Berlin *aktuell*

The digital economy and industry go hand in hand

November 2019

www.ibb.de

Investitionsbank Berlin

www.uvb-online.de

Unternehmensverbände Berlin-Brandenburg

UVB

Editorial by the Chairman of the Board of Investitionsbank Berlin

Dr. Jürgen Allerkamp

Berlin is Germany's start-up capital, a fact reported in regular studies conducted by IBB and all other studies on this subject. Ten years ago, it would have been easy to dismiss the rapid development of the digital economy as another flash in the pan especially in light of how companies on the "new market" developed between 1999 and 2002. But now, after a decade in which Berlin's digital economy moved forward on a path of sustained, stable and above-average growth, we know better. Unlike at the turn of the millennium, the start-up community in Berlin has entered into a self-reinforcing, self-supporting cycle. The high investments announced by Japan in a data centre in the south of the city are evidence of this. For several years now, Berlin has been one of the leading European cities for investments in start-ups.

Digital companies of all kinds are emerging in the German capital. In the early days, reports focused on Berlin-based companies in the online retail sector which continue to conduct their international business from Berlin. The focus of public interest is increasingly on digital companies working in Industry 4.0, smart services and AI development; after all, digitalisation is not a means in itself.

Digital companies have a cross-sectional function and a very special pioneering role on the supply side of the economy. Developing new digital services to meet demand that has at times yet to be created is part of the very nature of start-ups. On the other hand, however, it is traditional, established industrial companies who are still responsible for much of the innovation being developed. These companies are producing digital innovations to solve very specific problems in production or logistics. Industrial companies are increasingly becoming the drivers of Berlin's digital economy.

The present study by IBB's economic experts, which this time was conducted in co-operation with the Berlin-Brandenburg business associations (UVB), shows that Berlin's digital economy has developed outstandingly well over the past decade. Today, close to 100,000 people are employed here – more than in any other major city in Germany. This means the number of people working in the digital economy is almost as high as in Berlin's industrial sector. However, the study also shows that there is an increasing degree of interaction between industry and the digital economy. Industry and industry-related services are an important focus for the almost 600 start-ups in the digital sector.

Berlin is already at the top of the digital economy in Germany. This position now needs to be maintained and expanded. Berlin must strive even harder for a pioneering role, especially in the digital transformation of industry. I am looking forward to working with local stakeholders in order to identify and leverage the enormous opportunities that digitalisation and Industry 4.0 have to offer for Berlin.

Dr. Jürgen Allerkamp, Chairman of the Board of Investitionsbank Berlin

Editorial by the Chief Executive of Vereinigung der Unternehmensverbände in Berlin und Brandenburg e.V. (UVB)

It was not without reason that Berlin was already one of the most important industrial cities in Europe in the 19th and 20th centuries. The big companies on the river Spree were extremely innovative and technological leaders – Borsig in locomotive construction, Siemens or AEG in electrical engineering. Inventiveness, creativity and courage made them successful.

More than 100 years have passed since this industrial boom. Today, in our increasingly digital world, the values that led to success in the past are once again in demand. Many things are in motion, what was once tried and tested has disappeared, new things are turning entire industries upside down. For industry in the capital, in particular, this is opening up opportunities to significantly strengthen the city's reputation as a manufacturing location.

In many places, digitalised production is on the advance. New manufacturing and work processes are paving the way for more individualised products, lower costs and rapid adaptation to the market. Companies in Berlin have recognised this and are investing in digital projects, more than in other cities in Germany. And are more successful than their competitors: When it comes to artificial intelligence, the Internet of Things, virtual reality or 3D printing, Berlin is right up there among the national leaders.

That's no coincidence. Berlin's digital economy, from software developers to online retailers and hardware manufacturers, is already playing in the premier league. In no other German city do more people work with bits and bytes than in the capital.

An important part of the digital economy is the start-up sector. Every 20 minutes, a new, promising company is set up on the banks of the Spree, often in the high-tech sector. The special ecosystem of creatives, inventors, incubators and financiers foster top performance so that four out of five euros of venture capital in Germany now flows into Berlin. Rapid change, a strong digital economy, a lively start-up scene – a special mix that is generating new potential for industry in Berlin. This is to be highlighted in this joint study by Investitionsbank Berlin and Berlin-Brandenburg's business associations. An entirely new perspective is now opening up for industry following years and decades of upheaval.

First steps have already been taken. Berlin is the most important location in Germany where digital technologies are being developed for industry. More than 100 digital hubs belonging to large, technologically strong corporations, such as Daimler, Google, Viessmann, Würth, Allianz and Volkswagen, operate in Berlin. Nowhere else in Germany is there such an enormous density of knowledge. This offers great opportunities to foster mutual development of both industry and the digital economy.

If we set the right course, for instance, in professional training, the digital transformation of schools and the administration and the digital infrastructure, the capital city has a good chance of becoming one of the winners of the new industrial revolution.

Christian Amsinck

Christian Amsinck, Chief Executive of UVB

Results at a glance

The digital economy in Berlin

- A total of 98,865 people are employed in Berlin's digital economy – more than in any other major city in Germany.
- Between 2008 and 2018, 58,056 jobs were created in this sector. This means that the digital economy has grown almost four times as fast as the rest of the economy (9.3% against 2.7%).
- One in seven new jobs in Berlin is created in the digital economy.
- Sales recorded by the 10,253 digital companies in Berlin amount to EUR 12.4bn, with gross value added totalling EUR 5.4bn.
- The digital economy accounts for almost 14% of Berlin's economic growth over the past seven years.

Core area of the digital economy

- In Berlin, 71,719 people are employed in the core area of the digital economy, i.e. software developers and data service providers, more than in any other major German city.
- Employment in the core area of the digital economy is growing at an average annual rate of 11.1% in Berlin, twice as fast as in Germany as a whole (5.3%).

Start-ups

- In 2018, 5,169 companies were launched in Germany's digital economy; this figure totalled 591 in Berlin (11.4%).
- The number of companies set up in the digital economy in Berlin is as high as Munich (120), Hamburg (236) and Frankfurt (246) combined.
- An average of one new digital company is set up every 15 hours.

Industry in Berlin

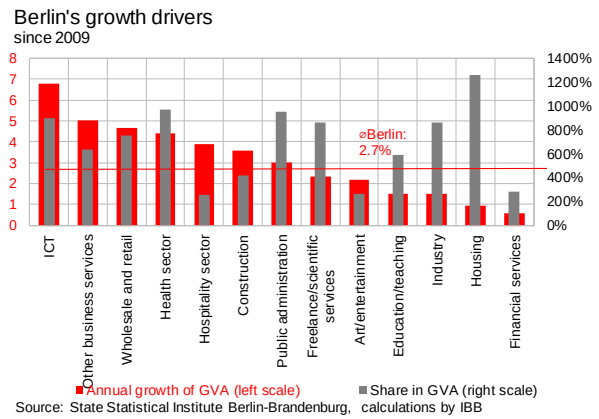
- According to the most recent figures, 111,700 people work in regular jobs in industry (+5.4% compared to 2015).
- In 2018, Berlin's industry generated sales of EUR 26bn (+4.3% compared to 2015).
- 56% of this figure is generated abroad.
- Gross value added of industry totals EUR 11.3bn.

