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The Data Landscape

A Report for Facebook

November 2017

Contents

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Executive summary

In the context of widespread digitalisation and emerging technologies, this study examines the trends that are driving growth in the volume of data generated and provides original research exploring the breadth of data-generating interactions between individuals and organisations.

Individuals are enabling exponential data growth by using digital services and devices

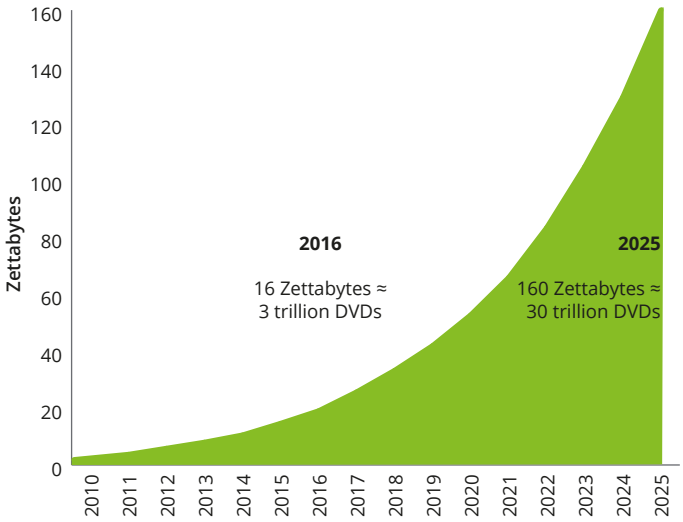
The widespread use of a plethora of digital services is transforming the data landscape. Faster connectivity and near-ubiquitous smartphone adoption – exceeding 80% in countries such as the UK[1] – enable users to create and share vast volumes of data seamlessly. Globally, this is reflected in activities such as the 35 billion e-commerce transactions made annually,[2] more than 6 billion online searches made each day,[3] and around 500 hours of video uploaded to YouTube every minute.[4]

Consumer devices and applications have become ingrained in everyday lives. The average smartphone owner in the US, UK, Italy and Spain interacts with more than 25 applications per month, including communication, productivity, games, entertainment and travel applications.[5]

The amount of data being generated by individuals through these interactions is expanding exponentially as a result. As much as two thirds of all data is estimated to have been generated by individuals – amounting to around 10 zettabytes, the equivalent of approximately two trillion DVDs.[6] Exponential future growth is expected, with the total volume of digital data in existence expected to have increased tenfold by 2025.[7]

New devices such as wearables, connected cars and connected homes will make a key contribution; the International Data Corporation (IDC) forecasts 80 billion connected devices by 2025 globally, compared to 11 billion connected devices in 2016.[8] These devices will be supported by 5G networks that could support up to 1 million connected devices per square kilometre.[9]

Figure 1. Estimated global volume of data



Source: International Data Corporation (2017), 'Data Age 2025'; Deloitte analysis.

As much as two thirds of all data is estimated to have been generated by individuals.

Individuals create data by interacting with a diverse and expanding range of organisations

Individuals today routinely use a variety of offline and online services. In doing so, they may establish 'data relationships' with organisations when they create and share data with a service provider, whether by registering, viewing online content, making purchases or otherwise engaging with a service.

There is limited existing evidence on the volume of data relationships overall, reflecting that data is generated and shared across a wide range of services and sectors. Some data relationships, such as with employers, insurers or utilities suppliers, occur across a large majority of individuals, but the potential for further data generation through other activities is vast. To explore this, Deloitte commissioned a bespoke survey conducted by Ipsos MORI to examine usage of a range of common services[10] by individuals in the UK, Germany and France.

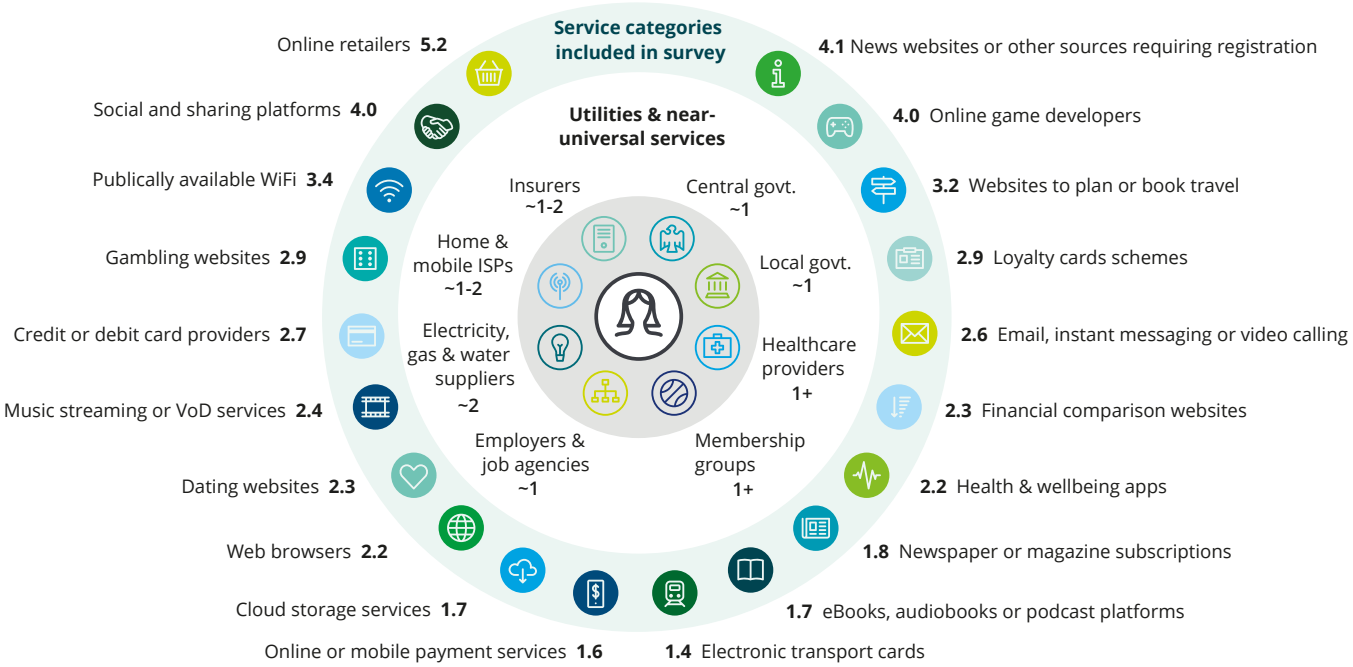
Survey results reveal that individuals on average hold data relationships with 24 organisations across the select categories included in the survey, in addition to other data relationships falling within categories that are almost universally used. Overall, the average individual can be estimated to hold around 35 data relationships across all of these categories.

Within each category, use of multiple providers is prevalent; for example, where individuals shop online, they typically use around five different retailers. These estimates may yet understate the true number, as the survey responses rely on recollection and therefore may focus on services and providers used most frequently or recently.

The findings vary across individuals; for example, for the 10% of individuals who use a particularly wide range of services, the estimated overall number of data relationships is around 60 on average and in some cases exceeds 100. The set of services and providers used are different for each individual, meaning that the total number of providers individuals interact with across the categories is estimated to be in the order of hundreds.

These findings appear consistent with relevant existing evidence. For example, in various developed countries it is estimated that the average smartphone user uses more than 25 applications per month,[11] which would not include other types of data relationships. Similarly, estimates of the number of online accounts held by each individual across all online services range from 25 to 90,[12] potentially increasing to around 200 in years to come.[13]

