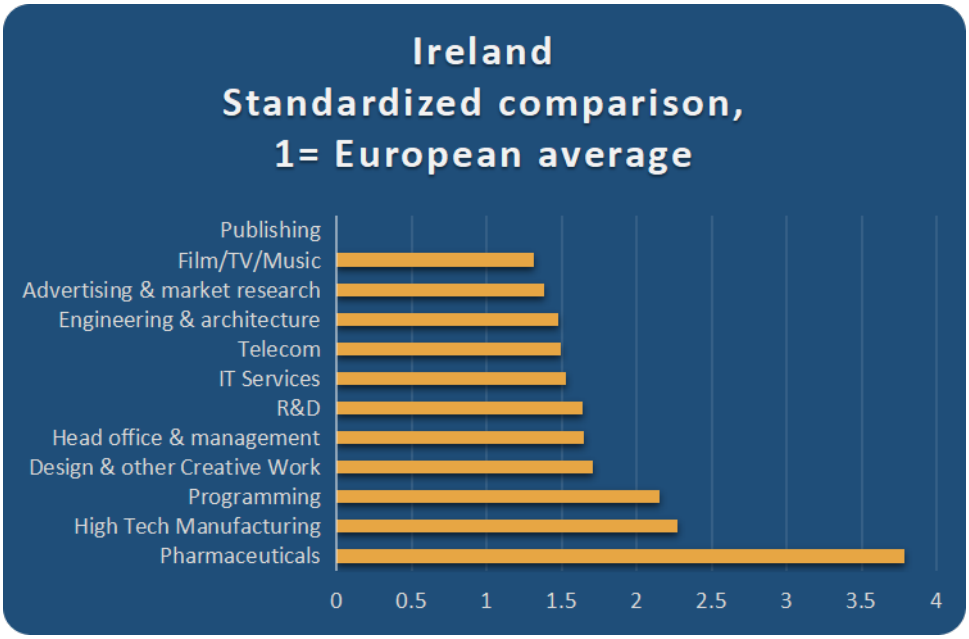
On the other hand, Iceland lags behind the rest of Europe when it comes to areas such as high-tech manufacturing, head offices & management and adver-

tising & market research. The explanation for this is Iceland's small size and distant geographical location. In the years to come, the challenge for Iceland is to foster more knowledge-intensive jobs and climb to the European top.

Country Analysis: Ireland

In Ireland, the number of employees of the most knowledge-intensive firms has grown from 150 600 in 2012 to 211 800 in 2019. Out of the 61 200 new Brain Business Jobs, 43 percent have been created in ICT, 28 percent in the tech sector, 21 percent in advanced services and 7 percent in creative professions.

Knowledge-intensive jobs account for 7.3 percent of the working age population in Ireland, which is lower than 8.1 percent in the UK. The rate of Brain Business Jobs growth is however higher in Ireland than in the UK. If the trend continues, Ireland will catch up with and pass its larger neighbour.

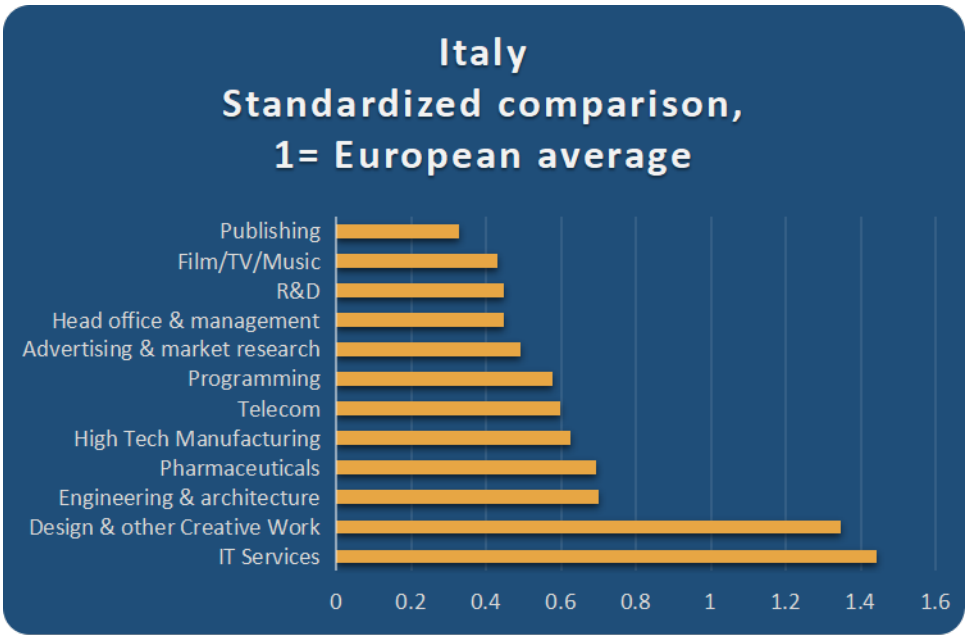


Compared to the rest of Europe, Ireland has several strengths. The main one is pharmaceuticals, where the share of knowledge workers is almost 4 times the European average. Other strengths are high tech manufacturing and programming, where the share of knowledge workers is more than twice the European average.

Country Analysis: Italy

In Italy, the number of employees of the most knowledge-intensive firms has grown from 1 405 000 in 2012 to 1 529 500 in 2019. In total numbers, only Germany, the UK and France have more jobs in highly knowledge-intensive firms. Brain Business Jobs have increased by 72 600 in ICT, 53 500 in advanced services and 6 500 in creative professions. At the same time, Brain Business Jobs in the tech sector have been reduced by 7 900.

Compared to the rest of Europe, Italy has a number of 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, R&D as well as head offices & management.



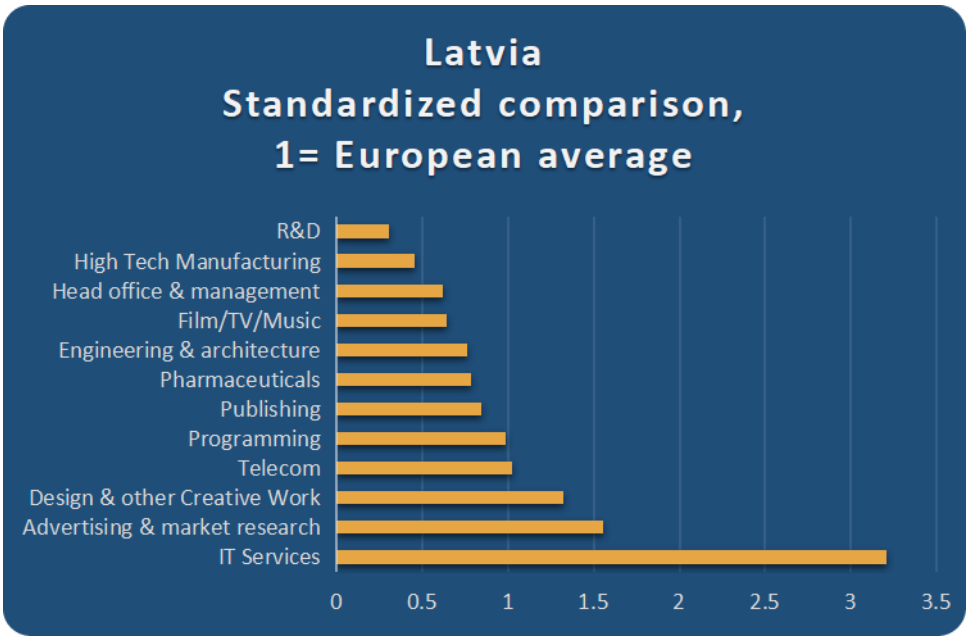
The strongest region in Italy is Lombardia. Here, 409 400 individuals are employed in Brain Business Jobs, corresponding to 6.9 percent of the adult age popu-