The digital transformation of industry

- Industry and the digital economy are closely interlinked. Around one third of Berlin's digital units and innovation hubs are initiated by industrial companies.
- Berlin is one of the leading centres for the technologies that are important for both the digital economy and industry, i.e. artificial intelligence, Internet of Things and additive manufacturing.
- More than 59% of industrial companies are already implementing digitalisation projects. In mechanical engineering, this figure is particularly high at 73%.
- The main reason why industrial companies are embarking on the path of digitalisation is to strengthen competitiveness and reduce costs.
- 43% of AI companies in the region develop smart maintenance and process management systems for industrial plants.
- 32% of additive processes are used in mechanical engineering.
- 13% of start-ups founded in 2018 work in industry or industry-related services.
- 19% of IOT (Internet of Things) companies offer solutions for industrial production.

Digital sectors of the economy with strong growth momentum

For many years now, the information and communication technology (ICT) sector has been one of the most important growth drivers in Germany's capital city. Economic output here rose more than in any other sector: Between 2009 and 2018, gross value added rose by 6.8% annually (Berlin: 2.7%). ICT accounted for an 8.9% share in gross value added (previous year: 8.7%).



Source: State Statistical Institute Berlin-Brandenburg, calculations by IBB

The digital economy is an important growth driver within the ICT sector

Within the ICT sector of the economy, which also includes publishing, media and broadcasting services, companies in the digital economy are in a particularly strong position. The introduction of new technological and digital innovations offers huge potential for growth, not only for the digital companies themselves, but also for the rest of the economy.

This study is intended to enrich public debate on the topic with up-to-date figures from official statistics. The digital economy, which is in itself not listed as an independent sector in the classification of economic sectors by the Federal Statistical Office (WZ-2008), can be defined mathematically for research purposes with the help of the relevant service and industrial sectors.

Breakdown of the digital economy based on the official statistical industry classification

WZ-2008	*Economic branch*		
26.1	Manufacture of electronic components	ICT base infrastructure	Hardware and infrastructure
26.3	Manufacture of devices and setting up telecom systems		
61.1	Line-based telecommunications		
61.2	Wireless telecommunications		
61.3	Satellite telecommunications		
61.9	Other telecommunications		
58.2	Software publishing	Software and data service providers (core area)	
62.01	Programming activities		
62.02	Consultancy services in the field of IT		
62.03	Operation of IT facilities for third parties		
62.09	Other IT services		
63.11	Data processing, hosting and related activities (database service, data storage services)		
63.12	Web portal		
26.2	Manufacture of IT devices and peripheral devices	Consumer Electronics	
26.4	Manufacture of consumer electronics		
26.8	Manufacture of magnetic and optical data carriers		
47.91	Internet and mail-order retail		

Source: Destatis, broken down by Investitionsbank Berlin

In addition, the digital economy can be divided into the following main areas:

1. Provision of information technology infrastructure and hardware (with the two sub-areas of ICT basic infrastructure and consumer electronics)
2. Creation of software and data services (core area)
3. Organisation of e-commerce

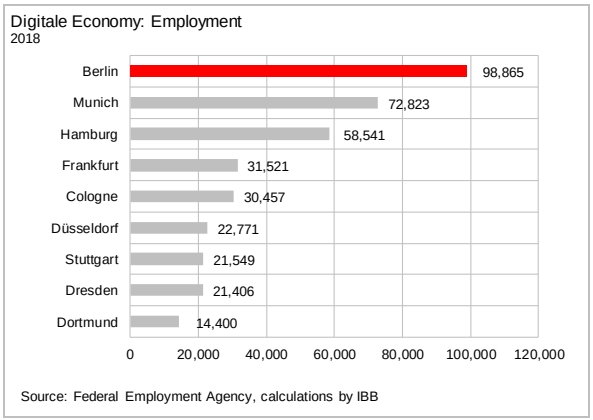
Especially companies involved in software development and data services are becoming increasingly important for many areas of the economy in the context of digital transformation. It is in the so-called 'core area of the digital economy' that the software and data services necessary for digital transformation are being created. E-commerce has now become an integral part of Berlin's digital economy. With the expansion of the Internet, mail-order commerce changed dramatically, paving the way for new, innovative companies which, to a very large extent, are setting up shop in Germany's capital city and are also operating on an international scale.

In total 1.25 million people are employed in Germany's digital economy. Nearly 372,000 or 30% of them work in the nine major cities compared, although only around 14% of the German population live in these cities. The digital economy is particularly strong in areas where digital infrastructure has been developed and digital companies find it easy to recruit highly qualified staff.

Digital economy as a whole

Berlin leads the nation

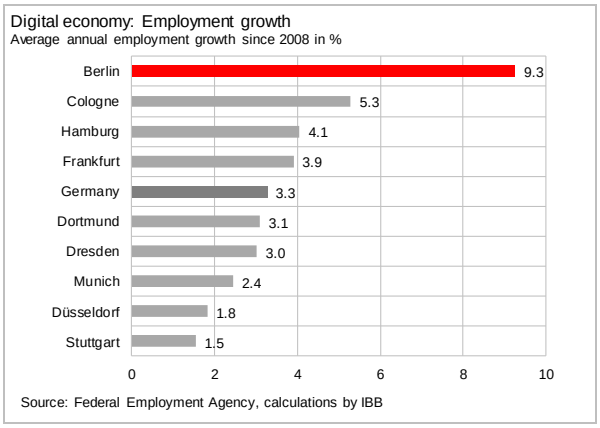
In 2018, 98,865 people were employed in Berlin's digital economy – more than in any other major German city. In Munich (72,823), Hamburg (58,541), Frankfurt (31,521) and Cologne (30,457), on the other hand, far fewer people were employed in the digital economy in absolute terms.



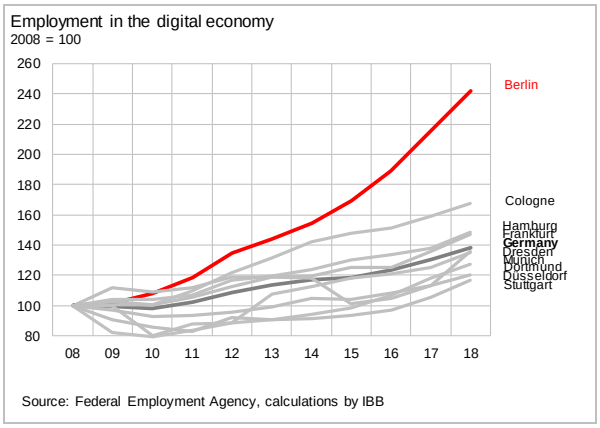
In relation to the total number of jobs, however, Berlin's digital economy only ranks third. In Munich and Dresden, for instance, the digital economy accounts for 765 and 736, respectively, out of every 10,000 jobs. Adjusted for size, this figure totals only 612 in Berlin. The German average totals 332 digital jobs out of every 10,000 jobs.

The digital economy driving jobs

The importance of the digital economy for Berlin's overall economy has increased continuously in recent years. Between 2008 and 2018, 58,056 new jobs were created in Berlin's digital economy. This corresponds to an average annual increase of 9.3% and is hence the highest annual growth of all cities, followed by Cologne and Hamburg with annual increases of 5.3% and 4.1%, respectively.

