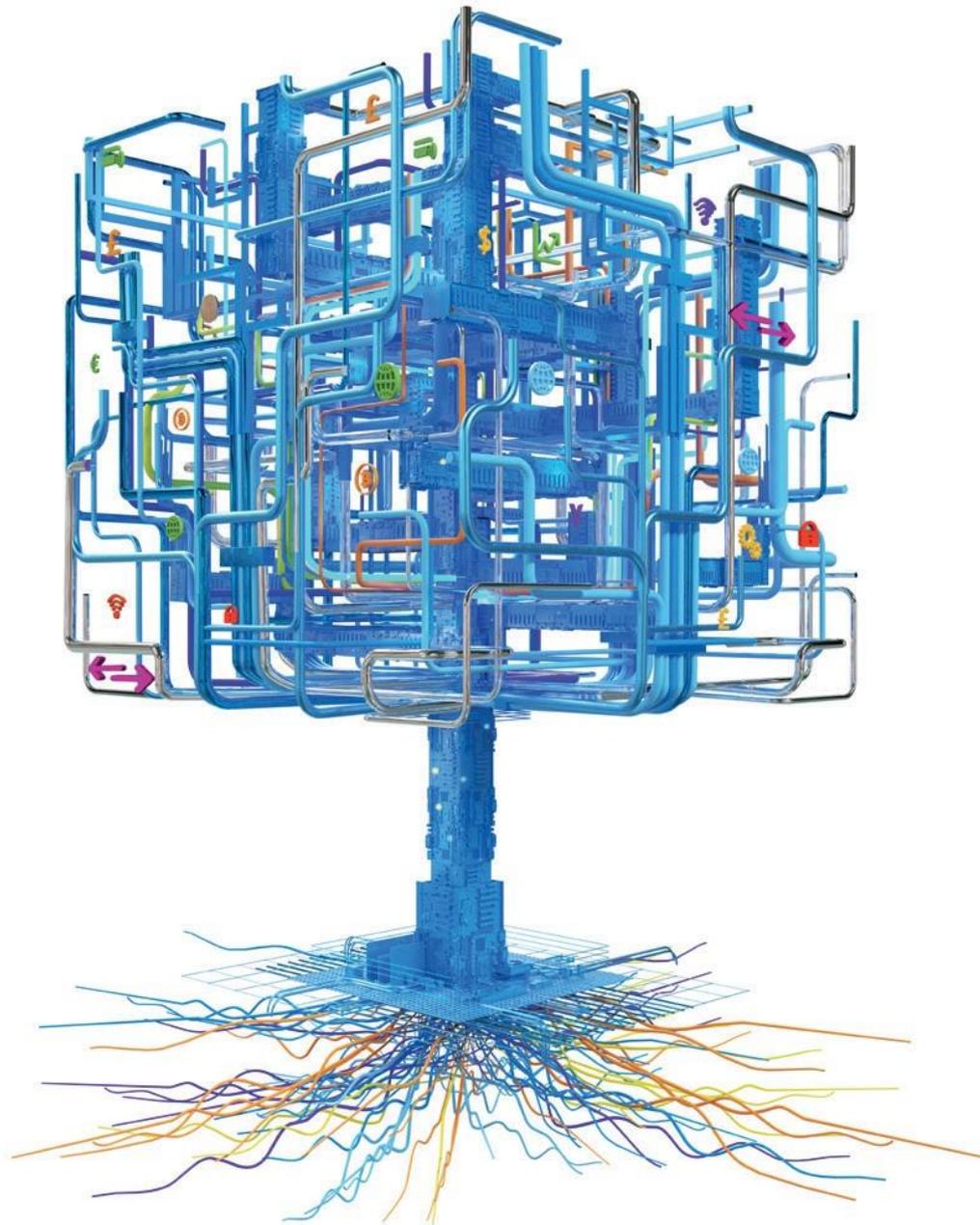




DIGITAL REALTY
Powering your digital ambitions

Digital Capitals London Report

2019



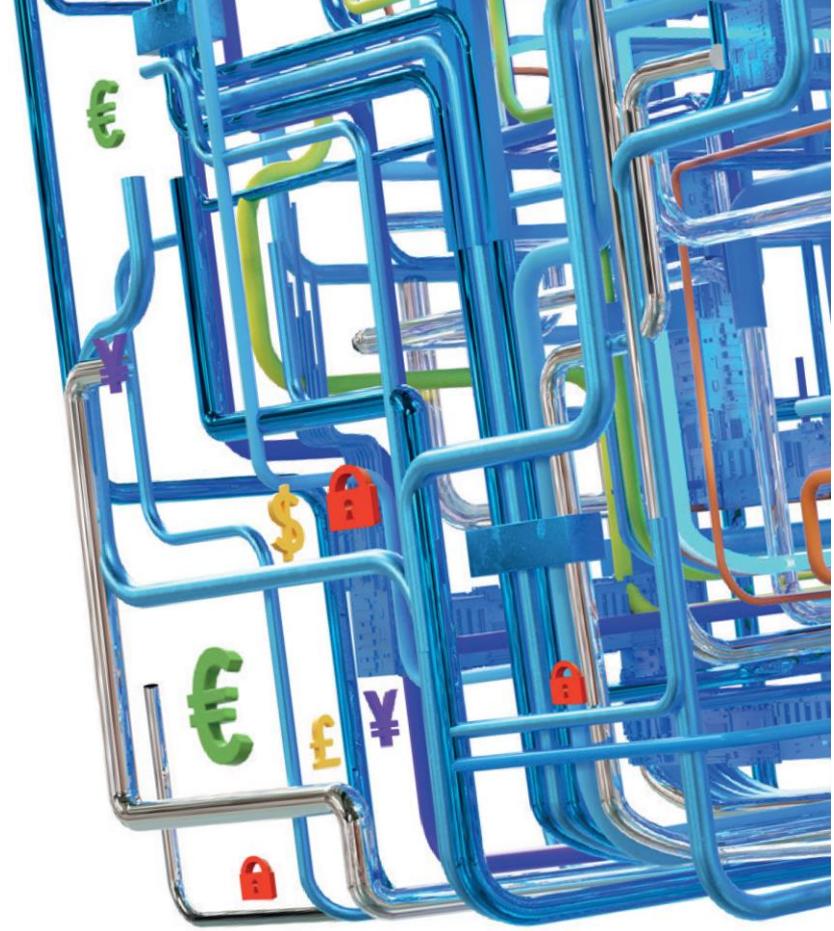


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01

Introduction



The creation and sharing of data is central to both economic and social activity. However, in recent decades there has been an enormous increase in the rate at which data is created, stored and used for commercial purposes, and for other uses such as in healthcare and entertainment.