lation. In the Rome (Lazio) region the corresponding numbers are 215 500 individuals and 6 percent of the working age population. The Piemonto region is also strong, with 126 200 Brain Business Jobs that amount to 4.9 percent of the working age population. On the other hand, there are also weak performing regions in Italy. Siciila has only 48 800 Brain Business Jobs, corresponding to 1.6 percent of the working age population. Calabria has 16 100 Brain Business Jobs, amounting to 1.3 percent of the workforce.

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 also 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

In Latvia, the number of employees of the most knowledge-intensive firms has grown from 49 400 in 2012 to 74 300 in 2019. Latvia has caught up to and surpassed France, Austria and Belgium in Brain Business Jobs concentration during this period, an impressive feat. Out of the 24 900 new Brain Business Jobs, a majority of 54 percent have been created in ICT, 18 percent in advanced services, 14 percent in creative professions and the remaining 13 percent in the tech sector. If the current upward trajectory continues, Latvia will soon outdo Estonia as well as Norway in Brain Business Jobs concentration.



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. The concentration of people employed in IT services in Latvia is three and a half times higher than the concentration in knowl-

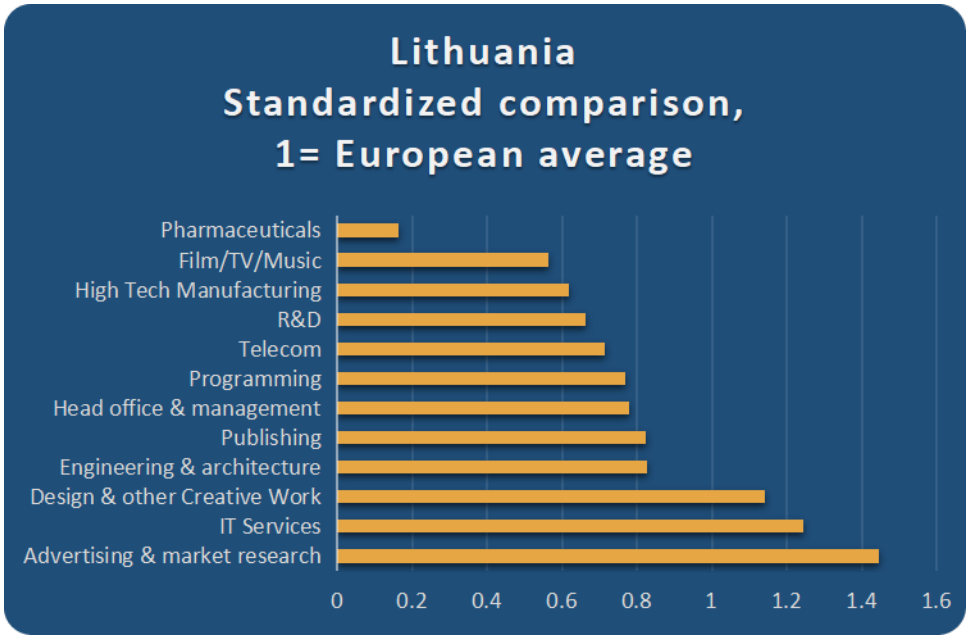
edge-intensive countries such as Sweden and the UK. This is explained by the fact that IT services largely have migrated to countries that combine ample supply of talent with lower wage costs and advantageous business and work regulation.

Other strengths lie in advertising and market research as well as design & other creative work. On the other hand, Latvia is behind the rest of Europe when it comes to areas such as R&D, high-tech manufacturing and head offices & management. The challenge for Latvia is to build upon its impressive strength in IT services, while also boosting growth in other Brain Business areas such as research and development.

Country Analysis: Lithuania

In Lithuania, the number of employees of the most knowledge-intensive firms has grown from 66 300 in 2012 to 90 100 in 2019. Out of the 25 800 new Brain Business Jobs, 44 percent have been created in ICT, 21 percent in advanced services, 18 percent in the tech sector and the remaining 17 percent in creative professions.

Lithuania already has a higher concentration of Brain Business Jobs, as share of the working age population, than Portugal, Spain and Italy. If the current trends continue, Lithuania will also soon catch up to France and Belgium in knowledge-intensive jobs concentration.



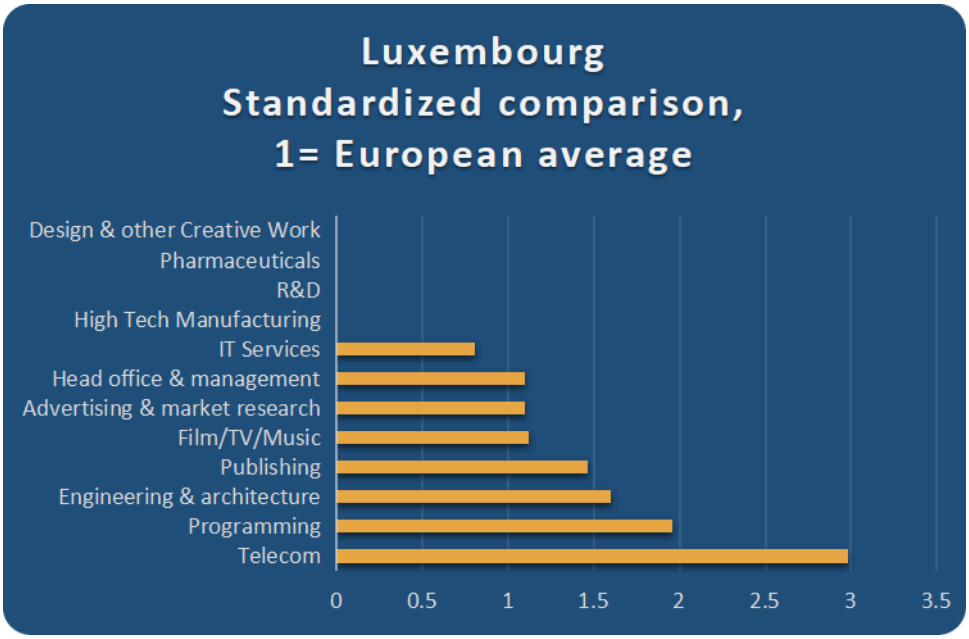
Compared to the rest of Europe, Lithuania has a number of strengths. The main strengths are in advertising and market research, IT services as well as design & other creative work. In these three areas, Lithuania scores above the European average. On the other

hand, Lithuania has a lower concentration than the rest of Europe when it comes to areas such as pharmaceuticals film/TV/music, R&D and high-tech manufacturing. 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

In Luxembourg, the number of employees of the most knowledge-intensive firms has grown from 27 200 in 2012 to 33 300 in 2019. Out of the 6 100 new Brain Business Jobs, 57 percent have been created in ICT, 20 percent in advanced services, 18 percent in the tech sector and the remaining 5 percent in creative professions.