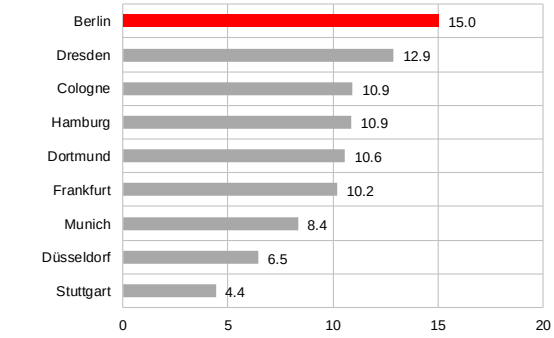


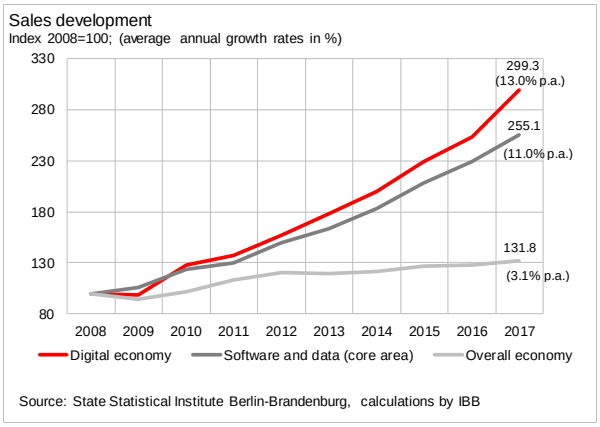
The German average growth rate for jobs in the digital economy is 3.3%. By comparison, total employment in Berlin rose by an annual average of 2.8% during this period (Germany: 1.4%).



One in seven new jobs in Berlin is created in the digital economy

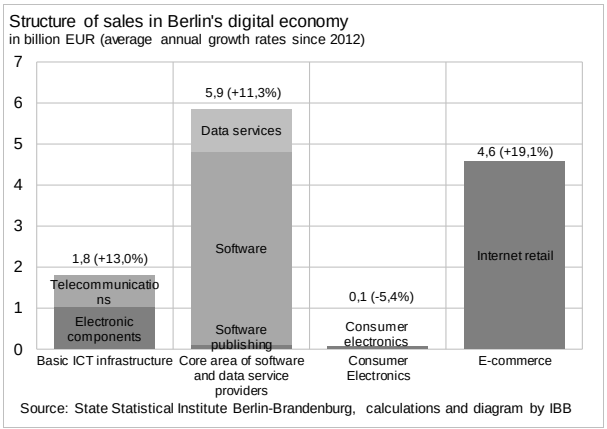
Since 2008, every 7th new job in Berlin has in fact been created at a company working in the digital economy, corresponding to 15% of all new jobs. With this contribution to job creation, the digital economy has become comparatively important for Berlin's economy and is more important than in all other cities.





Internet companies generate sales of more than EUR 12bn

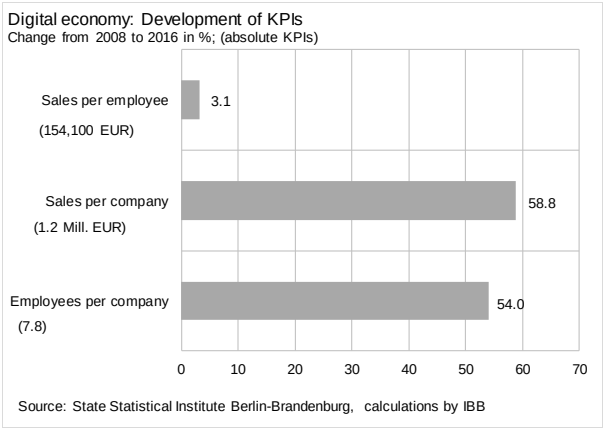
In 2017 (most recent figures available), Berlin's 10,253 Internet companies together generated sales of EUR 12.4bn – EUR 8.3bn more than in 2008. This corresponds to an annual increase of 13%. They thus exceeded the sales recorded by construction companies (EUR 10.7bn).



Compared to the previous year alone, sales in the digital economy increased by 18.4%. On the other hand, only a 3% increase was recorded for all companies in Berlin.

In the core area of the digital economy (software and data services), where the number of companies totalled 8,245, sales have in fact increased by 155% since 2008, rising from EUR 2.3bn to around EUR 5.9bn. This corresponded to an annual average increase of 11%. The positive development in the core area is even surpassed by sales developments in e-commerce which increased by an annual 20%.

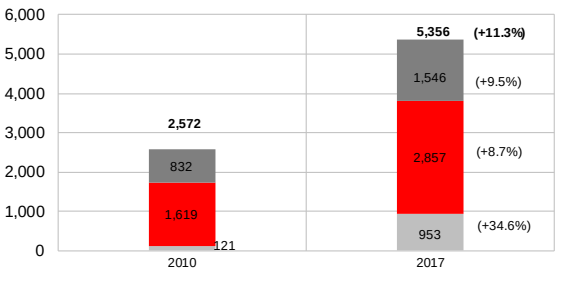
The rapid rate of growth in Berlin's digital economy is also reflected in other key figures. Every employee generates average sales of EUR 154,000. The average figure for Berlin is only EUR 151,000 per employee. The number of employees per company has also increased over the last 10 years by 54% to an average of 7.8 employees. From an entrepreneurial perspective, these jobs are needed because sales per company (EUR 1.2m) have also risen by 58.8%. The shortage of skilled workers is now proving to be a stumbling block.



The digital economy is responsible for 14% of Berlin's economic growth

Since 2010, gross value added in Berlin's digital economy has more than doubled to around EUR 5.4bn (last official figures available from 2017). Around 53% of gross value added is generated in the core area of software and data services (EUR 2.9bn). Hardware and infrastructure account for EUR 1.6bn and e-commerce with its dynamic growth for EUR 953m.

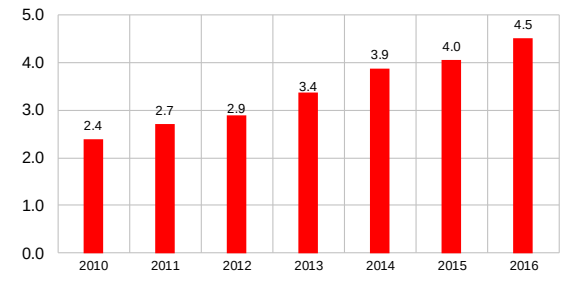
Structure of value added in Berlin's digital economy
Price-adjusted in million EUR; annual growth rates in brackets



Source: State Statistical Institutes, federal-state regional accounts, calculations and diagram by IBB

Between 2010 and 2017, around 14% of Berlin's total economic growth can be attributed to the digital economy. The reason for this is that since 2010 price-adjusted gross value added generated by Berlin's digital economy has grown by EUR 2.8bn (average of 11.3% annually) to EUR 5.4bn. By comparison, the price-adjusted increase in Berlin's economy as a whole totalled EUR 19.9bn (average of 2.6% annually) over the same period.