Figure 2. Number of data relationships held by users of each service on average

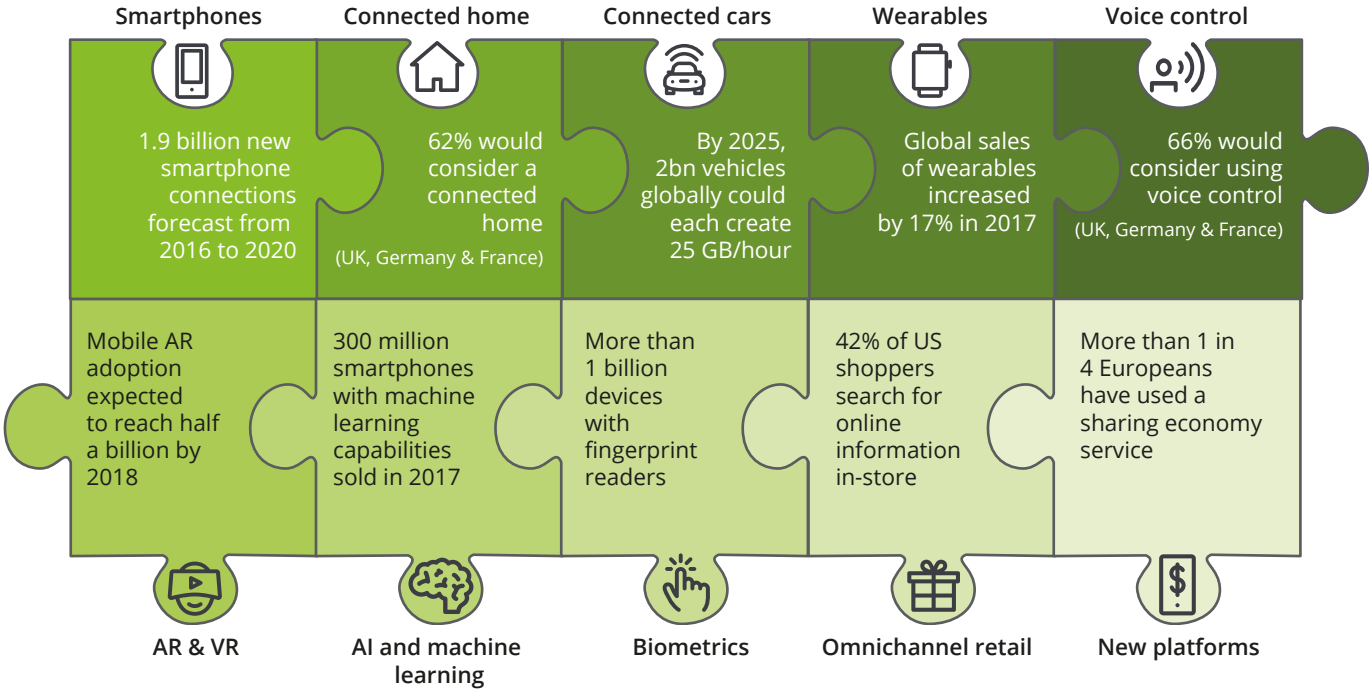


Source: Deloitte Data Relationships survey (2017) and Deloitte analysis. All countries. Weighted base: users of each service. 'Don't know' responses excluded.

Further proliferation of data relationships will come from new devices and services

The volumes and types of data created and shared across multiple organisations are growing rapidly as technological transformations expand the range of digital services and devices available to individuals. Data-led technologies, innovative online platforms and tools, and a myriad of IoT devices are combining to create new avenues of data creation and use.

Figure 3. Key areas for future data growth



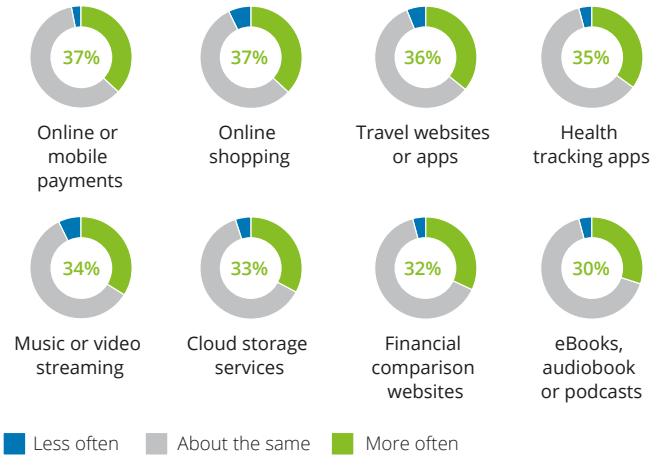
Source: Deloitte Data Relationships survey (2017); SAS (2015), 'The Connected Vehicle: Big Data, Big Opportunities'; Hitachi Data Systems (2015), 'The Internet on Wheels and Hitachi, Ltd'; Gartner (2017), 'Gartner Says Worldwide Wearable Device Sales to Grow 17 Percent in 2017'; IDC (2016), 'IDC FutureScape: Worldwide IT Industry 2017 Predictions'; Deloitte (2017), 'The Deloitte Consumer Review: Digital Predictions 2017'; Think With Google (2014), 'New Research Shows How Digital Connects Shoppers to Local Stores'; European Commission (2016), 'Flash Eurobarometer 438: The use of collaborative platforms'.

People are showing appetite for new devices and technologies enabled by data. The Organisation for Economic Cooperation and Development (OECD) estimates that a typical family of four in a developed country will have twice as many internet-enabled devices by 2022 compared to 2017.[14] As a result, IDC predicts that "*the average rate per capita of data-driven interactions per day is expected to increase 20-fold in the next 10 years as our homes, workplaces, appliances, vehicles, wearables, and implants become data enabled*".[15]

These increasing interactions are likely to see more data being created and shared with new and existing providers. Adopters of new IoT devices may share data with manufacturers, application developers and other providers along the supply chain. For example, one smart speaker reportedly already offers around 15,000 third-party applications,[16] while users of smart home devices can choose from a multitude of smartphone applications to manage and control other devices.[17]

Survey responses are also indicative of increasing adoption of a broader range of devices and services. Younger people in particular look set to create more data, as around one in three 18-34 year olds anticipate increasing use of innovative applications and online services, from health and entertainment applications to financial platforms and cloud storage services – taking into account that individuals may often not anticipate future adoption of new services.

Figure 4. Expected future use (18-34 year olds)



Source: Deloitte Data Relationships survey (2017). All countries. Weighted base=1760. 'Don't know' responses excluded.

Compared to other people, 18-34 year olds are approximately twice as likely to expect higher use of online shopping and music or video streaming services, and 50-70% more likely to expect higher use of several other online services such as travel websites and online payment platforms. Similarly, 72% of 18-34 years olds are open to considering using voice-controlled devices and connected homes respectively, significantly higher than for older people.

Compared to other people, 18-34 year olds are approximately twice as likely to expect higher use of online shopping and music or video streaming services.

Individuals are creating similar sets of data by interacting with several providers

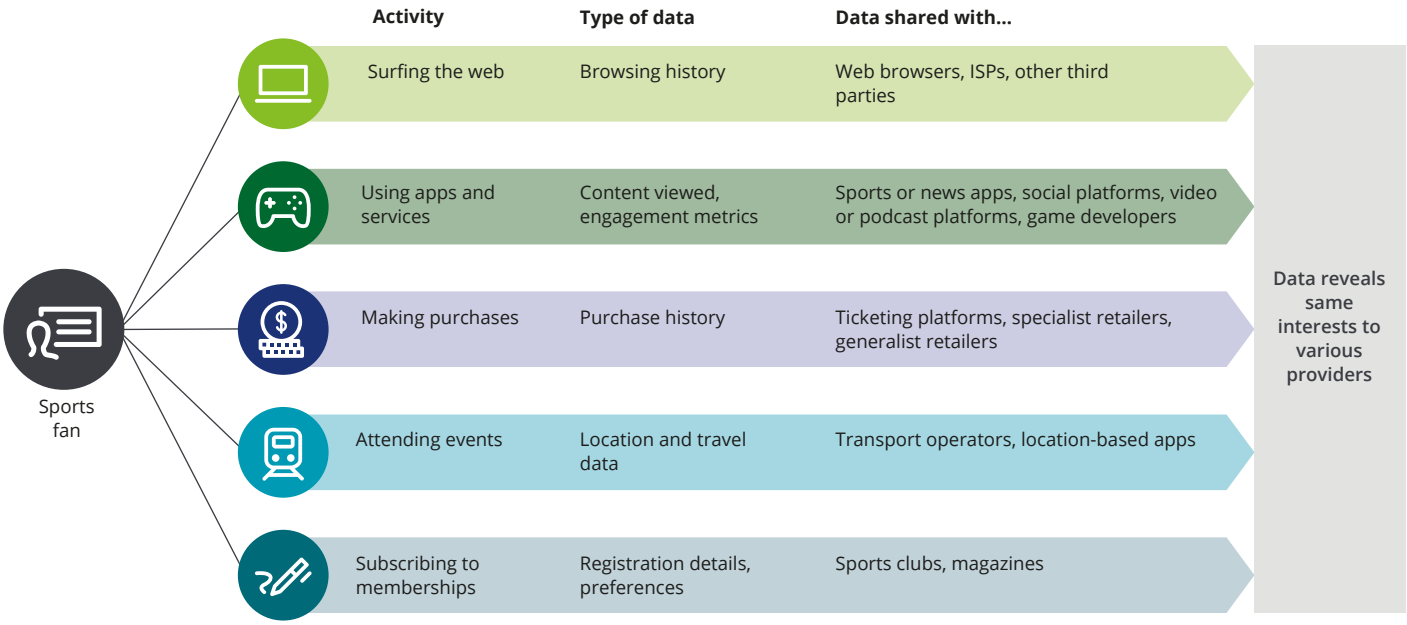
As individuals interact with a diverse range of services, they often generate or share the same data with different providers. For example:

- Online services typically require users to provide names, contact details and further information (such as socio-demographic characteristics) as part of the registration process.
- Browsing histories may be created with multiple providers, such as Internet Service Providers (ISPs), web browsers, advertising networks and websites visited.
- Transaction data may be shared with financial institutions, traditional payment service providers and online or mobile payment platforms.
- Location data is generated when using various digital services – around one in four mobile applications reportedly access a device's precise location;[18] ISPs and online services may infer approximate locations through users' IP addresses.