The rate at which data is being created continues to grow at astounding rates. According to recent estimates, growth in data generation is expected to increase at over 60% per annum over the next 5-6 years, driven by data-intensive technologies in business, government and in the home. The growth in data is also expected to be further stimulated by new or evolving data-intensive technologies such as Artificial Intelligence (AI) and the fifth generation of mobile communications technology (5G).

The economic contribution of digital information has previously been termed the data economy¹; this is the financial and economic value generated by the creation, storage, retrieval and use of highly-detailed business and organisational data at high speeds. The economic contribution of the data economy to national economies has been previously examined in an earlier study also commissioned by Digital Realty (dating from 2018), which focused on the current and potential future size and value of the digital economy in a number of European countries.

The world's leading cities are major hubs for the data economy because they typically have very high densities of commercial activity stimulated by data and digital technologies. This leading role is linked to the concentrations of knowledge-intensive and data-fuelled industries, such as financial services, professional services, and media and communications. Of course, the largest cities are also very often the location for command and control functions for governments, major corporations and other entities.

The leading cities – the digital capitals – also possess some of the world's richest digital skills resources, research and development (R&D) assets and digital and supporting infrastructures that make it easier for entrepreneurs and skilled workers to share ideas, collaborate and develop new forms of technology and applications.

To explore the status of London as one of the world's Digital Capitals, Digital Realty has commissioned a new report that quantifies the current and assesses the potential future contribution - over the decade to 2029 - to the data economy of four specific digital technologies: AI; Blockchain; the IoT; and 5G.



02

Main Drivers

There has been a huge increase in data generation over the past decade, driven by advances in digital technology which have led to the proliferation of connected devices and sensors in both business and household situations. The growth in the rate at which data is being generated currently shows no signs of diminishing, driven by an increasing range of industrial, government and consumer applications. The amount of data generated each day is expected to be further boosted as new technologies such as virtual reality and autonomous vehicles are introduced and become widespread in their usage.

Various predictions of the scale of data generation are available, all of which anticipate continued huge increases in the volume of data production. For example, IDC in 2018 predicted that there is likely to be a world-wide annual growth rate for data generation of 61% p.a. up to 2025².

This global growth is being driven by ever larger numbers of people being connected to digital devices for an increasingly large number of uses and applications. However, it is expected that the creation of data by businesses will become even more important than that by consumers as the number of sensors and devices in industrial, commercial, infrastructure, healthcare, transportation and many other situations increases exponentially.

The continuing increase in the generation and sharing of data is being further boosted by the emergence and development of four inter-linked digital technologies: AI, IoT, Blockchain and 5G.

03

Digital Capital: London

As a digital capital, London currently performs well when factors such as size of economy, human capital, digital infrastructure, data openness and the attractiveness of the business environment are all taken into consideration.

However, as highlighted in the Data Capitals Index, the comparative ranking of London is expected to fall between 2019 and 2024, from 4th to 6th overall. This deterioration is due in part to an expected short-to-medium term disruption to growth influenced in part by the UK's decision to leave the EU and the European single market.

There are also uncertainties linked to the ability of London to continue to attract business investment across a range of sectors – such as digital media and financial services – that are intensive users of digital technologies.

There is also a potential danger of the UK being perceived as a less welcoming place to attract world-class international talent. This is a particular challenge for the UK as it faces a chronic shortage of highly skilled workers, including those in computer science and data analytics³. The UK has in recent years relied to a significant extent on inward migration of workers with high levels of qualifications in these areas. Moreover, there is also a danger of some types of business activity, such as in financial services and headquarters functions (across a range of sectors) deciding to relocate activities to other European centres such as Amsterdam, Dublin, and Paris.

Over the period from 2024 to 2029, it is assumed that the UK's political situation will stabilise and that by 2024 the UK will have established new trading relationships with all of its main trading partners, including the EU. It also assumes that the UK will have established new mechanisms to attract and retain international talent, including those with computing, data and other skills necessary for the continued development of the data economy.

04

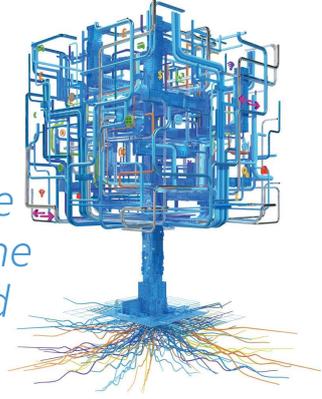
Value of AI, IoT, Blockchain & 5G to the London Economy, 2019

A key part of the growth of London as a Digital Capital that we'll see in the next decade will result from a set of data intensive, interconnected technologies such as AI, IoT, Blockchain and 5G. With that in mind, we also examined economic contributions of these four high-potential, data-led technologies to understand how well London's data economy is adapting for the technologies of tomorrow.

The contribution of the four digital technologies to the London economy in 2019 is estimated to be worth £6.25 billion, with IoT contributing £3.09 billion (49% of the total) and AI contributing a further £1.99 billion (32%). A further 17% of value is contributed by Blockchain, with 5G being the newest technology at 2%.

As a proportion of the overall city economy, the four technologies in aggregate are currently estimated to

“As a proportion of the overall city economy, the AI, IoT, Blockchain and 5G in aggregate are currently estimated to contribute £6.25 billion to the overall economy of the London, which amounts to an estimated 1.76% of the city's overall economy.”



contribute £6.25 billion to the overall economy of London, which amounts to an estimated 1.76% of the city's overall economy.

In terms of international rankings, London is ranked 5th on three of the technologies, with the exception being Blockchain where it is ranked 6th. Given that the city currently ranks 4th overall in the overall data capital ranking, London appears to be failing to convert all of its data capital advantages into economic value.

The main constraint on growth for London appears to be a chronic shortage of skills related to digital technology. However, the uncertainty over Brexit and future trading relationships may have contributed to a hesitation by some businesses to innovate in technology, resulting in some under-performance on the part of London.

However, there is also a widely recognised economic issue⁴ in the UK with respect to lagging productivity performance, which is, in part, linked to a comparative reluctance of UK businesses to invest in new technology and may also be reflected in the comparative under-investment in technologies such as AI, IoT and Blockchain.