The concentration of Brain Business Jobs, as share of working age population, is higher in Luxembourg than most European countries, including high tech nations such as the United Kingdom, Germany, Ireland and Finland. The only European countries that outdo Luxembourg are Switzerland, Sweden, Denmark and the Netherlands.



Compared to the rest of Europe, Luxembourg has a number of 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

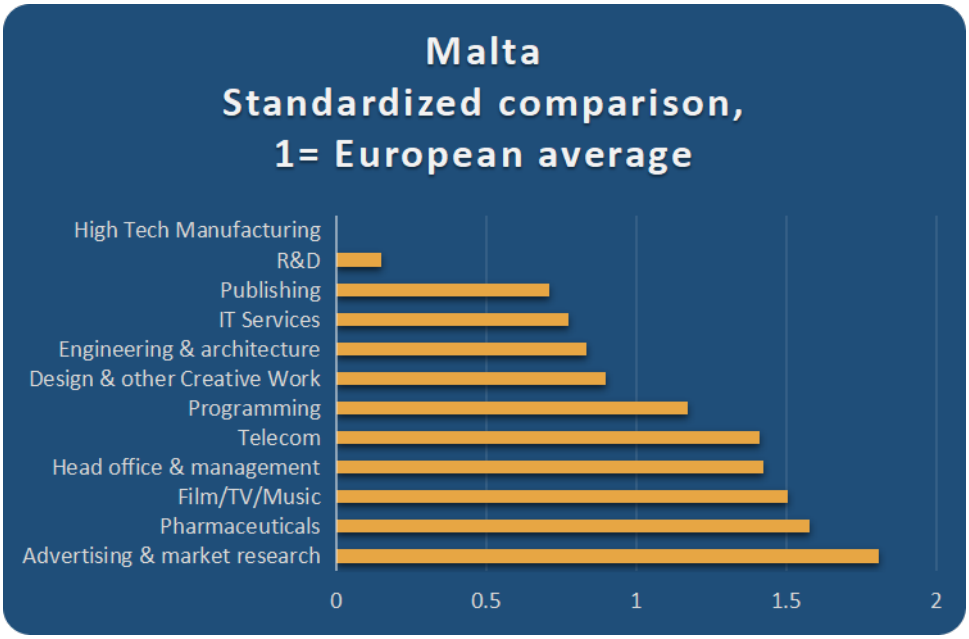
countries comes close to having the concentration of knowledge-intensive jobs as Luxembourg. Besides Ireland, Luxembourg has the second highest concentration of programmers, amongst the working age population, in Europe.

Other strengths are engineering & architecture and publishing. Luxembourg however lags behind in design & other creative work, pharmaceuticals, R&D and high-tech manufacturing. The challenge for Luxembourg is to continue developing knowledge-intensive jobs, in areas where the small nation is already strong but also in areas such as R&D where it currently lies behind the rest of Europe.

Country Analysis: Malta

In Malta, the number of employees of the most knowledge-intensive firms has grown from 14 600 in 2012 to 18 200 in 2019. Out of the 3 600 new Brain Business Jobs, 62 percent have been created in ICT, 23 percent in advanced services, 12 percent in the tech sector and the remaining 3 percent in creative professions.

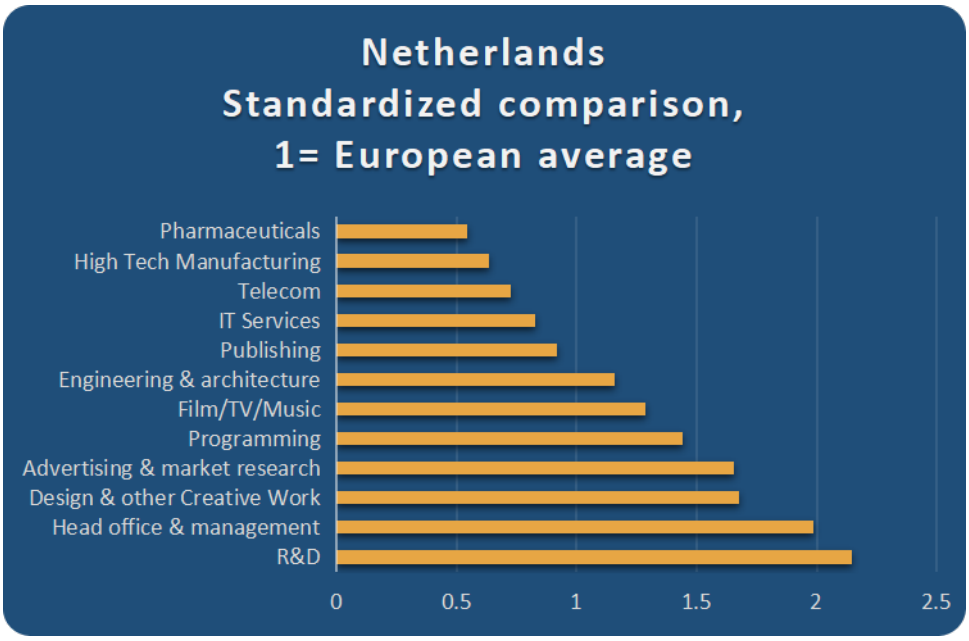
Malta is a leading Brain Business centre of Southern Europe, with a share of knowledge-intensive occupation even higher than that of France. The island nation continues to benefit from business-friendly policy regimes, moving towards a position as a new Singapore of the Mediterranean region. Talent shortage is however becoming a major concern. While the growth of Brain Business Jobs has been strong in Malta over time, the two past years have seen slower growth. Instead, countries such as Cyprus and Portugal, which compete by lower wage costs, have surged.



Compared to the rest of Europe, Malta has a number of strengths. The main strength is in advertising and market research, pharmaceuticals and film/TV/music as well as head offices and management. In these areas, as well as in telecom and programming, Malta has a higher share of knowledge-intensive firm occupation than the European average. On the other hand, Malta still has a way to go to catch up with the rest of Europe when it comes to areas such as high-tech manufacturing and R&D. The challenge ahead for Malta is to sustain its impressive development, encouraging more Brain Business Jobs in areas where it is already strong and in new domains such as research and development. Talent shortage needs to be addressed for Malta to continue evolving as a Southern European knowledge hub.