Even where the nature of the data varies somewhat in different contexts, a variety of providers have opportunities to gain detailed insights about their users' interests and to update these over time, which can help to improve or personalise the user experience and develop new services. For example, online retailers use browsing histories, items viewed, time of day, registration information, purchase history and return history to infer individual preferences.[19] Web browsers, search engines, social networks, media and entertainment platforms and other online service providers or application developers across sectors may obtain similar insights from engagement metrics such as searches made, content or pages viewed, mouse clicks, product ratings, comments or saved lists.

Through these different types of data, individuals often generate similar information about their characteristics, interests, habits or preferences to a wide range of providers. For example, a follower of a particular sport or team may create similar information about this interest by interacting with several providers, whether by browsing relevant websites, purchasing relevant retail items or merchandise, engaging with various relevant applications and content, or even travelling to sports events.

Figure 5. Example of different types of data indicating personal interests to various providers



Source: Deloitte

A variety of small and large organisations are using data to innovate

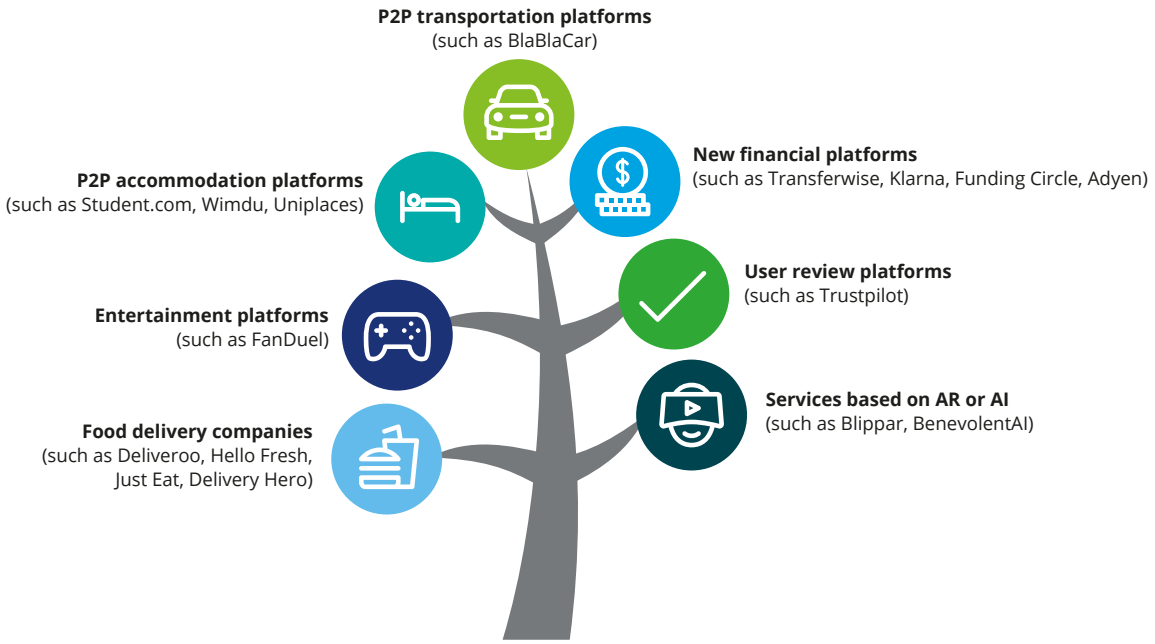
The potential for data to help promote innovation and generate value is recognised by organisations such as the OECD, which states that "*even traditional sectors such as retail, manufacturing and agriculture are being disrupted through DDI [data-driven innovation]*".[20] The innovation effects of data may be amplified as data skills, tools and capabilities improve over time and across sectors, with trends suggesting that more and more organisations will use data in the future.

While sophistication of data use varies between sectors, with sectors such as information and technology at the forefront,[21] developments indicate that public and private sector organisations alike are increasingly able to use data to create innovative applications or solutions. Looking to the future, organisations across virtually all sectors are investing in improving data and analytics capabilities,[22] while a growing ecosystem of third-party data sources and tools has developed to help small and large organisations alike use data in combination with data-led technologies.[23]

Reflecting these trends, a study for the European Commission estimates that around 900,000 small and medium enterprises (SMEs) and 10,000 large enterprises in the EU are already using data as an integral part of their activities, with more than 100,000 new SMEs expected to start using data intensively by 2020.[24] A vast range of successful start-ups are building innovative business models around data, for example in the 'sharing economy',[25] with more than 100 new organisations founded to date in the UK and France alone.[26]

Looking to the future, organisations across virtually all sectors are investing in improving data and analytics capabilities.

Figure 6. Examples of start-ups with data-driven business models



Source: Deloitte

Users stand to benefit from data-led innovation

When individuals generate or share data, they may benefit in a number of ways, provided the appropriate security and privacy safeguards are in place.[27] New data-led service and business models continue to emerge and organisations are using data to enhance service delivery and provide sophisticated personalised content, recommendations or products.

Figure 7. Examples of services enabled by data

Data types	Services enabled	Potential benefits
Real-time location data	**Location-based services** such as online maps, navigation apps and journey planners	**Time and fuel saved** Estimated as more than $200bn in a 2016 study
User data	**Sharing economy services**, from hosting platforms built on property data to P2P lending platforms built on financial data	**Flexibility and affordability** Nearly 6 in 10 Europeans participating in the sharing economy are doing so to save money
IoT sensor data	**Safety services** and features developed for vehicles by leveraging data from internal and external IoT sensors	**Enhanced safety** From 2018 all new cars in Europe will use sensor data to send automatic emergency signals in case of a crash
Wearables data	**Health apps** for the mass market, as well as specialised healthcare services	**Health awareness** 96% of health app users think that apps help improve quality of life

Source: Deloitte analysis; McKinsey Global Institute (2016), 'The age of analytics: Competing in a data-driven world'; ING (2015), 'International Survey: Mobile banking, new technologies and financial behaviour'; European Commission (2015), 'eCall in all new cars from April 2018'; Research Now (2015), 'US Survey, mHealth Apps: Supporting a Healthier Future'.

As data creation grows further, data-led technologies such as AI and machine learning are rapidly developing in parallel, providing new opportunities to utilise data. The role that data can play in innovation looks likely to increase over time, as data skills and capabilities improve across organisations and the wider ecosystem evolves to offer ever superior tools and solutions for organisations to use data, including to develop new and improved services for users.

1. Introduction

1.1 Digitalisation and connectivity are transforming data generation

Widespread use of digital services is fundamentally changing how individuals generate data and share this with organisations. As recently as the year 2000, three quarters of the world's data still existed in analogue form; this balance has since tipped dramatically and by 2007 over 90% of the world's data was already stored digitally.[28]

The individual is at the centre of these developments. Smartphone adoption has reached 65% across developed countries[29] and is as high as 85% in countries such as the UK.[30] The Internet of Things (IoT) continues to open up new avenues for data creation, as people embrace new devices such as wearables, connected home devices and connected cars, generating detailed streams of real-time data. Wearables and smart speakers are now owned by around 10% of people in some developed countries[31] and connected cars are expected to become ubiquitous within a decade,[32] each generating upwards of 25 gigabytes of data per hour.[33]

The proliferation of digital services and connected devices has profound implications for data. The scope for individuals to seamlessly generate and share data with other individuals and with organisations is expanding to include new types of data and activities. Advances in computing capabilities and new technologies create entirely new opportunities to use data. As a consequence, the volumes of data being created and used are growing across all sectors of society and the economy.