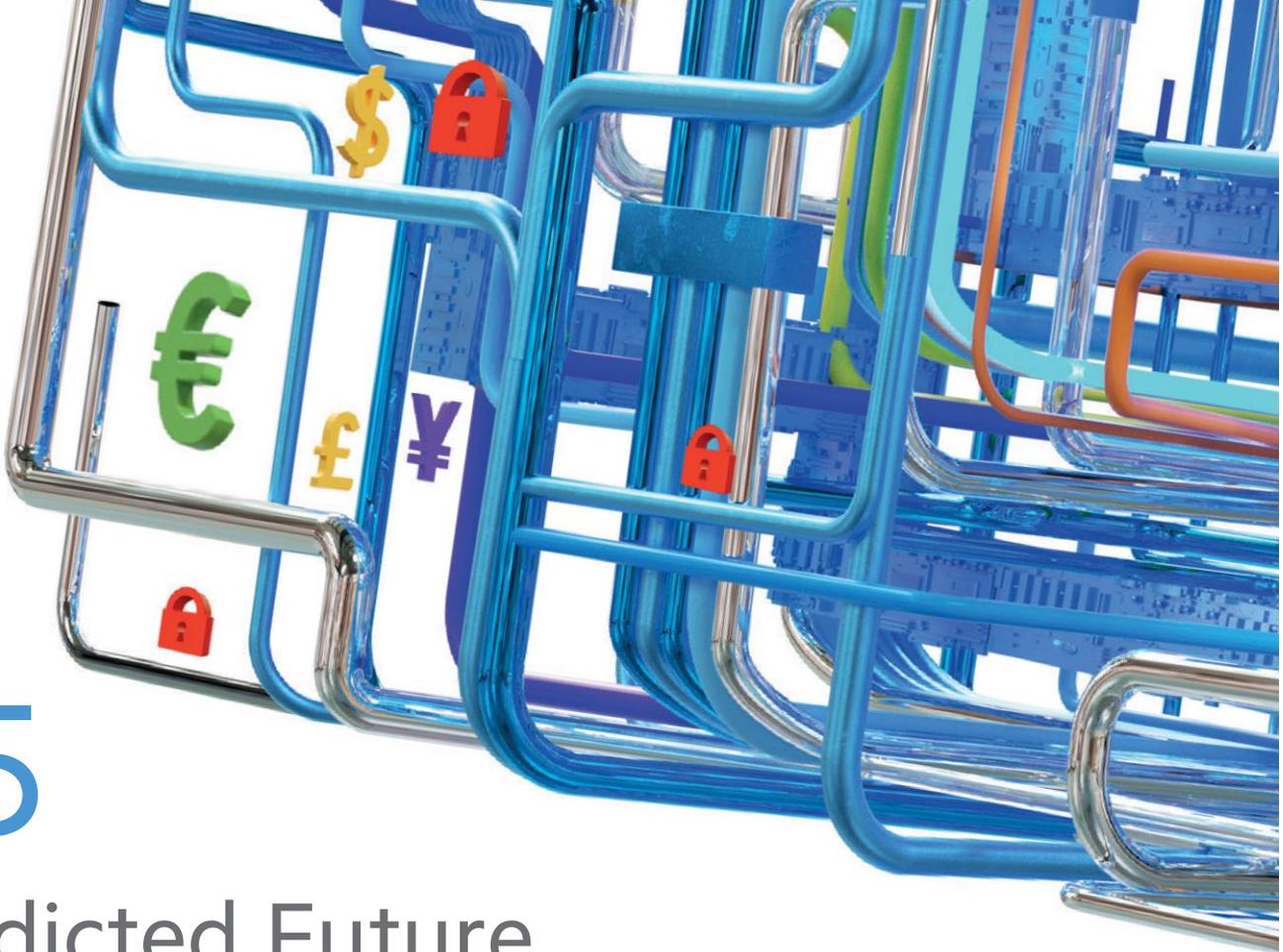
Technology	Annual value (in £ billions), 2019	% of overall city economy, 2019
AI	1.99	0.56%
Blockchain	1.04	0.29%
IoT	3.09	0.87%
5G	0.13	0.04%
Total	6.25⁵	1.76%

Table 1: London - Estimated value of four digital technologies: 2019 (£ billions, 2019 prices)

⁵

⁴ <https://www.ft.com/content/6ada0002-9a57-11e8-9702-5946bae86e6d>

⁵ Note: table column totals may not sum exactly due to rounding of decimals



05

Predicted Future Value: 2024

By 2024, the value of the four technologies to the annual value of London's economy is expected to have grown to £13.96 billion per annum (p.a.). This represents growth of £7.71 billion compared to 2019, which translates into predicted growth of 123%. By 2024 the four technologies are expected to contribute 3.39% to the city's overall economy, up from 1.76% in 2019.

In absolute terms, the largest component of growth is expected to be from AI: this segment is expected to contribute £5.79 billion p.a. by 2024, compared to £1.99 billion p.a. in 2019, representing an annual increment in value amounting to £3.80 billion p.a. (which is a proportionate increase of 191%).

However, the most spectacular growth – in proportionate terms – is expected to come from 5G, with real growth in annual value of 930%. This is because while 5G is currently a newly emerging technology, by 2024 the use of 5G is expected to be widespread among both consumers and businesses.

With respect to international rankings, London is expected to be ranked 6th across all four technologies. This expected deterioration is linked to both indigenous factors (e.g. the reluctance of businesses to invest and the threat of relocation of some high order functions), with competitors such as Paris having the potential to improve its ranking at London's expense.