Country Analysis: Netherlands

In the Netherlands, the number of employees of the most knowledge-intensive firms has grown from 761 600 in 2012 to 891 200 in 2019. Out of the 129 700 new Brain Business Jobs, 40 percent have been created in ICT, 31 percent in advanced services, 18 percent in the tech sector and 11 percent in creative professions. The Netherlands has a higher concentration of Brain Business Jobs than all the major European economies, including the United Kingdom and Germany.



Compared to the rest of Europe, the Netherlands has a number of strengths. The main strengths lie 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

behind the rest of Europe when it comes to areas such as pharmaceuticals, high-tech manufacturing, telecom and IT services.

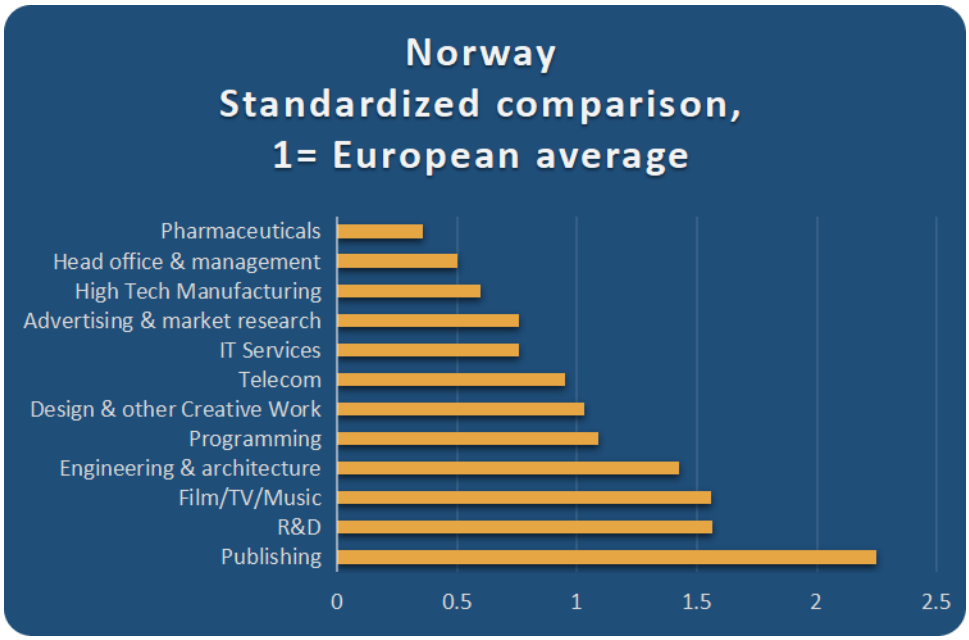
Amsterdam has 211 000 individuals employed in Brain Business Jobs, corresponding to 12.4 percent of the working age population. The highest concentration is however found in Utrecht, where the 101 700 Brain Business Jobs amount to fully 13.3 percent of the workforce. Utrecht has a higher concentration of Brain Business Jobs than most European regions, including Oslo, Berlin, Helsinki, Brussels and Vienna.

The Noord-Brabant region, with 116 600 Brain Business Jobs (7.9 percent of the working age population) and Zuid-Holland with 167 000 Brain Business Jobs (7.7 percent) are other strong regions. The lowest share is found in Zeeland, with 7 500 Brain Business Jobs corresponding to 3.5 percent of the workforce. The challenge for the Netherlands is to expand knowledge-intensive occupation in regions that are currently underperforming. If Brain Business Jobs instead continue to concentrate, significant regional inequality might arise.

Country Analysis: Norway

In Norway, the number of employees of the most knowledge-intensive firms has grown from 191 000 in 2012 to 221 600 in 2019. Out of the 129 700 new Brain Business Jobs, 45 percent have been created in ICT, 22 percent in advanced services, 25 in creative professions and the remaining 8 percent in the tech sector.

In relation to the rest of Europe, Norway has a number of strengths. The main strength is in publishing, followed by R&D, 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 head offices & management and high-tech manufacturing.



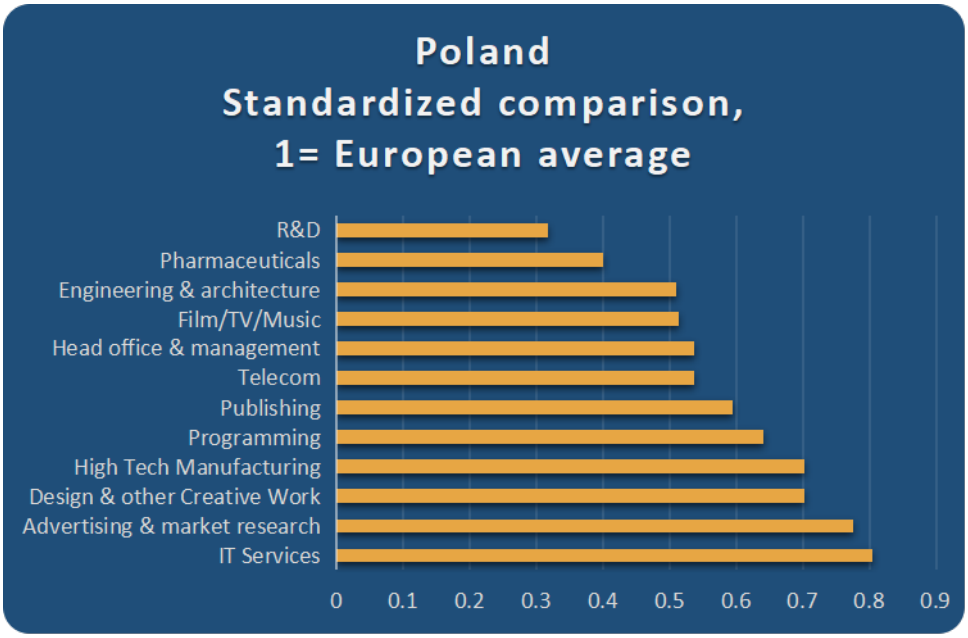
The strongest region in Norway is the capital region of Oslo. Here, 100 200 knowledge-intensive jobs exist, corresponding to 12.8 percent of the working age population. In Sør-Østlandet the number of knowledge-intensive jobs is 24 700 (4.3 percent of the working age population). The third largest Brain Business region is Agder og Rogaland, with 23 000 knowledge-intensive jobs (5.1 percent) followed closely by Vestlandet, which has slightly less than 23 000 knowledge-intensive jobs (4.4 percent). Trøndelag has 16 600 knowledge-intensive jobs, and the second highest concentration of these jobs amongst the working age population (6.2 percent). In Hedmark og Oppland the number of knowledge-intensive jobs is only 6 200, or 2.8 percent of the working age population. In Nord-Norge the number is 8 300, corresponding to 3 percent.

A key 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. While of course regional disparities due to geography and population density prevent all regions from having the same concentration of knowledge jobs, it is important to strive for improvement in the less densely populated parts of the country. If Brain Business Jobs instead continue to concentrate, considerable regional inequality might arise.