As more individual-related data is created, measures to protect individual preferences and privacy continue to play an important role. The evolving regulatory framework reflects this, for example through the incoming General Data Protection Regulation in the EU, with rules around consent that aim to ensure people are presented with "*genuine choice and ongoing control*" over their data.[34] Privacy controls are being made available by web browsers, third party add-ons, social networks, operating systems, and others, which may help to mitigate the risk of privacy preferences being breached. In fact, where such controls are available, individuals may be up to 52% more willing to share information.[35]

2.1 Data is a source of innovation

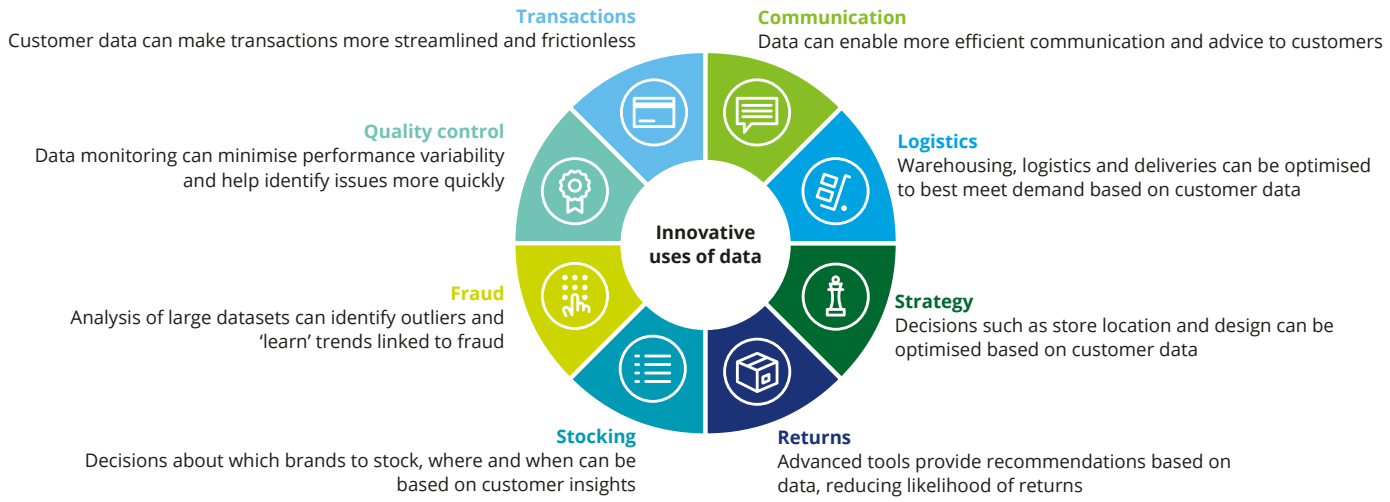
Recognising the above trends, policymakers and institutions have increasingly acknowledged the economic potential of data and the ways in which it can support productivity and innovation throughout the economy. Even businesses or sectors that were not historically data-led are increasingly making use of data, including customer data, as well as operational and systems data. For example:

- The Organisation for Economic Cooperation and Development (OECD) recognises data-driven innovation (DDI) as "*a disruptive new source of growth that could transform all sectors in the economy. Even traditional sectors such as retail, manufacturing and agriculture are being disrupted through DDI*".[36]

- A recent study for the European Commission estimated that the economic impact of data amounted to €300 billion in 2016 across EU28 countries, potentially rising to €430 billion by 2020.[37] This includes the direct impacts in terms of revenues from big data, analytics and other data-related services, plus indirect impacts across sectors of the economy and induced impacts through increased economic activity. However, the measure does not capture user benefits and social impacts.

In practice, there are a multitude of ways in which data supports the economy, reflecting the variety of types of data being generated and the different potential uses. In many cases, organisations use data to improve processes, supply chains and productivity; empirical studies suggest that firms that use data to a significant extent can achieve productivity gains of 5%-13%, all else equal.[38]

Figure 8. Examples of innovative uses of customer data for productivity



Source: Deloitte analysis of CMA (2015), 'The commercial use of consumer data'; CEBR (2012), 'Data equity: Unlocking the value of big data'.

Organisations of all types and sizes are using data to innovate

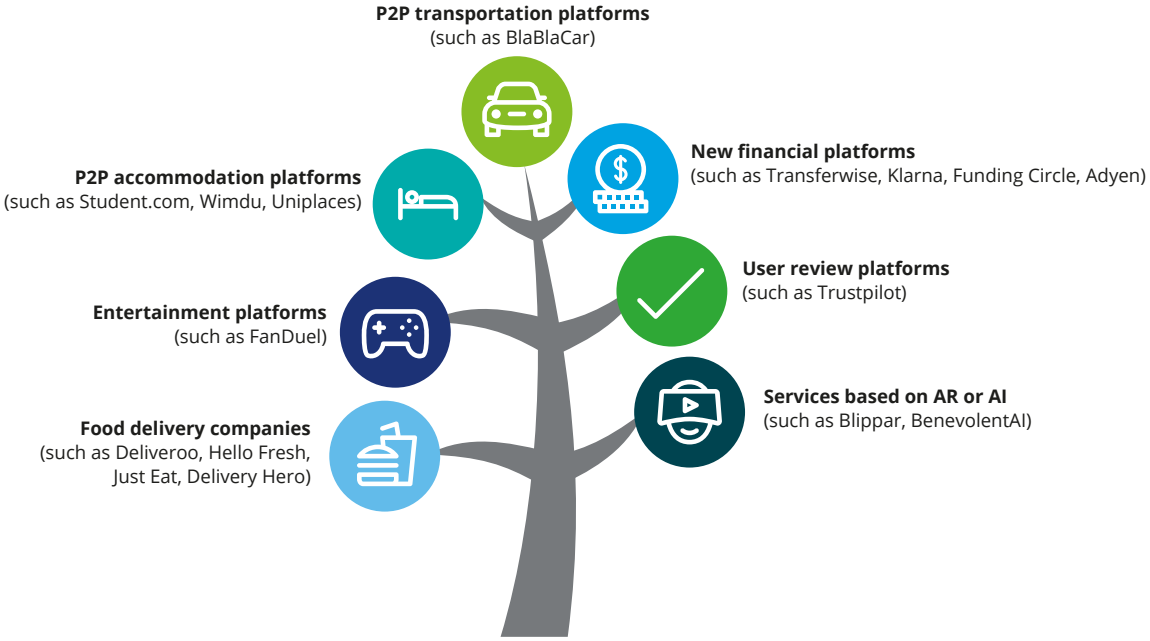
Organisations across all sectors are using data to improve productivity and service delivery:

	Transport and logistics: Location and navigation data allows individuals and organisations alike to optimise routes, providing up to $500 billion of value globally in terms of time and fuel savings by 2020, as well as reducing emissions.[39]
	Retail: Retailers such as Walmart are using demand data to inform store design – such as the choice between self-checkout and facilitated checkout – as well as to optimise stocking and product assortment decisions based on shopper preferences.[40]
	Healthcare: Use of deep data and smart sensors could lead to "*up to 50% improvement in treating serious diseases, halving the negative side effects of today´s generic medicine methods*" and wider benefits in the order of billions.[41]
	Energy: Data from smart meters can enable more efficient network management and other savings.[42] The European Commission finds that potential savings may be in the order of €160 per gas metering point and €300 per electricity metering point.[43]
	Insurance: Driving data collected through applications or telematics devices may help insurers to assess risk more accurately. Further, a study commissioned by the UK's CMA found that "*innovations are taking place in the area of fraud prevention using consumer data*" in the insurance sector, using various new data sources.[44]

The impacts of data through innovation are not limited to large organisations, or those which already have access to large pools of data. Many innovative services enabled by data have been developed by entrepreneurs or start-ups. For example, in the sharing economy,[45] platforms tend to use data provided by users in order to connect relevant individuals to one another. Workshops held by the European Commission have found that "*the collaborative economy is producing a range of innovative enterprises that are providing new services and changing the way existing services are being provided*".[46]

In recent years, many small enterprises with data-led business models have grown and generated substantial value, in some cases reaching 'unicorn' status.[47]

Figure 9. Examples of start-ups with data-led business models



Source: Deloitte

As data-led technologies such as IoT, artificial intelligence (AI), machine learning, augmented reality (AR) and virtual reality (VR) evolve further, the potential applications enabled by data for all types of organisations are expected to continue evolving at a rapid rate.

In the context of widespread digitalisation and emerging technologies, this study examines the trends that are driving growth in the volume of data generated and provides original research exploring the breadth of data-generating interactions between individuals and organisations.

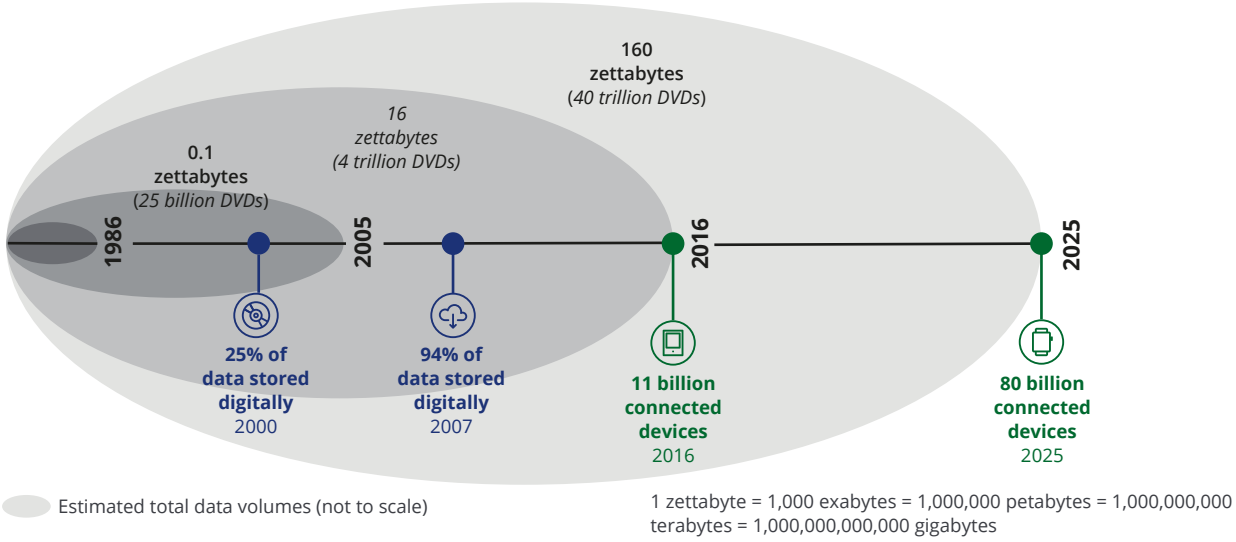
2. The growth in data volumes

2.1 Data generation is growing exponentially

Data volumes have expanded rapidly in recent years, as digital technologies offered new ways for data to be created, shared and stored. More than ever before, data is being created and transmitted digitally. Electronics and information technology have been brought into mainstream use across industries, while internet-enabled devices have become part of our daily lives.