Technology	Annual value (in £ billions), 2024	% of overall city economy, 2024
AI	5.79	1.40%
Blockchain	1.97	0.48%
IoT	4.85	1.18%
5G	1.35	0.33%
Total	13.96⁶	3.39%

Table 2: London - Estimated value of four digital technologies: 2024 (£ billions, 2019 prices)

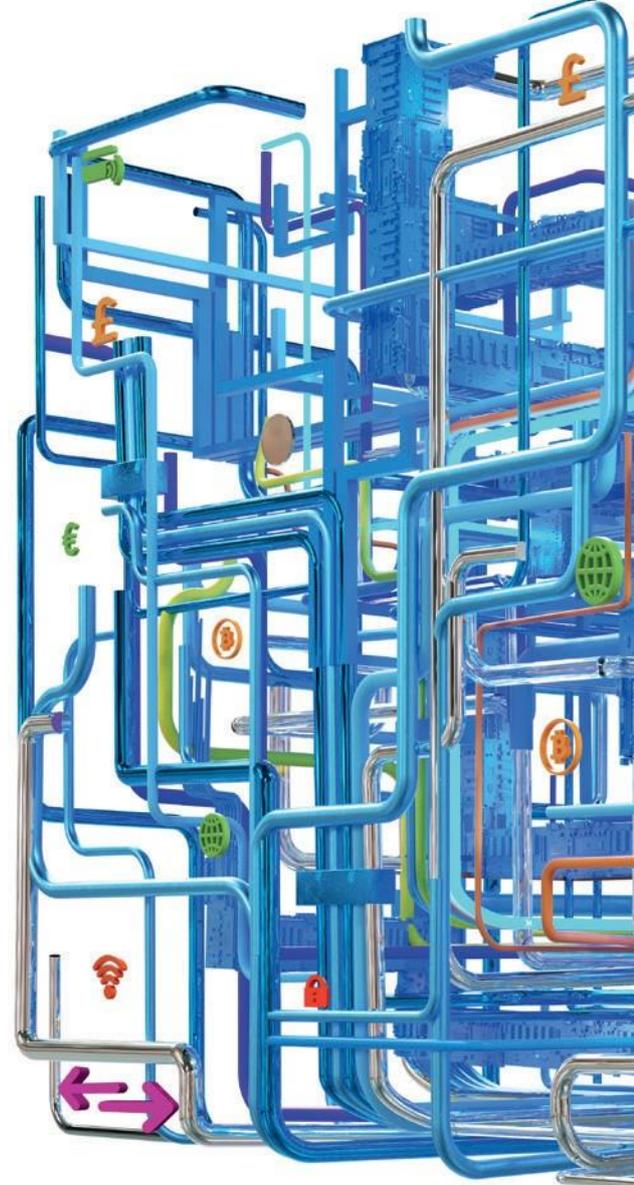
06

Predicted Future Value: 2029

The overall contribution in terms of value to London's economy of the four technologies by 2029 is expected to grow to £24.29 billion, representing an increase in real terms of £10.33 billion p.a. compared to 2024. The overall increase in annual value when the 2029 predicted values are compared to those for 2024 is expected to amount to 74%. By 2029, the contribution of the four technologies to the London economy is expected to increase from 3.39% in 2024 to 5.09% in 2029 (and from just 1.76% in 2019).

Compared to 2024, the largest component of growth is expected to be from AI, with an annual increase of £4.67 billion. However, the most significant change is the relative contribution of 5G, which is expected to provide an increase of £2.94 billion p.a. (i.e. an increase of 217% compared to 2024 levels).

Overall, in proportionate terms, AI is expected to provide 45% of the increase in annual value (when 2029 levels are compared to 2024 levels), with 5G providing a further 28%.

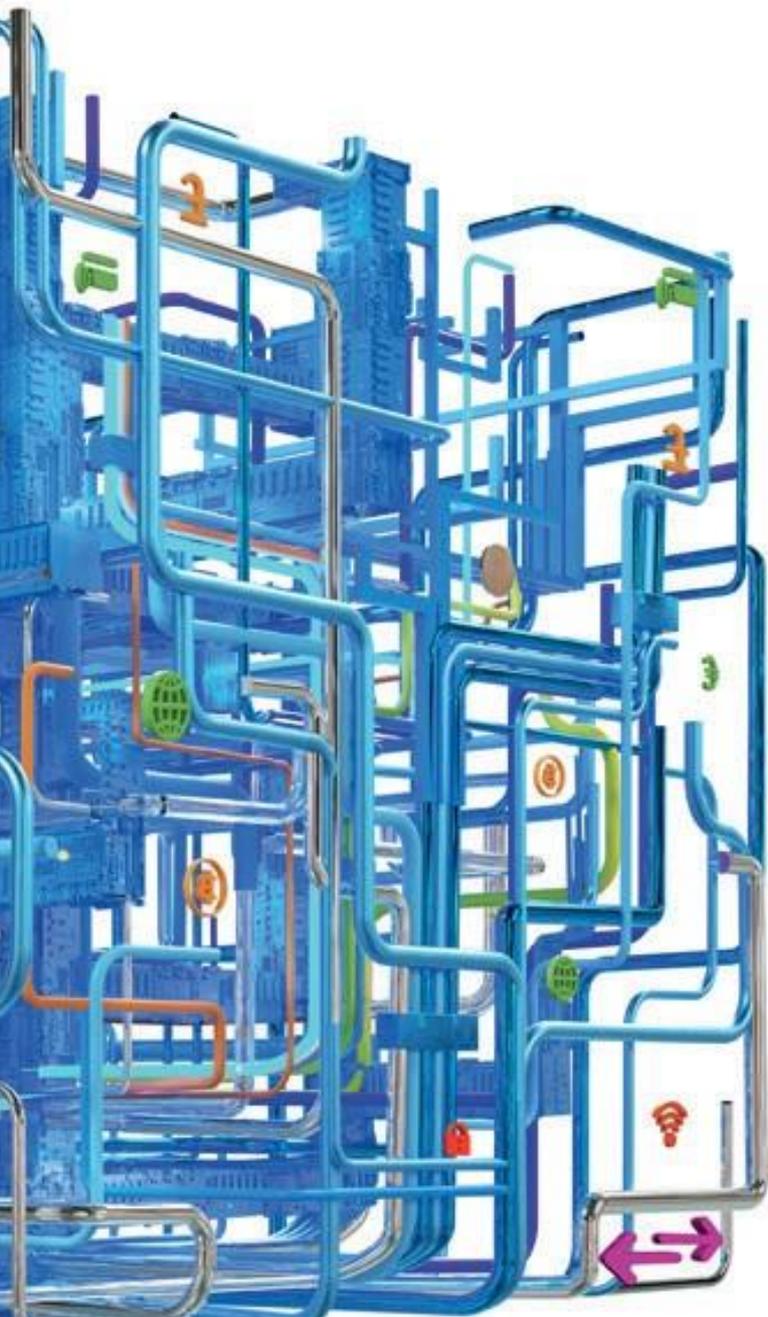


Technology	Annual value (in £ billions), 2029	% of overall city economy, 2029
AI	10.46	2.19%
Blockchain	3.09	0.65%
IoT	6.44	1.35%
5G	4.29	0.90%
Total	24.29 ⁷	5.09%

Table 3: London - Estimated value of four digital technologies: 2029 (£ billions, 2019 prices)

However, in terms of international rankings the overall performance of London in comparative terms is expected to deteriorate slightly, with London expected to slip from 6th to 7th on three of the four technologies. The exception is IoT where London is expected to slip backwards by two places, from 6th to 8th.