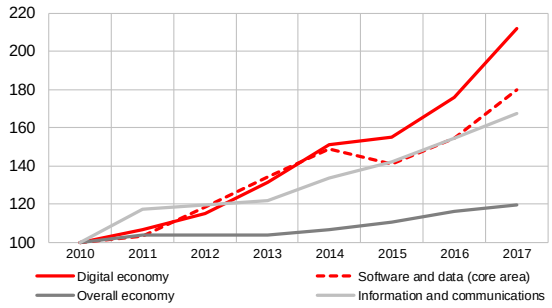
Gross value added in Berlin's digital economy
in billion EUR, price-adjusted



Source: Federal Employment Agency, State Statistical Institutes, calculations by IBB

In addition to the considerable increases in employment and value added, it also makes sense to take a look at how much value added is actually being generated in Berlin. Value added is, after all, what fuels wages, salaries, profit distributions and dividends. Higher demand for goods and labour indirectly creates new jobs in the region. In Berlin, gross value added in the digital economy totals around 35% of sales generated.

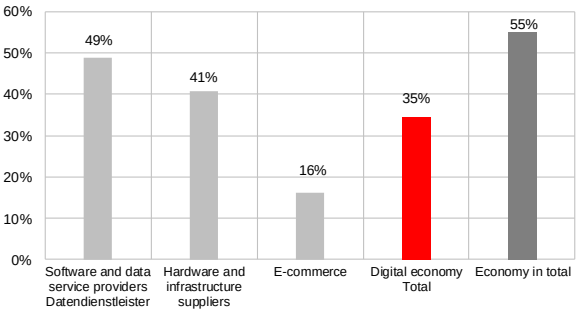
Gross value added in Berlin's digital economy
Index: 2010, price-adjusted



Source: State Statistical Institutes, federal-state regional accounts, calculations by IBB

There are, however, enormous differences in the individual sub-sectors of Berlin's digital economy when it comes to their shares in value added. Providers of software and data services reach 49% and are almost on par with the value added share of Berlin's overall economy (55%). However, hardware and infrastructure suppliers (41%) along with e-commerce (16%) have only below-average value added shares because these sectors require a particularly high level of input from other regions.

Value added shares in Berlin's digital economy
Shares in sales 2017



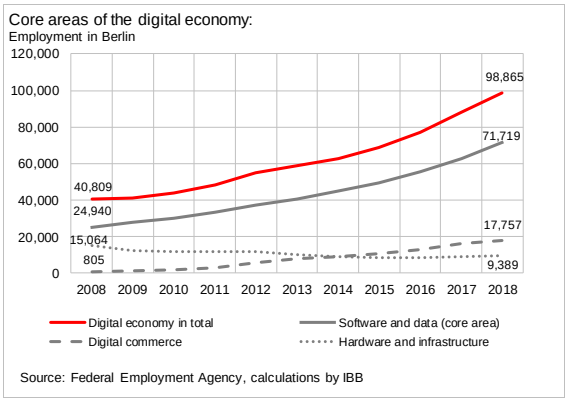
Source: State Statistical Institutes, federal-state regional accounts, calculations by IBB

The digital transformation will lead to a loss of jobs in Berlin too. This will be felt particularly in sectors where the automation of simple tasks will lead to greater efficiency and cost savings. But even if simple jobs are lost, new, high-quality jobs will be created to steer digitised processes. What's more, a growing number of jobs will be created in the digital economy and this will ultimately benefit private consumption and government revenues. Public investment and public services will be stepped up and this too will in turn create new jobs.

Sub-areas of the digital economy

1. Decline in infrastructure and hardware

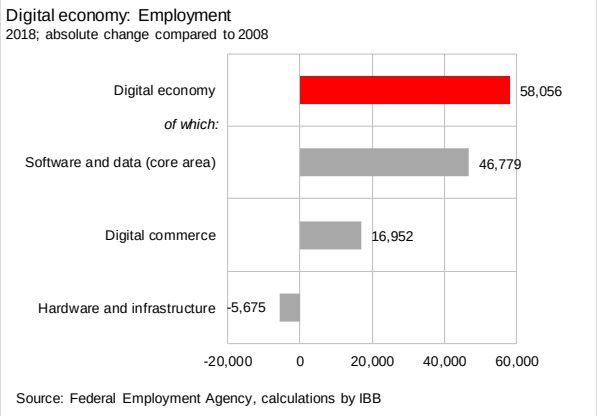
The sub-sector of hardware and infrastructure suppliers includes all those companies that provide the infrastructure needed to transmit (basic ICT infrastructure) and display (consumer electronics) the content and services generated in the core area of the digital economy.



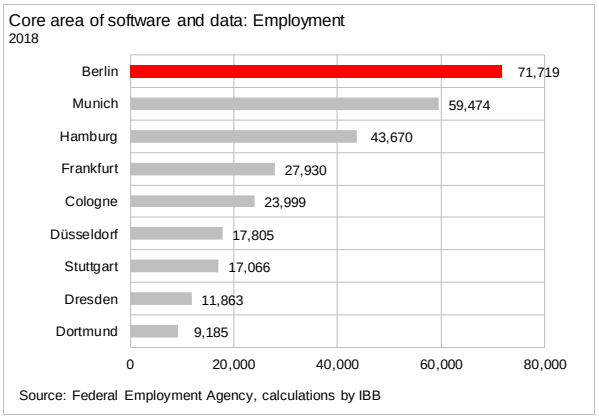
Since 2008, employment in this sub-sector in Berlin has fallen from a good 15,000 to only 9,400 jobs. This marks a decrease of 38% since 2008. However, employment has declined throughout Germany, where today's 294,000 jobs are around 70,000 down against 2008 (-19.2%). In this more industry-orientated sector of the digital economy, employment is declining, partly as a result of migration, but primarily due to automation. Thanks to higher productivity, the remaining companies are still able to make a significant contribution to regional economic growth.

2. The core area accounts for the strongest growth in Berlin

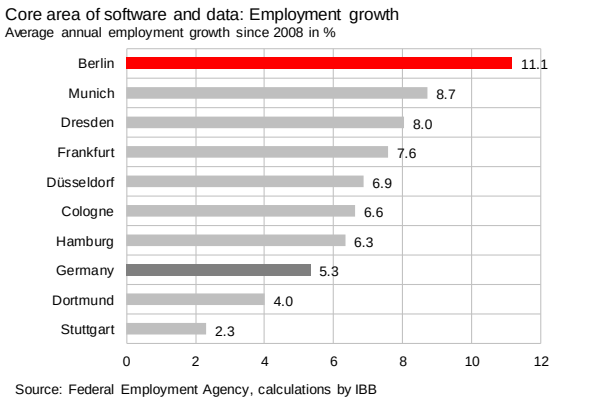
Software and data service providers, the so-called core area of the digital economy, are especially important for Berlin. Since 2008, almost three times as many jobs have been created in this core area (+46,779) as in the strong growth market of e-commerce (+16,952). This core area is extremely important and not just in Berlin. The products and services produced here are needed in many sectors of the economy throughout the world.