Country Analysis: Poland

In Poland, the number of employees of the most knowledge-intensive firms has grown from 721 600 in 2012 to 945 500 in 2019. The knowledge-intensive jobs sector of Poland has boomed. Out of the 224 000 new Brain Business Jobs, 54 percent have been created in ICT, 25 percent in advanced services, 10 percent in the tech sector and the remaining 10 percent in creative professions.

The main strength of Poland is in IT-services, followed by advertising and market research, design & other creative work and high-tech manufacturing. On the other hand, Poland lags behind 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, Here 264 900 Brain Business Jobs exist, amounting to 7.9 percent of the working age population employed in knowledge-intensive occupations. This is

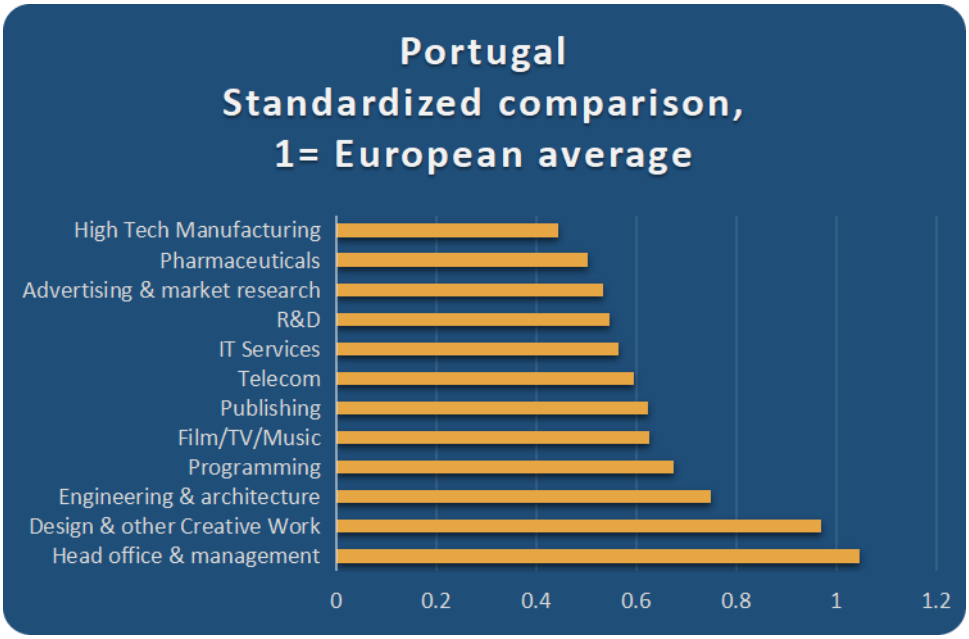
more than twice the national average. Other strong regions are Dolnoslaskie with 81 900 Brain Business Jobs (4.4 percent of the working age population) and Malopolskie with 93 800 Brain Business Jobs (4.5 percent). There are also a number of low-performing regions in Poland. In Warminsko-Mazurskie for example only 11 200, or 1.2 percent of the working age population, are employed in knowledge-intensive firms.

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 further investments in knowledge, through the education system, and improve the business climate for domestic and international firms, in order to continue its strong growth trajectory in knowledge-intensive jobs.

Country Analysis: Portugal

In Portugal, the number of employees of the most knowledge-intensive firms has grown from 228 200 in 2012 to 299 400 in 2019. Out of the 71 300 new Brain Business Jobs, 34 percent have been created in advanced services, 33 percent in ICT, 18 percent in creative professions and 14 percent in the tech sector. This impressive growth means that Portugal is one of the countries in Europe with fastest increase in knowledge-intensive jobs concentration.

Compared to the rest of Europe, Portugal has a number of strengths. The main strength is in head offices & management, design & other creative professions as well as engineering & architecture. 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.



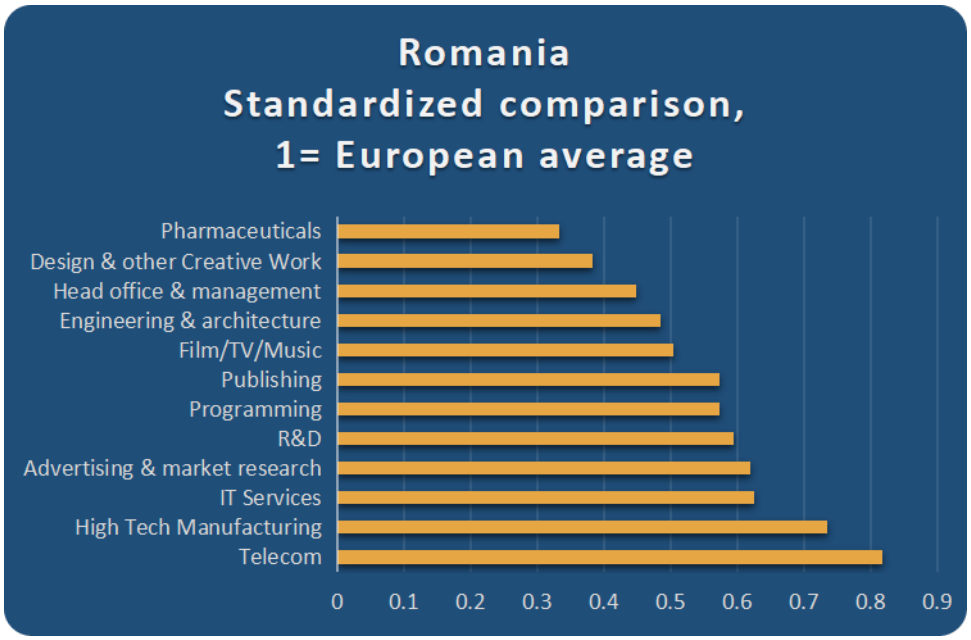
The strongest region in Portugal is the capital region of Lisbon. Here, 141 500 individuals are employed in Brain Business Jobs, amounting to 8.6 percent of the working age population. Other strong performers are in the Norte region with 67 900 Brain Business Jobs (3.1 percent of the working age population) and the Centro region with 33 300 Brain Business Jobs (2.5 percent). Alentejo with only 8 300 knowledge-intensive jobs (2 percent) lags behind the rest of the country.

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. If the current development in Portugal continues, it can, like Malta, evolve into a Southern European knowledge hub.

Country Analysis: Romania

In Romania, the number of employees of the most knowledge-intensive firms has grown from 347 800 100 in 2012 to 447 500 in 2019. Out of the 99 700 new Brain Business Jobs, 64 percent have been created in ICT, 15 percent in advanced services, 14 percent in the tech sector and the remaining 7 percent in creative professions. Romania stands out as one of the countries in Europe with the fastest increase in knowledge-intensive jobs concentration.

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



In Romania, the Brain Business Jobs are highly focused to the Bucharest area. There are 188 400 Brain Business Jobs in the Bucharest region, corresponding to 12.3 percent of the working age population. This is one of the highest shares amongst 278 regions in Europe, higher than Berlin, Helsinki, Brussels, Madrid as well as Vienna. The Brain Business Jobs concentration of Bucharest is only slightly lower than that of Amsterdam and Oslo, creating an opportunity to overtake these regions in knowledge-intensive jobs concentration in the years to come.