“The overall contribution in terms of value to London’s economy of the four technologies by 2029 is expected to grow to £24.29 billion, representing an increase in real terms of £10.33 billion p.a. compared to 2024.”



07

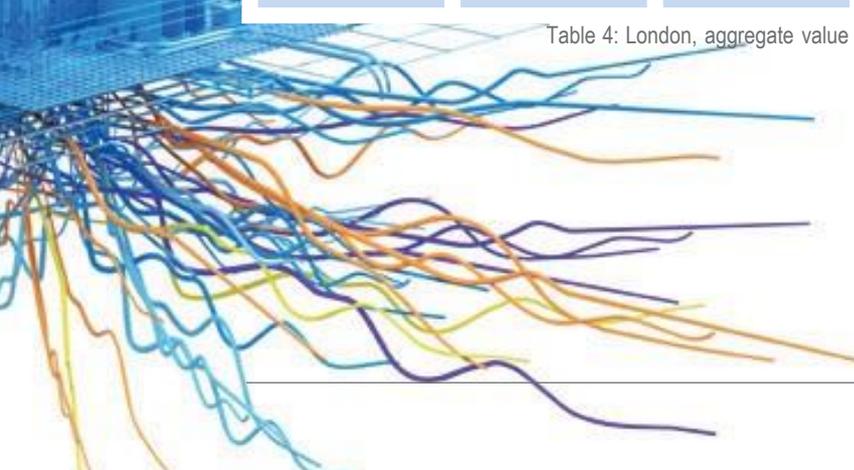
Overall Performance, 2019-2029

The overall expected situation with respect to the contribution of the four technologies is summarised in the table below.

Overall value is expected to increase from £6.25 billion in 2019 to £24.29 billion by 2029, with 47% of the overall increase expected to be contributed by AI, with 5G contributing a further 23%.

Technology	GVA 2019	GVA 2024	GVA 2029	Total increase in GVA: 2019-2029	% contribution to growth
AI	1.99	5.79	10.46	8.47	47.0%
Blockchain	1.04	1.97	3.09	2.05	11.4%
IoT	3.09	4.85	6.44	3.35	18.6%
5G	0.13	1.35	4.29	4.16	23%
Total	6.25	13.96	24.29⁸	18.03	100.0%

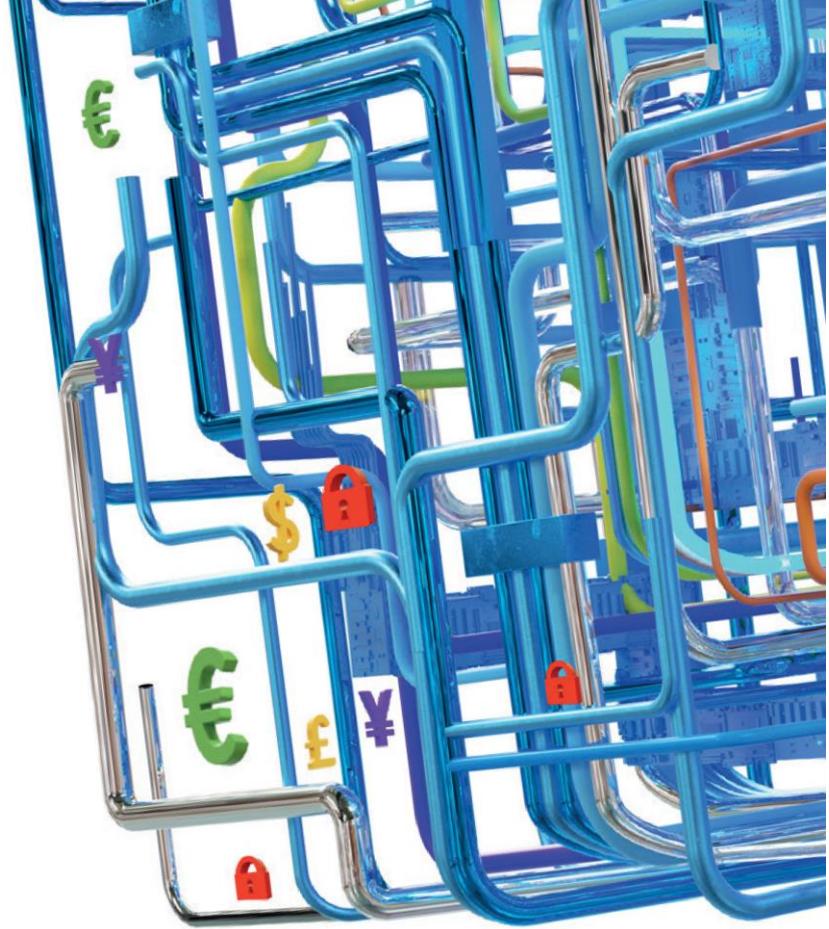
Table 4: London, aggregate value of technologies: 2019, 2024 & 2029 (£ billions, 2019 prices)



⁸ Note: table column totals may not sum exactly due to rounding of decimals

08

Conclusions



By any measure, London is a major growth engine and hub for the world's data economy.

However, London faces a number of challenges, some of which are linked to Brexit, including the potential for a slow-down in investment, the relocation of functions to competitor cities, and a potential constraint on its ability to attract and retain highly-skilled workers for its digital industries.