In Germany, 809,974 people are currently employed as software developers and service providers in the core area of the digital economy. When compared to other major German cities, Berlin is also particularly dynamic in this area which accounts for the highest number of jobs in Berlin (71,719). This corresponds to 8.9% of all employees in this sector in Germany. A total of around one third of all German software developers (around 283,000) work in the nine major cities surveyed.

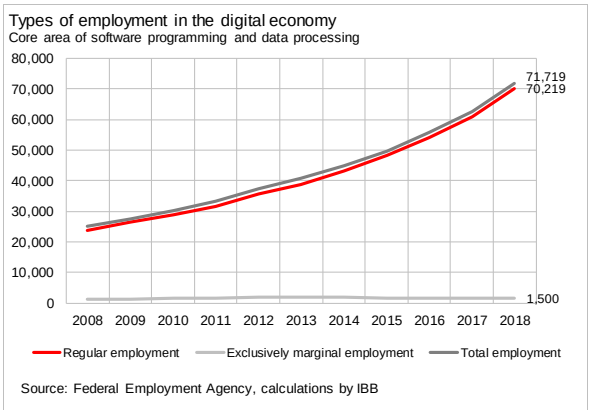


The number of employees in the core area of the digital economy in Berlin is increasing at an average rate of 11.1% annually. Neither Munich (+8.7%), Dresden (+8.0%) nor Frankfurt (+7.6%) recorded such high employment growth.



The digital economy needs more programmers

The jobs created in the software and data services sector are mainly regular jobs, accounting for 97.9% of jobs here (70,219). In the area of software and data services, the number of jobs has risen by an average of 11.5% annually since 2008. By contrast, the increase in marginal employment is of secondary importance (+1.4% p.a.). Due to strong growth in this sector, companies are continuously on the lookout for programmers, database specialists and web designers.

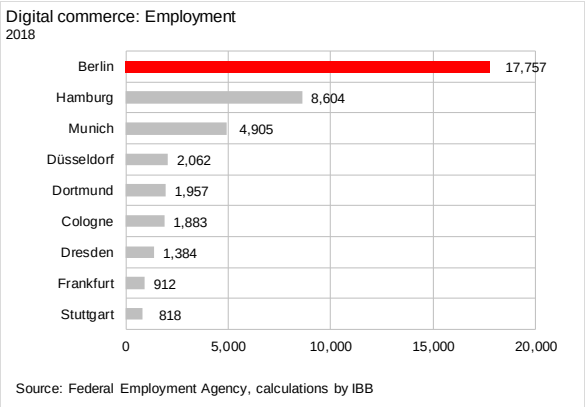


However, the influx of young professionals being drawn to Berlin from all over the world is no longer sufficient to satisfy demand for qualified specialists. Potential applicants are being offered good working conditions and high salaries. Compared to other sectors in Berlin, gross salaries offered in this sector in 2018 were well above average totalling around EUR 4,750 (Berlin: EUR 3,400).

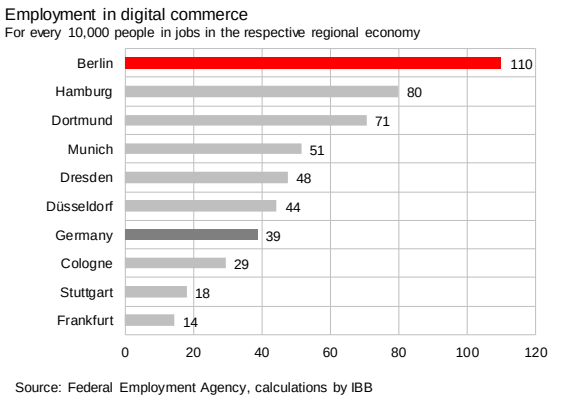
The software and data services sector is not just the backbone of Berlin's digital economy, it has also become extremely important for many other sectors in Berlin. This is where the technological know-how of the much-publicised digital transformation can be found, a transformation that is moving ahead rapidly in industry and in many areas of the economy. In recent years, both employment and labour productivity have risen steeply. Since this sector is extremely knowledge-based, it can be assumed that the value added share will continue to be above-average.

3. E-commerce concentrated in Berlin

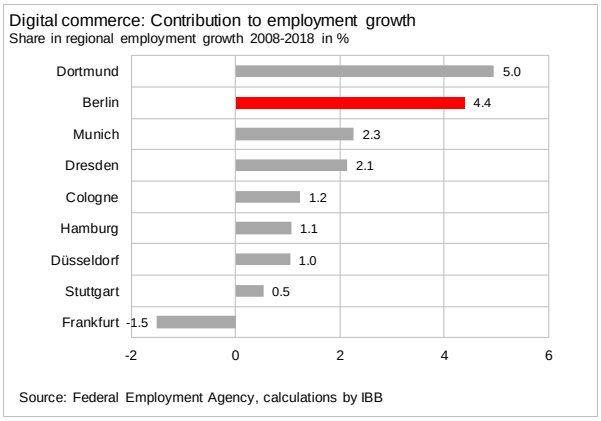
Over the last decade, Berlin has undergone structural change. Although the number of people employed in the hardware and infrastructure sub-sector in Berlin has fallen by almost 5,700 since 2008, the decline in this sub-sector has been more than compensated for by strong growth in e-commerce, where three times as many new jobs were created in the same period. There are currently a good 17,800 people working at around 1,000 e-commerce companies in Berlin, with around 145,000 people in total working in this sub-sector in Germany. In terms of Germany as a whole, every 8th job in e-commerce is located in Berlin (12.2%).



Today, more people work in e-commerce in Berlin than in Hamburg (8,604), Munich (4,905), Cologne (1,883), Dresden (1,384) and Frankfurt (912) combined.



Even when adjusted for size, ecommerce can still be seen to be concentrated in Berlin which comes out on top among major German cities. For every 10,000 people employed in Berlin, 110 work in ecommerce.



Only Dortmund has developed at an even faster rate than Berlin over the past ten years. Since 2008, 5% of all jobs in the ecommerce sector were created here, compared to 4.4% in Berlin.

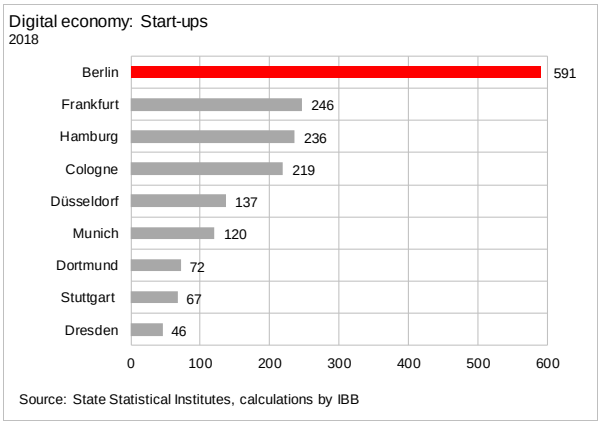
Ecommerce becoming more international

Developments in e-commerce are now having an effect on other areas of Berlin's economy. In 2018, exports to Italy, Berlin's fourth most important export country, increased significantly (up by EUR 42.3m to EUR 790m). A good one third of the increase in exports can be attributed to strong growth in shoes and clothing (up by EUR 14.8m). Berlin's ecommerce companies have been active in Italy for several years and have several logistics centres of their own there.