The strong performance of Bucharest is due to the high supply of talents combined with lower wages for these talents compared to in Western and Northern Europe. The rest of Romania has lower shares of knowledge-intensive jobs, lagging behind the rest of Europe.

In the Vest region there are 39 700 Brain Business Jobs (3.5 percent of the working age population), compared to 52 500 in the Nord-Vest region (3.3 percent). The lowest shares are found in Sud-Vest Oltenia and Sud-Muntenia (1.3 percent). 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

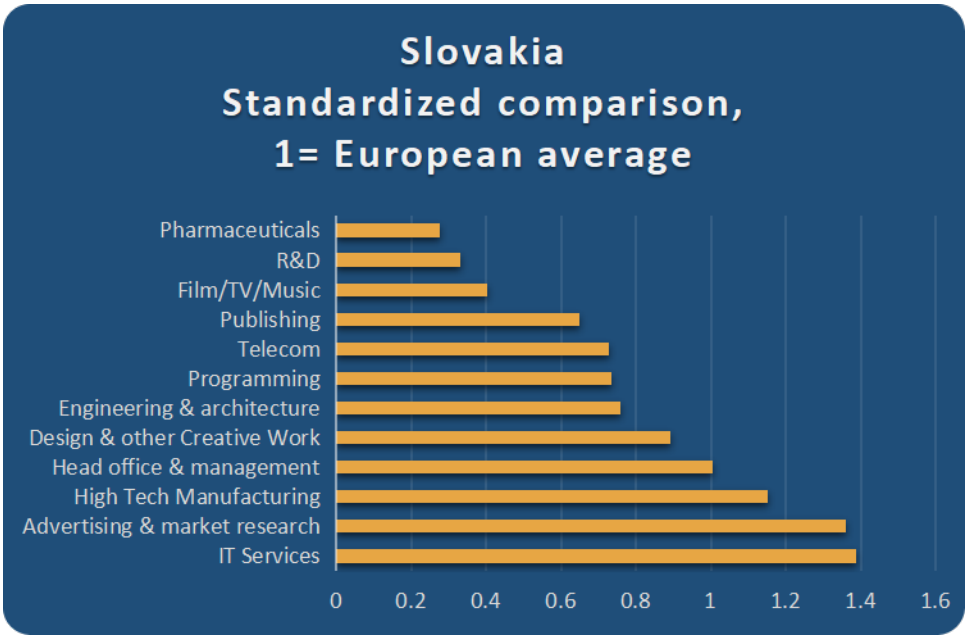
In Slovakia, the number of employees of the most knowledge-intensive firms has grown from 137 200 in 2019 to 201 800 in 2019. Out of the 64 600 new Brain Business Jobs, 43 percent have been created in advanced services, 31 percent in ICT, 15 percent in the tech sector and the remaining 10 percent in creative professions.

Slovakia is also home to the region of Bratislava, which has the highest rate of Brain Business Jobs in all of Europe. With 19 percent of its working age population employed in various knowledge-intensive jobs, Bratislava outpaces the other 277 regions in Europe—including the Oxford region at second spot (17.9 percent of the working age population employed in Brain Business Jobs) and the Stockholm region on third spot (17.8 percent).

Compared to the rest of Europe, Slovakia has a number of strengths. The main strength is in IT-services, followed by advertising & market research and high-tech manufacturing. Head office & management is also a strength. On the other hand, Slovakia lags behind the rest of Europe when it comes to areas such as pharmaceuticals, R&D, film/TV/music and publishing.

Bratislava's top position as a knowledge-intensive region is due to the small population of the region, combined with abundance of 78 300 knowledge-intensive jobs. In the rest of the country, the concentration of Brain Business Jobs is lower. The second-ranking region is Západné Slovensko, with 40 900 knowledge-intensive jobs (3.4 percent of the working age

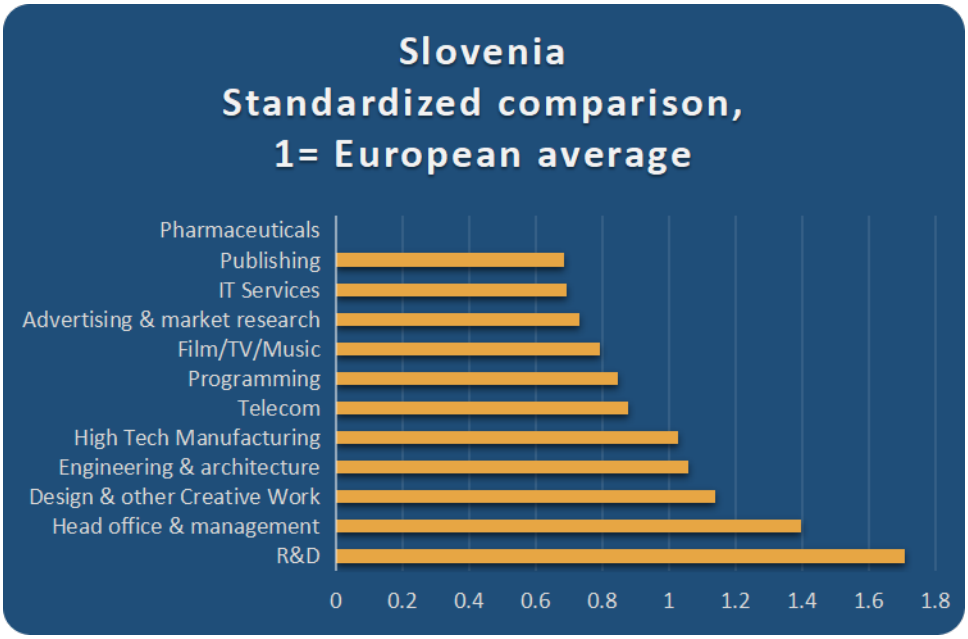
population), Stredné Slovensko with 29 600 knowledge-intensive jobs (also 3.4 percent) and lastly Východné Slovensko with 28 000 knowledge-intensive jobs (2.7 percent). Slovakia needs to expand on the advantage of hosting the leading Brain Business region of Europe, while also striving to have other regions catch up.



Country Analysis: Slovenia

In Slovenia, the number of employees of the most knowledge-intensive firms has grown from 67 200 in 2012 to 83 400 in 2019. Out of the 16 200 new Brain Business Jobs, 37 percent have been created in advanced services, 34 percent in ICT, 18 percent in the tech sector and the remaining 11 percent in creative professions.

Compared to the rest of Europe, Slovenia has a number of strengths. The main strength is in R&D, followed by head offices & management and design. Engineering & architecture and engineering & architecture are other knowledge-intensive areas where the concentration of knowledge jobs in Slovenia is higher than the European average. On the other hand, Slovenia lags behind the rest of Europe when it comes to areas such as pharmaceuticals, publishing and IT services.