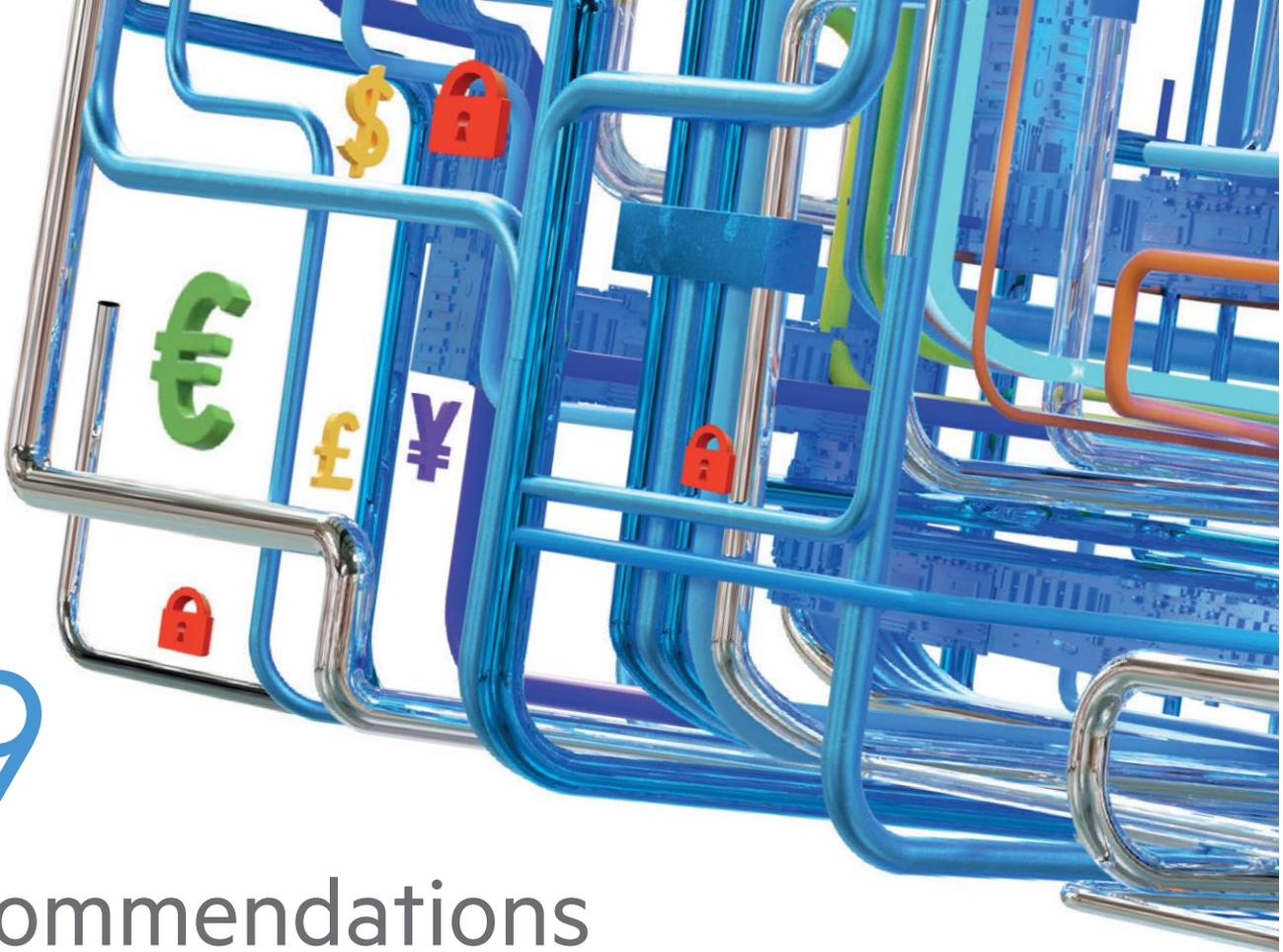
Overall, London is expected to lose two ranking places by 2024 with no further deterioration in ranking places by 2029. Moving from 5th in 2019 to 7th by 2029.

Looking at how well London is adapting to new data-led technologies, the potential is evident. The current annual contribution of AI, IoT, Blockchain and 5G to the London economy is estimated to be £6.25 billion in 2019, a value that is expected to increase massively, to £24.29 billion p.a. by 2029.

By 2029, these four technologies in combination are expected to contribute around 5.1% to the London economy, up from just under 1.8% in 2019. The greatest share of this growth (around 47%) is attributable to AI with a further 23% coming from 5G.

However, despite this spectacular growth, in comparative terms the annual value of the contribution from the four digital technologies is expected to grow less strongly than in some major competitor cities due to some of the unique challenges that London is facing as described above.

"It's essential that London and the businesses associated with it take all the right actions that, in spite of the current uncertainties, see this Digital Capital continue to invest in and take advantage of the new technologies that will help them thrive and grow."



09

Recommendations and Opportunities for Businesses

If businesses want to benefit from, and even help increase, the £24.29 billion p.a. that AI, IoT, Blockchain and 5G are estimated to contribute to the London economy by 2029, they need to start taking action today. The economies of digital capitals around the world will only continue to grow, albeit at different speeds depending on a number of factors such as economic and government stability.

It's essential that London and the businesses associated with it take all the right actions that, in spite of the current uncertainties, see this digital capital continue to invest in and take advantage of the new technologies that will help them thrive and grow.

Provided below are some recommendations that businesses should seriously consider if they are to remain competitive in this rapidly growing technological environment.

Take advantage of competitive digital platforms

There are unrealised opportunities for businesses that have not yet created adaptable technology platforms that, working with key partners, allow them to deploy each of these specialised technologies to gain competitive advantage:

- The four technologies explored are only growing in importance enabling businesses to create and gain intelligence from their data in ways that have never been achieved before.
- An adaptable technology platform will differentiate a business' agility by reducing the time to connect to partners, providers and markets using the latest technologies.
- This will enable companies to tailor their technology deployments at speed and to meet, and even exceed, their needs in an increasingly competitive environment.



Invest in talent

This report highlights one key area where investment is crucial: a skilled workforce. It is clear that cities and businesses should incubate and invest in technology talent to ensure they continue to have the skills to operate, deliver and capitalise on innovative technologies.

Major cities are vital in creating and hosting high value and innovative commercial activity through their role as locations for knowledge-driven business clusters. As a result, the high density of business networks in the city means the availability of talent and the presence of key infrastructure is also usually found in those places. With today's new technologies, this can very quickly lead to a major skills shortage and prevent businesses from being able to harness the power of their technology innovations.

Investing in digital apprenticeships and supporting college and university digital training programmes is essential to the future success of all digital capitals and especially in London.

Think urgently about your future technology strategy

Businesses should continuously invest in upgrading and expanding their technology strategies to stay ahead of business need:

- AI could add £10.46 billion per year to London by 2029, compared to just £1.99 billion today.
- Blockchain could add £3.09 billion to London by 2029, from £1.04 billion today.
- The business that is not ready to take advantage of these technologies is the one that is going to rapidly lose ground against its competitors.