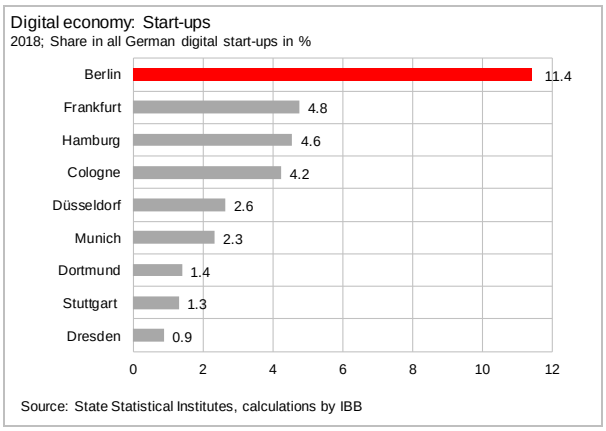
Start-ups

One new digital company every 15 hours

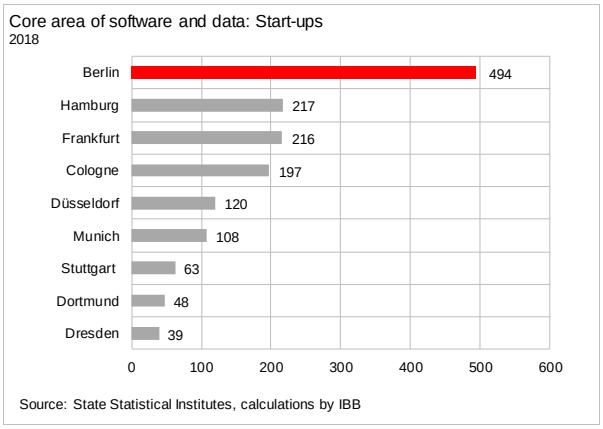
Berlin's ecosystem of investors, banks, business angels and entrepreneurs has made a name for itself internationally, with a particularly high number of start-ups in the digital economy.



In 2018, 591 new digital companies were launched in Berlin. This means that on average one new digital company is set up every 15 hours in the German capital. These companies are so-called business start-ups, i.e. corporations, such as limited liability companies, stock corporations or limited partnerships. Unlike simple business registrations, companies like these can be assumed to be of greater economic importance as soon as they are set up due to the high costs involved in their registration. The new companies being set up in Berlin's digital economy are largely headquarters, just 21% of these are branches.

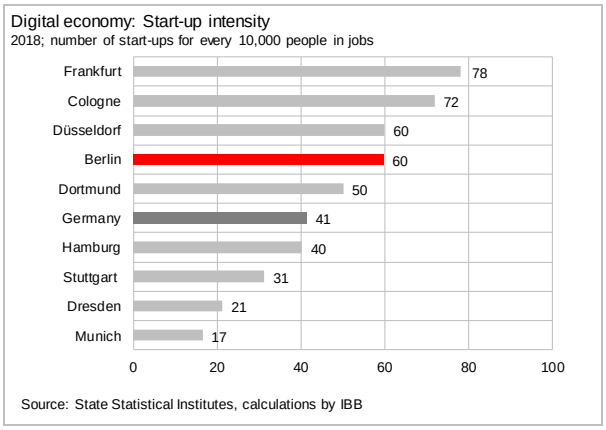


In a comparison of cities across Germany, digital start-ups in Berlin come out on top with more than every 10th digital start-up in Germany being launched in Berlin (11.4%). The number of new companies being set up in the capital city is as high as in Hamburg, Cologne and Düsseldorf combined. In Munich, the number of start-ups is significantly lower at 120 (2.3%).



With 494 start-ups – in absolute terms – Berlin is also the leading major German city when it comes to the technologically innovative core area of software and data services – far ahead of Hamburg (217 start-ups), Frankfurt (216) and Cologne (197).

However, when digital start-ups are related to employees in this sector, Berlin only comes fourth. Frankfurt, Cologne and Düsseldorf recorded a higher number of digital start-ups.



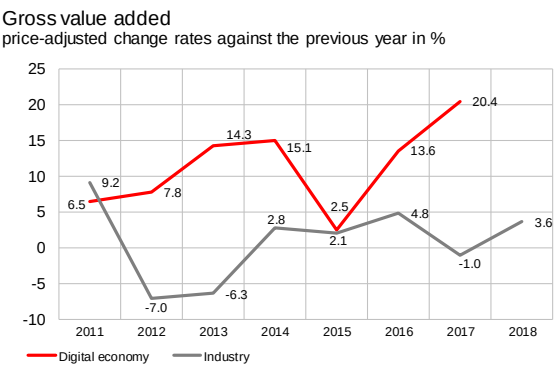
Focus on the digital transformation of industry

Industry benefits from the digital transformation

Berlin is a winner when it comes to economic transformation as a result of digitalisation. The boost in productivity brought about by the digital transformation along with the growing digital proximity to other international business centres will fundamentally transform the face of work in many sectors and this applies also to industry in Berlin.

In a highly globalised environment, industry must also go digital if it is to remain competitive. This applies especially to the digitalisation of production – the keyword here being Industry 4.0. Setting up and operating B2B online solutions as well as services to digitise business processes are increasingly in demand in the finance sector. The solutions often come from external companies and service providers (B2B solutions). These interdependencies between industry and the digital economy in Berlin will be examined in more detail in the following section and Berlin's prospects as a centre for industry and the digital economy Berlin will be explored.

The digital economy as defined here includes parts of industrial production. Industrial companies in the hardware and infrastructure sector provide the infrastructure needed to transmit and reproduce content and services. These include industrial companies from the higher-level area of production of data processing equipment and electronic and optical products. Digitalisation is also often 'outsourced' by industrial companies to companies working in business-related services sector. This means that Berlin's digital economy and its industry are becoming increasingly intertwined.



Source: : Federal Employment Agency, State Statistical Institutes, calculations by IBB

According to KfW's Digitalisation Report on Small and Medium-sized Enterprises (*Digitalisierungsbericht Mittelstand*), SMEs in Germany are primarily digitising interfaces within the value chain and with the end customer. This includes, for example, the redesign of websites as well as online ordering and payment systems, also for suppliers. In addition, the sale of industrial goods and production machinery is usually linked to a service package with an online service, e.g. remote maintenance. This requires in particular software and data services. All in all, the renewal of IT structures and the acquisition of new applications are the second most important reason for digitalisation in industry.

More digitalisation in industry than in Berlin's overall economy

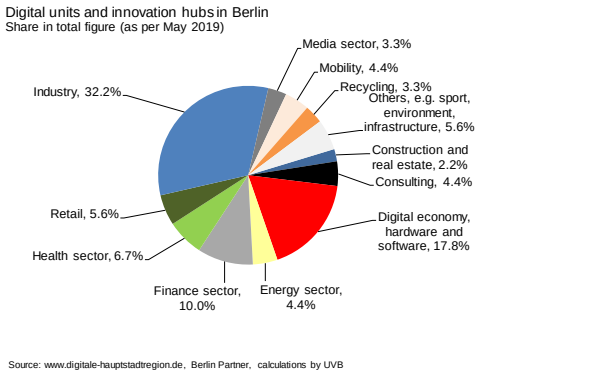
The proportion of companies pursuing digitalisation projects is higher among Berlin's industrial companies than in the regional economy as a whole. This is shown by a survey conducted by KfW and UVB and is related to the fact that the intensity of research and innovation in regional industry is higher than the average for the economy as a whole. According to the 2018 Innovation Survey by Technologie Stiftung, the innovation intensities (share of innovation expenditure in sales) in the industrial sectors are high compared to other sectors: In Berlin's industry, innovation intensity is just under 6%, however, in the services sector it is just under 3%. The main reason for digitalisation projects in regional industry is an expected efficiency gain both in production and between the business areas. The demands of end customers for digital products and services are very important for industry. As digitalisation increases, this aspect will boost competitive pressure on the market in the future.