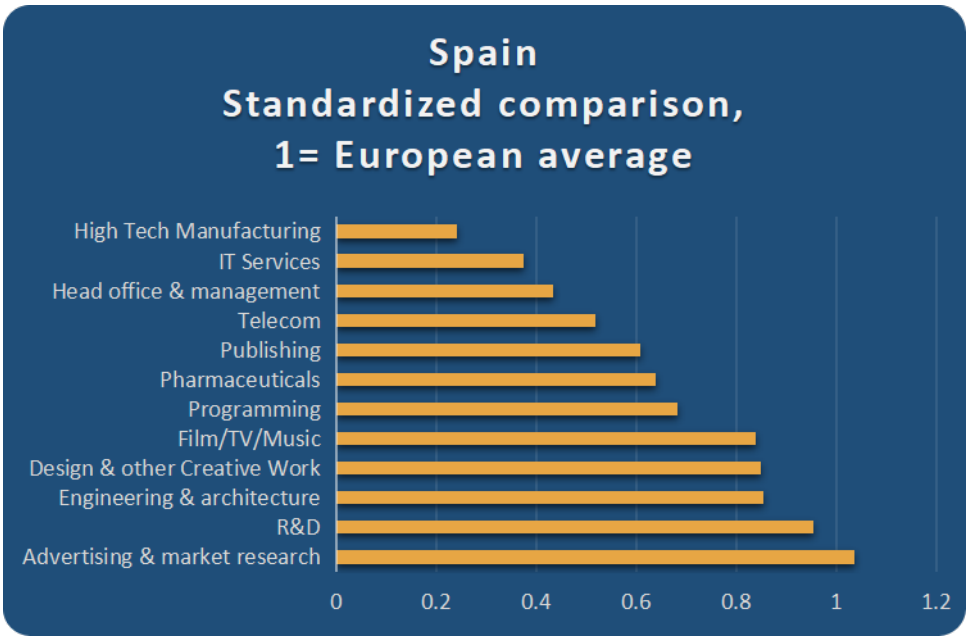


Slovenia has a higher share of its working age population employed in knowledge-intensive jobs than Belgium, France, Austria, Portugal, Spain and Italy. If the country can build upon its existing development, and further increase the trajectory of growth, it can soon also outpace even countries such as Norway and Finland. 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 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

In Spain, the number of employees of the most knowledge-intensive firms has grown from 1 033 000 in 2012 to 1 256 900 in 2019. Out of the 224 100 new Brain Business Jobs, 36 percent have been created in advanced services, 28 percent in ICT, 26 percent in the tech sector and the remaining 10 percent in creative professions.

Compared to the other parts of Europe Spain is particularly strong in advertising & market research, followed by R&D (research and development) and engineering & architecture. Weaknesses exist in form of high-tech manufacturing and IT services.



The strongest region in Spain is the capital region of Madrid. Here, 428 400 individuals are employed in Brain Business Jobs, corresponding to 10.7 percent of the working age population.
Cataluña is another strong region, with 256 300 Brain Business Jobs, or 5.7 percent of the working age popu-

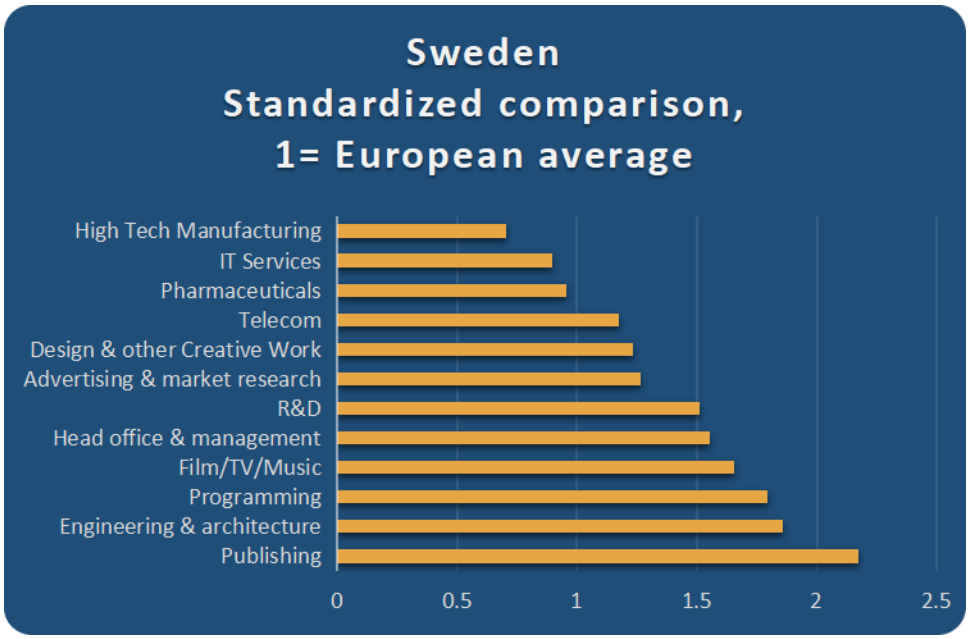
lation. Comunidad Foral de Navarra has 14 300 Brain Business Jobs, which for its size is a strong performance—with 7.3 percent of the working age population in knowledge-intensive jobs.

Another strong performer is the País Vasco region, with 68 700 Brain Business Jobs (5.3 percent of working age population) and Aragón (3.2 percent). The lowest share of Brain Business Jobs is found in La Rioja (1 percent) and Castilla-la Mancha (1.4 percent). The challenge for Spain is to strengthen IT services and programming. This is needed in order to keep up in a time where knowledge jobs are strongly linked to digitalization. Spain also needs to encourage Brain Business Jobs in those regions that are currently weak performers. Otherwise significant regional economic disparities are likely to arise due to the uneven distribution of knowledge jobs.

Country Analysis: Sweden

In Sweden, the number of employees of the most knowledge-intensive firms has grown from 491 000 in 2012 to 594 100 in 2019. Out of the 103 100 new Brain Business Jobs, 49 percent have been created in ICT, 31 percent in advanced services, 17 percent in creative professions and 4 percent in the tech sector.

No other country in the European Union has as high concentration of knowledge-intensive workers as Sweden. If the current trends continue, Sweden will even catch up to and surpass Switzerland, becoming the number one knowledge-intensive country of Europe. The reason is that Sweden has overall strengths, while Switzerland is focused on the tech sector, which is stagnating relative to ICT and advanced services.



Compared to the rest of Europe, Sweden stands out as having strengths in almost all Brain Business areas, except for high-tech manufacturing, IT services and pharmaceuticals. 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. Here, close to 240 000 individuals, corresponding to 17.8 percent of the working age population, is employed in Brain Business Jobs. Besides the Oxford region and Bratislava, Stockholm has the highest concentration of knowledge workers amongst 278 European regions. Stockholm's strong performance is linked to the strong start-up culture, supported by venture capital funding. Other strong performers are Västsverige with 95 300 Brain Business Jobs (8.4 percent of the working age population) and Sydsverige with 64 900 Brain Business Jobs (7.8 percent). The lowest share of Brain Business Jobs is found in Norra Mellansverige (4.5 percent) and Småland med öarna (4.9 percent).