The International Data Corporation (IDC) estimates that the total volume of the world's digital data will continue to grow exponentially, with an expected ten-fold increase between 2016 and 2025.

Figure 10. Illustration of global data growth trends over time



Source: Deloitte analysis of Cisco (2017), 'Cisco Visual Networking Index Global IP Forecast, 2016-2021'; Hilbert et al. (2011), 'The World's Technological Capacity to Store, Communicate, and Compute Information'; IDC (2012), 'The Digital Universe in 2020'; IDC (2017), 'Data Age 2025'; Harvard Business Review (2012), 'Big data: The Management Revolution'.

As a result of ubiquitous online services and connected devices, individuals lie at the heart of data generation. IDC estimates that approximately two thirds of the world's digital data has been generated by individuals – around 10 zettabytes, the equivalent of more than two trillion DVDs.[48] Consistent with this, the global IP traffic generated by consumers in 2016 was estimated to be over five times larger than the IP traffic generated by businesses and governments.[49] Everyday activities now contribute to growing volumes of human-related data, from the 269 billion emails sent[50] to the 6.59 billion internet searches[51] made every day and 3.3 billion images shared on social media.[52]

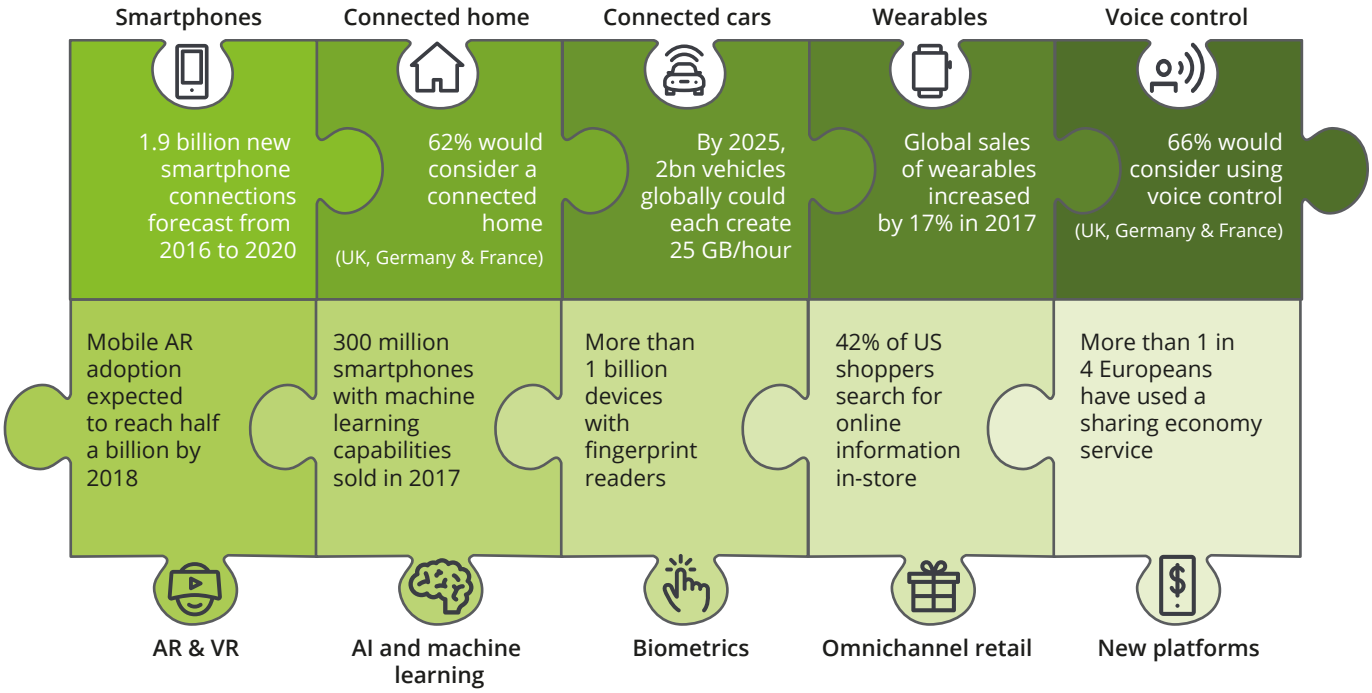
The total volume of the world's digital data is expected to grow exponentially, with a ten-fold increase between 2016 and 2025.

2.2 Demand and technological progress will continue to drive data growth

A combination of technological advances, which together are meeting demand for digital services and smart devices, lies at the heart of expanding data volumes.

The use of sophisticated devices such as smartphones is now widespread and a host of new connected devices are being adopted, leveraging new technologies such as AI, AR and VR that create and use new types of data. These developments are enabled and supported by advances in ICT infrastructure: internet connectivity is becoming ubiquitous and faster, while IT systems are evolving to manage greater volumes of data.

Figure 11. Drivers of data growth

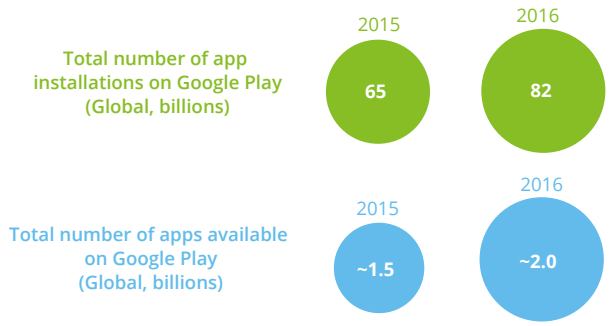


Source: Deloitte Data Relationships survey (2017); SAS (2015), 'The Connected Vehicle: Big Data, Big Opportunities'; Hitachi Data Systems (2015), 'The Internet on Wheels and Hitachi, Ltd'; Gartner (2017), 'Gartner Says Worldwide Wearable Device Sales to Grow 17 Percent in 2017'; IDC (2016), 'IDC FutureScape: Worldwide IT Industry 2017 Predictions'; Deloitte (2017), 'The Deloitte Consumer Review: Digital Predictions 2017'; Think With Google (2014), 'New Research Shows How Digital Connects Shoppers to Local Stores'; European Commission (2016), 'Flash Eurobarometer 438: The use of collaborative platforms'.

Smartphone use allows individuals to generate vast volumes of diverse data

Devices such as smartphones and tablets have changed the way people create data as they interact with organisations, providing constant access to digital services and enabling more frequent and extensive data creation. Modern smartphones generate various types of data, from location and call records to data captured by in-built sensors. A typical modern smartphone has ten or more such sensors, such as accelerometers, cameras and GPS trackers,[53] creating data that any application can request to access, in addition to data created or shared within applications themselves.