In addition, the SME Report 2019 by Creditreform and the IBB for Berlin shows that industrial companies are already implementing plans and projects for digitalisation measures. According to the special 'Industry' survey, a good fifth of industrial companies are very satisfied with Berlin as a business location and more than two thirds are at least satisfied. For 64% of industrial companies, digitalisation is important or very important, in mechanical engineering, this figure is as high as 90%. At over 59%, the share of industrial companies that already have plans for in-house digitalisation measures is particularly high compared to other sectors. Here, too, this share in mechanical engineering is above average (73%).

The main reason for digitalisation is to increase competitiveness (66%) and reduce costs (55%). If companies have not yet addressed digitalisation measures, this is mainly due to a lack of time (40%). On the other hand, there seems to be a sufficient supply of funding with only 9% of companies complaining of a shortage. For most companies, in-house research or the market introduction of new technologies initially seem too ambitious. This role can therefore be taken on by specialist start-ups that are keen to take risks. After market introduction, however, new technologies become interesting for industrial companies. For example, 60% of companies would like advice and financial support in order to use technologies that are already available.

The innovative environment is fuelling the digitalisation of industry

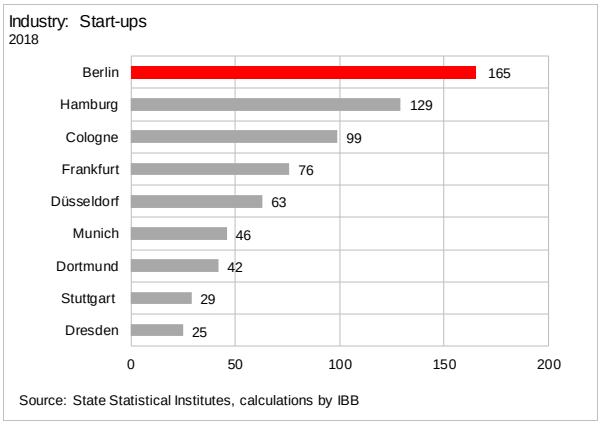
Berlin is home to a large number of hubs, labs, accelerators and incubators. Product and process innovations are emerging at the interfaces between industry and the digital economy.



Almost a third of the digital units and innovation hubs in Berlin are directly initiated by industry. These are predominantly established operational units where innovative digital business models are designed and implemented outside the company's existing structures. These include companies such as BMW Start-up Garage, Daimler Center for Automotive Information Technology Innovations (DCAITI), Schleicher Incubator Zoom Zone Labs (sizzl) and Würth Elektronik eiSos Competence Center.

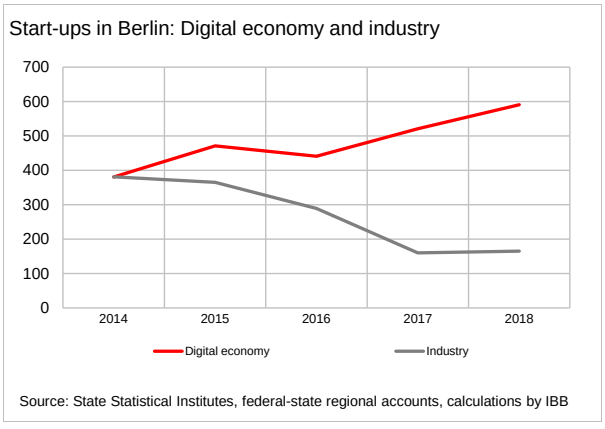
In the digital economy, hardware and software services account for 18%, i.e. the second-largest share, of the hubs recorded to date in Berlin. Examples include Deutsche Telekom (hub:raum), Mozilla WebFWD and IBM Startup Program. The financial sector is in third place with a share of around 10%. In response to competitive pressure from numerous Fintech companies, the banking sector is increasingly aligning its digital offering to customer needs, e.g. with apps or digital financing portals for both private and business customers.

Berlin's start-ups are digitalising industry



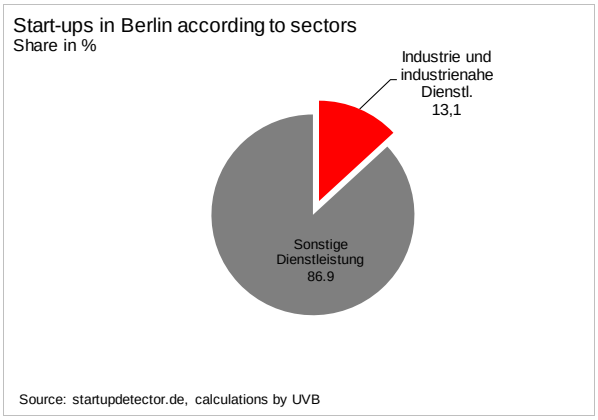
Industry in Berlin is closely linked to other sectors like company-related services. Berlin's industry – defined as manufacturing – is particularly dynamic compared to other cities and, with 165 start-ups in 2018, is the leader.

The fact that Berlin attracts founders also has an effect on industry. Although the number of start-ups within Berlin's industry has been declining since 2014, some of the start-ups in the digital economy do in fact specialise in improving production processes and product developments in industry.



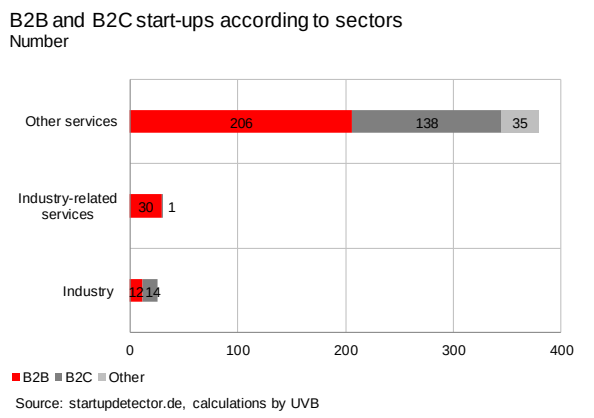
According to calculations in line with the statistics of branch affiliation for the digital economy, 591 digital start-ups were launched in Berlin in 2018. The 'Start-ups' overview from Startupdetector.de offers a further demarcation. Of the total of 9,481 start-ups in Berlin in 2018, 447 are classified here as 'start-ups', which means innovative or companies that are highly likely to grow fast.

Despite a slightly different definition, the two variables are comparable and the areas in which many start-ups operate correspond in content to IBB's definition of the digital economy.