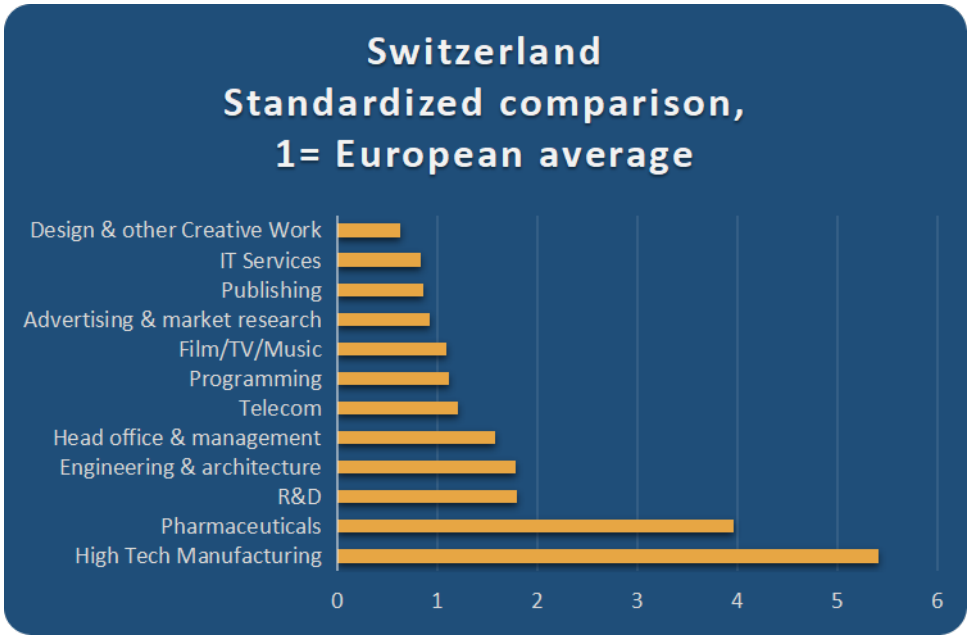
The challenge for Sweden ahead is to remain on top and continue to grow, in a time when in particular Eastern and Central Europe is catching up strongly in Brain Business Jobs—by relying on ample supply of talents and lower wage compared to countries such as Sweden. Cost of employment for talents remains a challenge, linked to the high levels of taxation.

Country Analysis: Switzerland

Switzerland is by margin the country in Europe that has the highest share of workers employed in knowledge-intensive occupations. In the country, the number of employees of the most knowledge-intensive firms has grown from 465 300 in 2012 to 559 300 in 2019. Out of the 93 957 new Brain Business Jobs, 41 percent have been created in advanced services, 30 percent in the tech sector, 25 percent in ICT and the remaining 4 percent in creative professions.

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, IT services, publishing and advertising & market research Switzerland has a lower concentration than 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, is leading to the country stagnating compared to parts of Europe. Sweden, the country with second highest concentration of Brain Business Jobs will eventually catch up to and outpace Switzerland, if current trends continue.

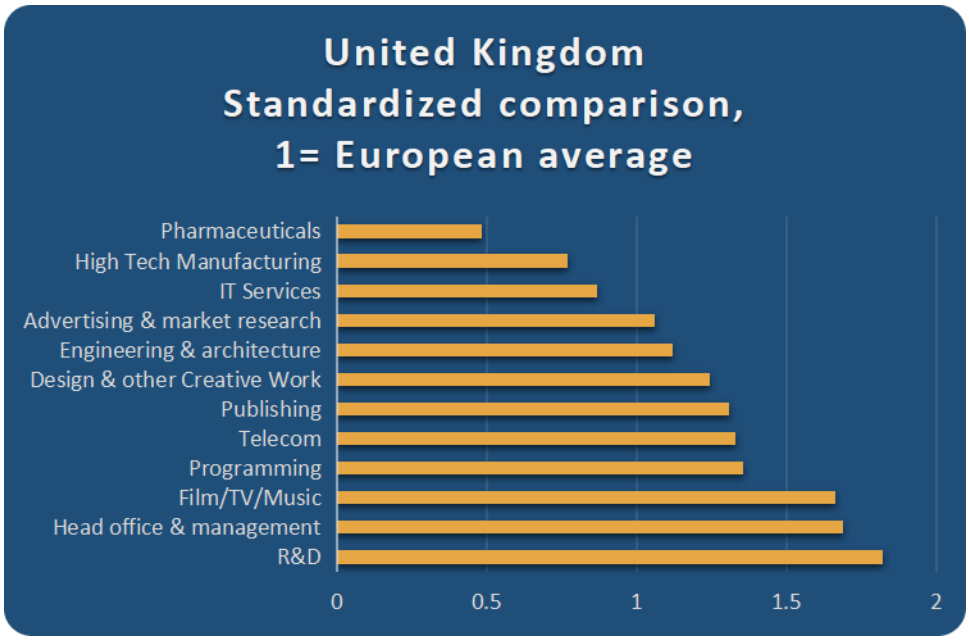


While Switzerland continues to have the lead in Brain Business Jobs concentration, competition is fierce from nations such as Sweden that grown by having broader spectrum of knowledge jobs, and also the Eastern and Central European countries whose capital regions compete by having ample supply of knowledge workers and lower wages for talents compared to rich countries such as Switzerland. 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

In the UK, the number of employees of the most knowledge-intensive firms has grown from 2.6 million in 2012 to 3.2 million in 2019. Out of the 602 500 new Brain Business Jobs, 46 percent have been created in ICT, 31 percent in advanced services, 13 percent in the tech sector and 9 percent in creative professions.

A comparison of 278 regions in Europe shows that London experienced the strongest growth of Brain Business Jobs, as the share of the adult population employed in knowledge-intensive occupations grew by 2.5 percentage points compared to two years earlier. In total, 17.3 percent of the working age population of London are employed in Brain Business Jobs.



Compared to the rest of Europe, the UK has a number of strengths. The main strength is in R&D, head offices & management and film/TV/music. In these sectors, the UK has close to twice the concentration of knowledge workers compared to the European aver-

age. Programming, telecom and publishing are other strengths. 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. In this Oxford region, 247 000 Brain Business Jobs exist, corresponding to 17.9 percent of working age population. This is the highest rate in all of Western and Northern Europe. Only Bratislava, which competes by having lower wages and strong supply of knowledge workers, has a higher concentration of Brain Business Jobs than the Oxford region.

North Eastern Scotland (11.3 percent) is another top-performing region, as is Bedfordshire and Hertfordshire (10.8 percent) and Surrey, East and West Sussex (10.6 percent). The lowest share of Brain Business Jobs is found in West Wales and The Valley (3.1 percent) and East Anglia (3.2 percent).

Overall the UK has the highest Brain Business Jobs concentration amongst larger European nations, yet needs to increase knowledge-intensive sectors in order to catch up to the leading smaller nations of Switzerland, Sweden, Denmark, Netherlands and Luxembourg. The opportunity exists to increase digital competition as well as encourage a renaissance for the tech sector.

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