Identify the partners, suppliers and key players that should be in your competitive ecosystem

Cities and businesses having technical networks that can be rapidly and seamlessly connected to a global digital ecosystem is vital to fostering innovation and enabling a wider, global connection.

There is good evidence that major cities like London will be increasingly important in creating and hosting high value and innovative commercial activity through their role as locations for knowledge-driven business clusters or ecosystems.

Ecosystems are geographically concentrated networks of interconnected companies and allied organisations (such as universities and research institutes; financial services corporates and suppliers) operating within a specific industry or sector.

Successful ecosystems are usually characterised by a high volume of interactions. For example, where companies work collaboratively to create competitive advantage, exchange ideas, develop innovative products or processes, and go onto to launch joint ventures, a competitive service or new businesses together.

“It is clear that cities and businesses should incubate and invest in technology talent to ensure they continue to have the skills to operate, deliver and capitalise on innovative technologies.”

10

Appendix

Approach to the study

Data economy rankings

As the first step in the research process of London's data economy, a desk-based review was undertaken of the evidence regarding the business benefits of digital technology. This review also identified potential sources of the latest available data covering London business and economic datasets.

Second, a set of potential digital economy indicators was proposed and agreed with Digital Realty. The 10 selected indicators covered the following:

1. The overall size of the city-level economy
2. The scale of activity of businesses operating in data-intensive business sectors plus the rate of adoption of digital technology among other businesses
3. The scale of consumer demand for data and digital applications
4. R&D: the presence of a leading university or universities in the city
5. The quality of telecommunications infrastructure
6. Human capital: the proportion of workforce with advanced data skills
7. The stability of the local political environment, levels of crime and other metrics of governance
8. Quality of life indicators, such as the quality of health, public education, the efficiency of public transport and environmental indicators
9. Support for the data sector such as through open data policies.
10. The quality of the environment for business (i.e. the ease of doing business, including for international companies).

Development Economics gathered quantitative data relevant to each family of indicators, as far as possible using single sources to facilitate consistent scoring and ranking on each indicator

Future predictions of the absolute and relative rankings for the data economy were also developed in the study. These were developed by harnessing information on – amongst other things – the expected trajectories of change with respect to the size and structure of the city's economy; demographic and labour market forecasts; expected trajectories of growth in digital adoption by both businesses and consumers; recent trends in performance of universities; and trends in digital infrastructure provision.

Contributions of the four technologies

Apart from ranking the current and potential contribution of London as a digital capital, the study also quantified the current and potential future economic contribution – in the form of GVA – of the four specific digital technologies – AI, IoT, Blockchain and 5G.

The approach taken to producing current estimates involved the gathering and analysis of information on the size, structure and productivity of the business sectors and workforces operating in the digital economy of London. The quantification of future predicted estimates of contributions harnessed a range of forecasts, both for the economy and labour market, but also the likely rates of adoption of each digital technology by the city's business base, its public sector and the householder population of the city.

Indicators and data sources

The information is constructed by gathering the most recent available data for 10 families of indicators of the current economic, business, demographic, infrastructure and other characteristics that influence the scale and level of participation in the modern digital economy. More details on each of the criteria and the indicators used are provided below:

Size of the economy

The first criteria used is a measure of the overall size of the city's total economy. This is measured in terms of the scale of economic output (GVA) produced by the city annually in terms of US Dollar and converted to GBP, with adjustments made to reflect productivity and local currencies using a purchasing power parity approach.

One challenge is that usually there are a variety of definitions available for the geographical and population coverage of any one city, such as the municipal area, the urban area or agglomeration, through to the wider urban area surrounding major cities. For London these choices include:

- Inner London
- The area corresponding to Greater London –which is the UK Government’s standard region of London
- A wider city-region area (also known as the primary urban area) which as well as the standard region also includes neighbouring or satellite towns such as Dartford, Watford and Woking

Here it was decided that the most appropriate for which consistent data was available corresponded to the ‘middle definition’ (i.e. the urban area/agglomeration).

Data on the human and business population in the city, plus the annual value of production per capita was then used to estimate the current annual value of economic activity taking place.

Business digital adoption and economy

This criterion is a blended indicator that considers several aspects that relate to the extent to which digital technologies are important to the economy of the city.

- First, the score considers the extent to which digital technologies have been adopted by all businesses and other employers (including government organisations) in the city.
- The second aspect that was covered is the estimated extent of the take-up by businesses and public agency users of the four digital technologies (AI, IoT, Blockchain and 5G) included in this study.
- The third aspect is the extent to which companies that are part of the supply chain for digital technologies are locally present in the city. This was taken into consideration through estimation of the annual value of delivery of digital technology services by supplying businesses located in the city.

Consumer demand for data

Having considered the supply side, the third indicator considers the demand for data on the part of the city’s urban population. This is based on the estimated annual per capita demand for digital data multiplied by the estimated size of the city’s population. The demand for data takes into account a number of sub-indicators, including number of mobile phone subscriptions; fixed broadband data usage; and social media usage.

Higher education + other R&D assets

This indicator involved the gathering of information on the scale, quality and relevance of the research and teaching resources available at universities and other higher education institutions in each urban area. If specialist research institutes relevant to any or all of the four digital technologies were known to be present in the urban area, this was also reflected through a manual upwards adjustment to the city’s scoring.

Essentially, scores were awarded for the scale (e.g. number of students, value of research grants awarded) and quality of the research and higher education institutions located in each urban area.

Data infrastructure

This indicator takes account of the estimated capacity and efficiency of the city’s fixed and mobile data infrastructure. This was assessed using current data on average mobile and fixed broadband data download speeds.

Human capital

This indicator considers the size, skills and qualifications of the city’s working age population. There are two aspects included within the scoring and ranking process:

Firstly, there is a general assessment of the qualifications of the city’s working age population, considering the proportion and size of the workforce that is educated to degree level or equivalent, and also considering the proportion (and number) of workers that have no qualifications.

The second aspect considers the proportion and size of the workforce that are ‘digital workers’ (i.e. the number of workers) and proportion of the workforce that are IT professionals (covering occupations such as computer systems designers and analysts, software developers, database administrators, information security analysts, etc.).

Governance

This is a measure of the efficiency of municipal governance provided in the city, including aspects such as crime rates, corruption levels, etc.

Quality of life

This criterion considers the ability of the city to attract and retain technology-based businesses, investment and skilled workers in ‘knowledge economy’ industries such as information and communications services, professional services and digital media. This is assessed by producing an overall score based on a range of quality-of-life based indicators, such as the quality of the city’s primary and secondary education and public health systems, the efficiency of the city’s public transport system, and the quality of the city’s environment (based on air quality readings).