In the following, Berlin's 'start-ups' 2018 will be examined at micro level. This allows a more in-depth analysis of their profiles, as more extensive data is available at micro level than at the level of official trade registrations, which only work with a few characteristics, such as sectors and number of employees. This data also highlights the close links between industry and the digital economy.

Of the 447 start-ups established in Berlin in 2018, 26% or 5.9% can be directly attributed to industry. A further 32 or 7.2% offer industry-related services. The vast majority, almost 87%, were established in the services sector. In this area, too, services are used by industry, especially for digitalisation.



What is striking is the enormous importance of 'Business-to-Business' (B2B) models for industrial start-ups, which now account for half of all start-ups. This business model is naturally predominant in start-ups that offer industry-related services. That being said, they also account for a good half of other services. Berlin's start-ups are thus moving towards the digital transformation of business processes and supplier interfaces, a development that is likely to become important nationwide.

Digital technologies for improved industrial competitiveness

Digitally connected and automated process chains are essential elements of Industry 4.0. The idea behind a 'smart factory' is that production plants organise themselves to a large extent independently and coordinate processes among themselves. This makes production more flexible, dynamic and efficient.
Four important technology trends can be identified:

- Artificial intelligence (AI)
- Virtual Reality, Augmented Reality
- Additive manufacturing (AM)
- Industrial Internet Of Things (IIOT)

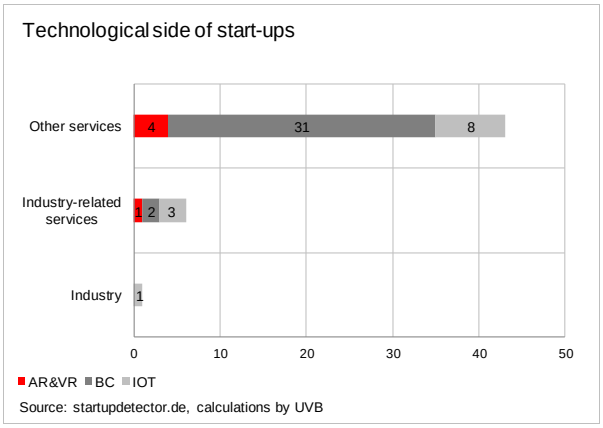
Companies working in the development of artificial intelligence (AI) will play a major role in the future development of this. According to a study by Technologie Stiftung Berlin, 223 companies in the capital region with 4,900 employees are already involved in this subject. This means that around 28% of all German AI companies are located in the Berlin-Brandenburg region. In addition, a nationwide comparison shows that between 2012 and 2017 48% of AI start-ups were founded in Berlin-Brandenburg. Around 80% of AI companies are active in the business-to-business sector.

Powerful hardware components, sensors, image processing systems and state-of-the-art software enable the use of Augmented Reality (AR) and Virtual Reality (VR) in industry. In addition to industrial use, VR technology can also be used for educational and training purposes or for product presentations. AR technology is now being

used in flight simulators, game systems, medicine, biochemistry and robotics.

In the case of Additive Manufacturing (AM), objects are developed layer by layer from a layered CAD model to create precision solutions. In Berlin's industry, this is mainly used to build prototypes because they can respond quickly to customer requests and changes.

Siemens, for instance, a pioneer in this field, uses the technology for rapid prototyping of gas turbine elements. In the Industrial Internet of Things (IIoT), Industry 4.0 and the Internet of Things (IoT) are merging. While the goal of digitalisation in industry is mainly to increase efficiency in the production process, the concept of IoT is geared to the end customer and focuses on optimising usage paths. According to Technologie Stiftung, 75 IoT organisations are located in Berlin, almost one third of Germany's total 268 IoT organisations. At the same time, the majority of IoT start-ups by far are located in the capital.



In Berlin, the concept of the Internet of Things is to be found particularly in service start-ups, whose products are also in demand by industrial companies. After all, the processes of three start-ups are directly rooted in industrial production. There are also a number of pioneer start-ups in Augmented Reality (AR). The blockchain approach (BC) is also widely to be found. This focuses on decentralised data storage and is used by Fintechs who account for almost 10 percent of start-ups established in 2018 in Berlin.

Close links between the digital economy and industry

All in all, the links between the digital economy and industry can be presently summarised as follows:

- Almost a third of the digital units and innovation hubs in Berlin are from industry.
- 13% of start-ups in Berlin belong to industry or industry-related service providers.
- 19% of IOT applications in Berlin are directly destined for production.
- 43% of the AI companies in Berlin-Brandenburg, for instance, develop AR applications for industrial plants and smart maintenance and process management systems.[1]
- 32% of additive processes in Berlin are used in mechanical engineering. The electrical engineering industry and vehicle construction are further areas of application.[2]

[1] IOT in Berlin, AI in Berlin and Brandenburg, Technologiestiftung

[2] Potential Analysis of 3D Printing, Senate Department for Economics, Energy and Public Enterprises (*Senatsverwaltung für Wirtschaft, Energie und Betriebe)*

Conclusion

Berlin is and will continue to be Germany's most important centre of the digital economy. The city has gained this position thanks to its unique start-up ecosystem that is also drawing international skilled professionals, VC investors and the innovation departments of large corporations to this major city on the banks of the river Spree. Berlin has benefited enormously from growth in digital commerce to date, but the recent shift to B2B has gained considerable momentum.

Other sectors have already embarked into the world of digitalisation. This is particularly visible in Berlin's industrial sector. Simple processes are being automated and new digital distribution channels and products have opened up. Industry not only demands digital products and services, its digital units and innovation hubs are also a driving force behind the digital economy. In Berlin, the future areas of energy, transport and health are excellently positioned. But in the years to come, the companies in these industries will also have to find solutions to some of the most urgent social challenges, such as the shortage of finite resources, environmentally friendly mobility and an ageing society.

The digital economy in Germany's capital city now provides jobs for close to 98,900 people. The core area of the digital economy – software and data services currently employing 72,000 people – will continue to be the heart of Berlin's digital economy in the future.

For industry, digitalisation is about merging IT technologies with production technologies and offering services for new, innovative products. This poses huge challenges in terms of data security, technical standards and a modern legal framework. In addition, there are investments in research, training and further education and the important question of new business and working time models. To achieve this, it is essential that the conditions at the production site remain competitive at all times.

Berlin is an important scientific hub with a multitude of universities and research institutes, which are home to clever minds and know-how for the future. In the future, Berlin must ensure that the city remains affordable for young people. All in all, Berlin is in a good position to assume a leading role as a location for the digital transformation of the economy in the years and decades to come. As a major centre for services, both customer and business services, Berlin is already prepared for the transformation of the economy from a product to a service society because Berlin was quick to understand the structural change taking place in traditional industry.

Berlin's technology-orientated key sectors, such as transport, mobility and logistics, as well as energy and the health sector, are likely to benefit in the interim from this development. Since these changes in the working world will come about even faster than in the past, life-long learning will have to be promoted both within and outside of companies.

Published by:
Investitionsbank Berlin
Economics
Bundesallee 210
10719 Berlin, Germany

Authors:
Claus Pretzell, IBB
Sarah Kopp, IBB
Klaus Jeske, UVB

Publishing date: September 2019

Other publications available at:
www.ibb.de/volkswirtschaft