Figure 12. App usage, installations and availability



Sources: Eleven Paths (2017), 'Demographic Analysis of Google Play'; GSMarena (2017), 'More than 82 billion apps were installed from Google Play in 2016'

Smartphones and tablets provide access to a diverse choice of app-based services. Pew Research Centre estimated that, by 2015, around 200,000 apps had each been installed 10,000 or more times, and more than 80% of available apps were free to use.[54]

The convenience and capabilities offered by these devices and the applications they support has resulted in high degrees of user engagement. For over three quarters of EU internet users, smartphones have become the main device used to surf the internet.[55]

The Internet of Things is expected to create a further step change

While smartphone adoption may be approaching saturation in some countries, new connected devices continue to expand opportunities to generate and use data. The OECD estimated that a representative family of four in a developed country had ten connected devices in 2012, including smartphones and computers, but predicted that this figure would rise to 25 by 2017, and up to 50 by 2022, as various new smart devices are adopted.[56]

Wearable devices, such as smart watches or fitness bands, create data about users' physical health and daily habits. Globally, more than 300 million wearable devices are estimated to have been sold in 2017, an increase of 17% from 2016.[57]

Connected vehicles can transmit a wealth of data about the vehicle and the driver, such as location, driving data and usage of services such as music streaming. Estimates predict that there could be 2 billion connected vehicles globally by 2025.[58] Connected cars today reportedly generate 25 gigabytes of data per hour[59] and autonomous vehicles could generate more than 100 times this amount in the future.[60]

Smart meters share real-time data on households' energy or gas usage, potentially revealing other information such as occupancy patterns. The European Commission has estimated that close to 200 million smart meters for electricity and 45 million for gas will be rolled out in the EU by 2020.[61]

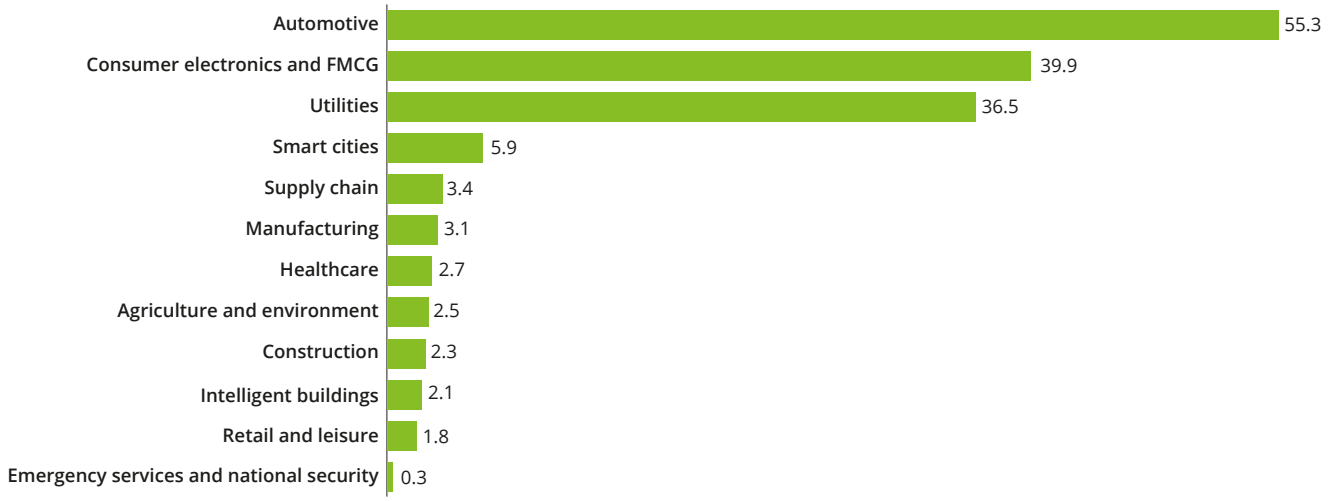
Other household IoT devices, such as smart TVs, speakers, thermostats, lighting systems, security systems and home appliances, can generate granular data that reflects individuals' daily routines and habits.

Smart city programmes are being implemented across countries, making use of IoT devices such as connected street lights, bins and traffic cameras.[62] Gartner predicts that 50% of citizens in large cities will share personal data in order to benefit from smart city programmes in the next few years.[63]

A representative family of four could have up to 50 connected devices by 2022.

IDC estimates that there will be 80 billion connected devices by 2025 globally, compared to around 11 billion in 2016.[64] In the UK alone, the number of IoT connections is forecast to grow from around 13 million in 2016 to over 150 million in 2024, largely driven by devices such as connected cars, consumer electronics and smart energy meters.

Figure 13. IoT connections in the UK, millions (2024 forecast)



Source: Cambridge Consultants for Ofcom (2017), 'Review of latest developments in the Internet of Things'.

The next generation of mobile network technology (5G) will support IoT data generation. Cisco predicts that a 5G connection will already generate 4.7 times more traffic by 2021 than the average 4G connection[65] and the International Telecommunications Union expects that each 5G mobile base station could support up to 1 million connected devices per square kilometre.[66]

New technologies will diversify and expand the data generated by individuals

As connected devices become embedded in everyday lives, the new technologies they offer change how users interact with devices and generate data about themselves. To date, touchscreen technologies, GPS, mobile operating systems and application development platforms have contributed to data growth. Other emerging technologies are expected to continue this trend going forward.

Voice recognition technology appears to be gaining popularity. Over a quarter of UK smartphone users report using a 'voice assistant' feature for purposes such as navigation and searching for information, while recently launched 'smart' speakers are already used by an estimated 9% of people in the UK[67] and 7% in the US.[68] This technology has the potential to enhance user engagement with various data-generating activities and may lead to new information being generated, such as the 'emotional tone' of conversations.[69]

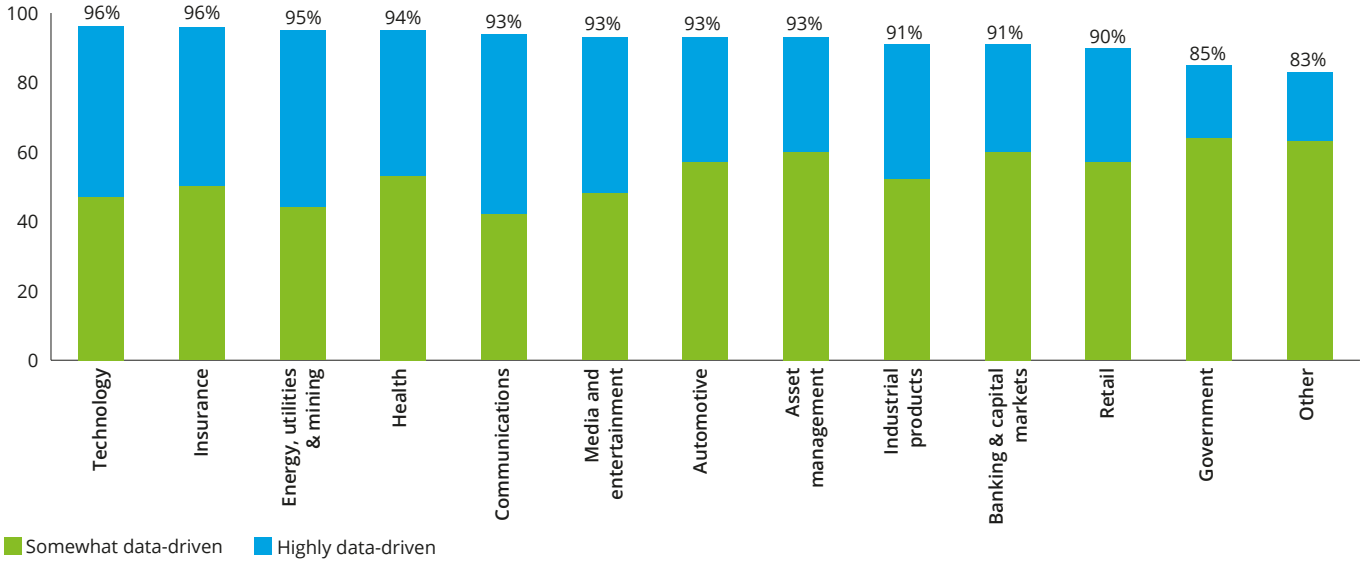
Augmented reality (AR) and virtual reality (VR) have the potential to strengthen user engagement with digital devices across sectors as diverse as education, healthcare and construction.[70] AR applications typically rely on data about a users' physical environment, such as location and audio-visual data. Estimates predict that mobile AR adoption will near half a billion people by 2018.[71] VR can be used to obtain more detailed data about users' interactions with services; for example, YouTube collects data to produce 'heatmaps' for VR videos, showing where user attention is focused.[72]

Biometric data is increasingly being shared by individuals. Around a third of US smartphone users have already used fingerprint readers on their phones,[73] and globally the active base of fingerprint reader-equipped devices reportedly exceeds one billion.[74] Further growth may come from eye or face recognition technologies, now used by some smartphones.

2.3 All sectors of the economy are generating and using data more intensely

Increasing volumes of data are being used by organisations across sectors to enhance service delivery, guide decision-making and R&D, and improve supply chains.

Figure 14. Percentage of businesses using data-driven decision making



Source: PwC Global Data and Analytics Survey 2016.

Though the intensity and sophistication of data use varies, cross-sector evidence suggests that data is now used as an input for decision making in the vast majority of organisations, and it is often a highly significant input in sectors such as communications, energy, technology, insurance and media and entertainment. As noted by the OECD, "*the use of data for value creation is not limited to ICT firms, although the ICT sector is still the largest user of advanced analytics according to some estimates*".[75]

2.3.1 Adoption of digital services is driving data growth in all sectors

Increased data generation, as individuals interact with organisations, is a pervasive phenomenon across sectors. This section considers some sectors where digitalisation has had a profound impact on data growth, though similar examples can be found across the economy.

Retail

E-commerce and m-commerce have become major sales channels and a majority of Europeans now shop online, generating detailed digital data about their shopping behaviour, from searches made to products viewed and purchased.

Figure 15. Growth in e-commerce

Source: Eurostat; Ecommerce Europe (2017), 'European Ecommerce Report 2017'; Statista.