Data openness

This indicator is different to those described above in that it applies to the national level rather than the specific city. Essentially, the score applied to the city is the national score achieved for data openness in the current edition of the open data barometer (ODB). This score reflects national policies with respect to the availability of government business datasets and other types of data.

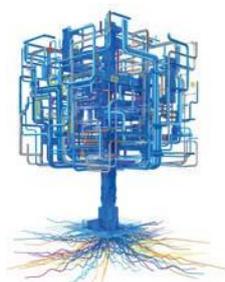
Business support environment

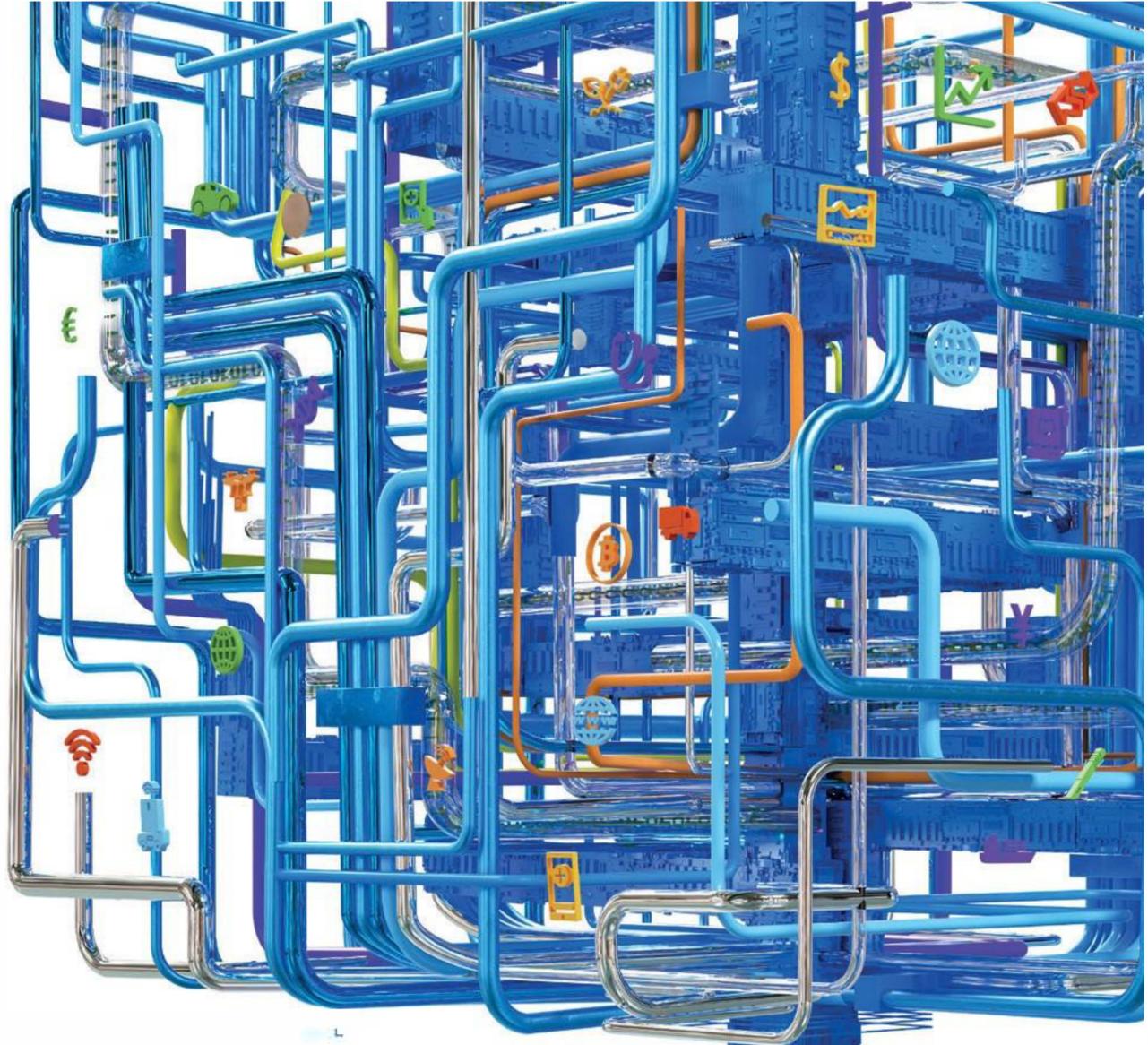
This measure provides an indication of the perceived ease of doing business in the city. The key component parts of this assessment are considered to include the business and personal tax burden, openness to inward investment and property ownership, policies with respect to international movement of digital industry talent, other skilled workers and entrepreneurs, intellectual property protection and levels of corruption.

Because many of these factors are mainly influenced by national policy it was decided to use a single national ranking.

Glossary of Terms

Term used in report	Explanation
5G	The fifth generation of mobile network connectivity, expected to deliver significantly improved levels of network reliability, considerably faster data transfer speeds and improved performance with respect to latency.
Artificial Intelligence (AI)	A range of rapidly evolving computer-based technologies used by machines and devices to simulate elements of human behaviour such as sensing, learning, reasoning and decision-making.
Blockchain	Blockchain is an electronic transaction-processing and record keeping technology that benefits users by decentralising the way that information about transactions is shared. Blockchain provides users a method of tracking information and transactions securely and by eliminating the need for third-party verification.
Clusters/ Ecosystems	Clusters/ ecosystems are geographically concentrated networks of interconnected companies and other organisations (such as universities, research institutes and public agencies) operating within a specific industry. Successful clusters/ ecosystem are usually characterised by a high volume of interactions and collaborations between businesses and other cluster/ecosystem participants.
Data Economy	The financial and economic value created by the storage, retrieval and analysis via software and other tools of very large volumes of business and organisational data at high speed.
Gross Value Added (GVA)	GVA is defined as the net value contributed to the economy by a company, industry or other economic entity. This includes compensation of employees, company profits and contributions to the Exchequer.
Internet of Things (IoT)	A system of assets or devices that are fitted with a sensor producing data that is stored and available for analysis that can be used to deliver production efficiencies or other improvements in the way the system operates. For example, sensors on machines that can be used to predict the need for maintenance or use of spare parts before the machine fails and production time is lost.





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