Even among brick-and-mortar retailers, there is a trend of data growth. Individuals create detailed purchase data by using electronic loyalty cards. For example, Nectar was launched in 2002 and is now the largest retail loyalty card scheme in the UK, with around 20 million users.[76]

New technologies may increase the data generated by shoppers, as retailers seek to offer an 'omnichannel' experience where customers can seamlessly use offline and online channels. Indoor location tracking, facial recognition and sensors can be used to obtain more information about in-store shopping behaviour.[77] Customers may share their measurements offline by using 3D scanners or 'magic mirrors',[78] whereas sophisticated personalisation tools are being implemented by online retailers to obtain analogous data.[79]

Banking

Banks have traditionally held large volumes of individual-level data and technological progress has expanded the volume of data being generated. Contactless credit cards and mobile payments are contributing to more people 'going cashless', meaning that transaction data is captured for a greater proportion of transactions.

Increased use of online and mobile banking means that, as well as transaction data, banks obtain data on usage of digital services, such as the time and frequency of logins and the use of specific features such as generating statements. The adoption of new digital financial services such as peer-to-peer lending, money transfer services, cryptocurrency platforms and crowdfunding may drive further growth.

Figure 16. Changing habits in banking

Number of cashless transactions in Europe	2007: **74bn**	2015: **112bn**
Europeans using online banking	2007: **25%**	2015: **46%**
US millennials using mobile banking apps	2015: **59%**	2016: **75%**

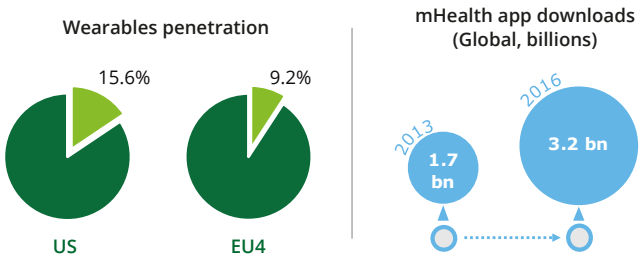
Source: Eurostat; European Central Bank Payment Statistics reports; Bank of America (2016), 'Trends in consumer mobility report'.

Health and fitness

The emergence of new devices and applications has sparked a rise in the volume of health and fitness-related data being captured. Smartphones are now capable of measuring activity data such as steps taken, while wearable fitness and activity trackers are becoming more common, sharing data about users' movement, sleep and heart rate.

Aside from wearables, a diverse range of mobile health and fitness applications are being used, allowing users to record and share various types of data with the service provider, from nutrition data to tracking different exercise routes and sports undertaken. In the healthcare sector, connected devices are allowing more patients to generate data using specialised wearables, 'ingestibles' and 'implantables'.[80]

Figure 17. Adoption of health and fitness devices and apps



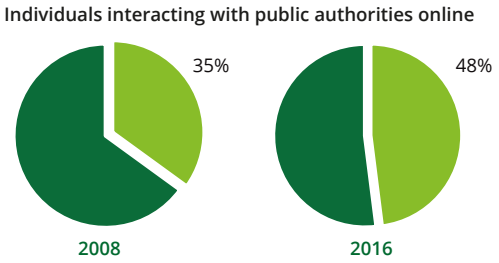
Source: Kantar Worldpanel ComTech; Research2Guidance (2016) 'mHealth App Developer Economics 2016'.

Government and public sector

Digitalisation means that more data is captured and shared as citizens interact with public bodies through e-government services.[81] For example, the EU has launched 27 applications on a broad range of issues including employment, health, transport and communication.[82] In Estonia, individuals hold state-issued digital identities that allow access to various digital services built on a nationwide data sharing platform – 'X-road' – used across government and by some private organisations.

Open data initiatives have made public sector data more widely available. The UK government has released over 40,000 datasets on its open data portal,[83] launched in 2010, while around 200,000 datasets are available on the US open data portal.[84] Organisations can use these in combination with internal data to innovate and improve services; the total market value of open data across Europe has been estimated to exceed €200 billion.[85]

Figure 18. E-government adoption



Source: Eurostat.

Transport

For public transport users, the introduction of electronic transport cards in many countries means that more detailed data about transport use is now generated. Since the introduction of the Oyster card in 2003, Transport for London (TfL) has obtained detailed data about individuals' journeys via the 3 million cards used per day.[86] Further change has been brought about by 'Intelligent Mobility' applications; for example, more than 600 travel applications exist for London alone, many of which use individuals' location data and journey plans, combine this with open data and provide helpful real-time information.[87]

For private transport users, several innovations have led to increased data volumes.

	Navigation applications: The availability of free smartphone applications for drivers has made GPS navigation widely accessible. These applications may rely on users' location and usage data.
	Telematics: Telematics or 'black box' devices have been used by insurers to obtain detailed driving data, including roads used, speed, driving patterns and times.[88] An estimated 5.3 million telematics insurance policies were in force across Europe in 2015.[89]
	Taxi-booking: Digitalisation has enabled online or app-based booking of taxi services as well as new sharing economy services. These applications require registration and therefore can collect detailed behavioural and location information linked to specific individuals.

Media and entertainment

The media and entertainment sector has been at the forefront of digitalisation, with on-demand services gaining popularity and new social media platforms being developed. In the US, more music was reportedly streamed in one day than purchased in the entire year in 2016.[90] Globally, almost 1 billion hours of video are watched on YouTube each day.[91]

Figure 19. Growth in on-demand media and entertainment services

Paid music subscriptions (Globally)	2012: **20m**	2015: **68m**
Consumer spend on VoD (Europe, in millions)	2008: **€410**	2015: **€1066**
FT digital subscriptions (Globally)	2009: **90,000**	2015: **566,000**

Source: IFPI (2016), 'Global Music Report – Music consumption exploding worldwide'; Statista (2017), 'Consumer spending on TV video on demand in Europe from 2008 to 2015 (in million euros)'; Fortune (2016), 'The Financial Times Discovers That a Paywall Is Not a Panacea'; The Guardian (2010), 'Is the Financial Times the perfect digital model?'

As well as registration information, usage and preference data is created where content is consumed digitally. User-generated content may further contribute to data growth: it is estimated that 500 hours of video are uploaded to YouTube every minute[92] and users share over one million pieces of content on social media every minute.[93]

In the gaming sector, use of internet-enabled consoles, mobile applications and sensors contributes to data generation. Games consoles can incorporate motion or video sensors, while gaming applications generate transaction data when in-application purchases are made. Applications may also collect various other information, such as location data, through the device.

New technologies such as AR and VR may involve new types of data being captured by playing games; for example, the AR-enabled game Pokemon GO has been installed over 100 million times on Android devices alone and relies on detailed user or device data, including the device's precise location and data from phone cameras.[94]

2.3.2 Different types of organisations are using data more intensely

As data volumes grow across sectors and new types of data are created, there is a common trend of organisations focusing on data capabilities. Though the sophistication of data uses varies significantly, it appears to be increasing across all sectors and among small and large organisations alike.

Various metrics presented in Figure 20 below suggest that sectors such as ICT, finance and energy are currently at the forefront of advanced uses of data, based on the data skills and tools available, and the investments made in relevant technologies.

Figure 20. Sophistication of data use across sectors

	People	Tools			Investment	
	Data workers, share of all workers	Adoption of big data analytics	Big data solutions per organisation	Adoption of AI	Increase in big data/IoT investment	Expected AI spend growth, next 3 years
Telecoms / ICT	11%	67%	2.6	31%	13%	12%
Banking & Finance	9%	64%	2.5	28%	13%	11%
Energy, Utilities, Resources	3%	67%	2.4	28%	14%	5%
Transport & Logistics	2%	63%	1.7	21%	15%	8%
Professional services	6%	53%	1.8	14%	10%	6%
Retail	3%	48%	2.0	19%	8%	5%
Health	2%	36%	2.0	17%	9%	6%
	(EU, 2016)	(UK, 2015)	(UK, 2015)	(Developed markets, 2017)	(UK, 2014-15)	(Developed markets, 2017

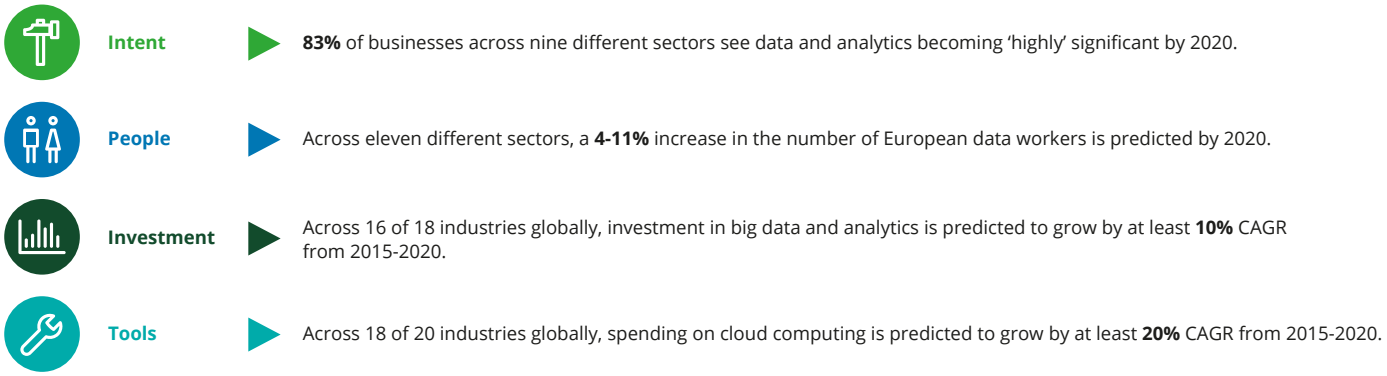
Source: Deloitte analysis of IDC and Open Evidence for the European Commission (2017), 'European Data Market'; Cebr (2016), 'The Value of Big Data and the Internet of Things to the UK Economy'; McKinsey Global Institute (2017), 'Artificial intelligence: the next digital frontier?'. Data workers are defined as workers who collect, store, manage and analyse data as part of their work and who are proficient in data use.

Nevertheless, even in sectors that have tended to use data less intensively, organisations are exploring more advanced uses of data. For example, retailers are widely reported to be investing in advanced data-related tools and technologies such as AI, AR, VR, in-store IoT devices, omnichannel analytics and advanced personalisation tools.[95] A global survey of retailers found that the majority of respondents plan to invest in solutions such as IoT analytics and machine learning.[96]

A similar overarching trend of increasing sophistication is observed across sectors, as organisations focus on the importance of data and invest in capabilities, tools and skills.

Though the sophistication of data uses varies significantly, it appears to be increasing across all sectors and among small and large organisations alike.

Figure 21. Drivers of future data analytics sophistication across sectors



Sources: Deloitte analysis of PwC (2016), '2016 Global Industry 4.0 Survey'; IDC and Open Evidence for the European Commission (2017), 'European Data Market'; IDC (2016), 'Double-Digit Growth Forecast for the Worldwide Big Data and Business Analytics Market Through 2020 Led by Banking and Manufacturing Investments, According to IDC'; IDC (2017), 'Worldwide Public Cloud Services Spending Forecast to Reach $122.5 Billion in 2017, According to IDC'.

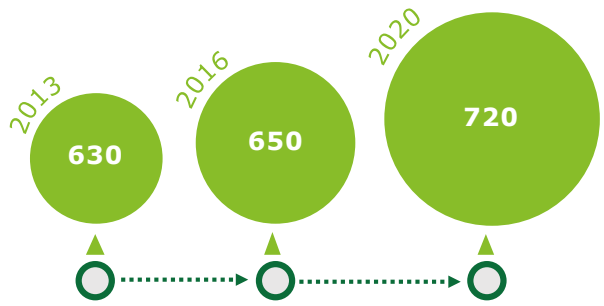
Opportunities to offer digital services – through which individuals generate and provide data – are open to organisations of all sizes, supported by the availability of online platforms to facilitate content creation, website design, publishing and other activities.

Third-party data-related services or analytics tools may help to make sophisticated uses of data more accessible, including for small businesses. Industry sources report that external cloud-based tools "*allow small businesses to harness the power of big data analytics as even non-technical users are able to access large data sets from inexpensive, off the shelf servers for data analysis projects*".[97] Coupled with open source software, these tools may significantly reduce the costs of delivering data-intensive services, potentially from the millions to the low hundreds of thousands.[98] Other commercially available tools such as IBM Watson reportedly help to make data-led technologies such as machine learning and AI more accessible.[99] The range of specialist tools and services appears to be expanding: Forrester has predicted that the number of vendors offering IoT analytics will double in 2017 alone.[100]

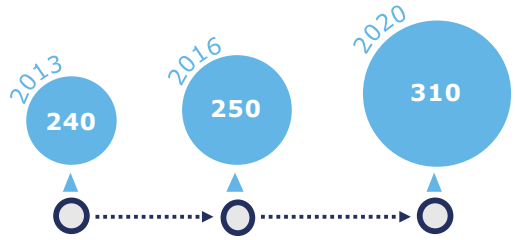
As a result, there are a vast number of small and large firms using data intensively. A study for the European Commission estimates that there are around 900,000 SMEs and 10,000 large enterprises in Europe who use data as an integral part of their activities, for example to improve their business processes or to offer data-related services.[101] These figures are increasing and the number of SMEs using data in these ways is expected to exceed 1 million by 2020.

Figure 22. Number of European SMEs that are 'data users' or 'data companies'

Data users
Organisations that generate, exploit, collect and analyse digital data intensively and use what they learn to improve their business
(SMEs, 000s)



Data companies
Organisations whose main activity is the production and delivery of digital data-related products, services, and technologies
(SMEs, 000s)



Source: IDC and Open Evidence for the European Commission (2017), 'European Data Market'. Figures are for the EU28 countries and are rounded to the nearest 10,000. Figures for 2020 reflect the 'Baseline scenario' estimates.

3. The diversity of individuals' data relationships

3.1 Individuals hold a broad range of data relationships with organisations

Individuals create data as part of using a variety of products and services. Such activities establish 'data relationships' between individuals and organisations, including where individuals actively share data with the service provider, for example by registering an account, as well as passively generating data through their usage of services and devices.

Due to the multitude of services available and potential interactions between individuals and organisations, both online and offline, it is not be feasible in practice to examine all data relationships comprehensively. However, by focusing on some commonly used products and services that involve significant data generation, it is possible to gain insights on the variety of these data relationships and obtain estimates of the number of data relationships typically held by individuals.

Deloitte Data Relationships survey

An online survey was conducted by Ipsos MORI for Deloitte, examining a range of data relationships held by individuals. The survey focused on 20 categories of products or services that are commonly used and involve significant data generation:

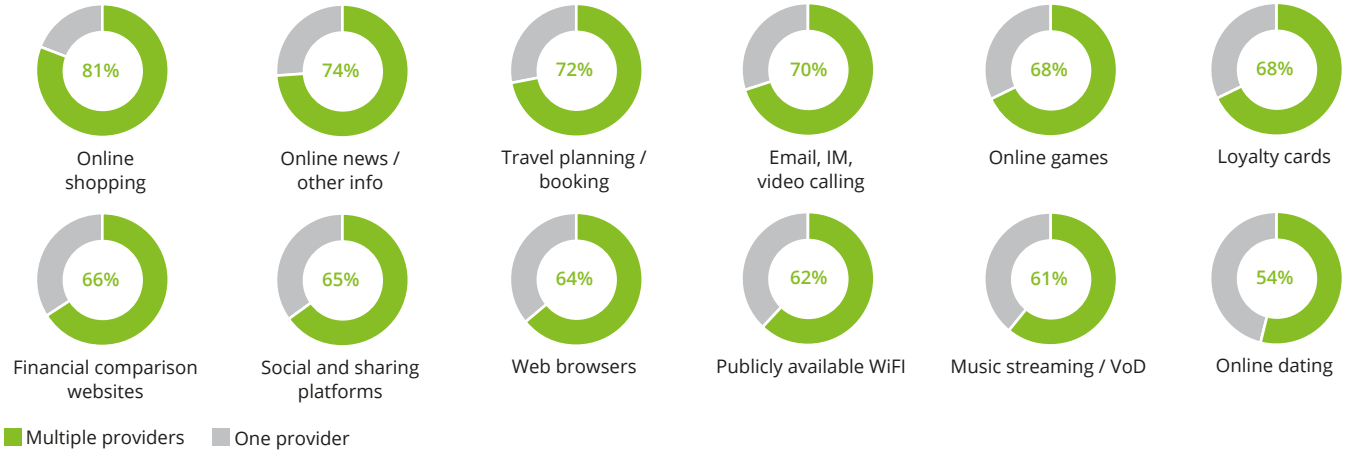
- Cloud storage services
- Credit or debit cards
- eBook, audiobook or podcast platforms
- Electronic loyalty cards
- Electronic transport cards
- Email, instant messaging or video calling
- Financial comparison websites (requiring registration)
- General web browsing
- Health tracking applications (including health, fitness, training or sleep tracking
- Music streaming and video-on-demand (VoD) services
- News websites, forums or other online information sources (requiring registration)•
- Online dating
- Online gambling
- Online gaming
- Online or mobile payments (including online or mobile wallets, online money transfer services or peer-to-peer lending)
- Online shopping
- Publicly available WiFi
- Social or sharing platforms (including social networks, blogging platforms, professional networking and collaborative economy services)
- Subscriptions to newspapers or magazines (print editions)
- Travel websites or applications (for planning or booking travel or holidays)

The survey was conducted in the UK, Germany and France in August and September 2017. A sample of around 2,000 internet users aged 18-75 was selected in each country. The sample is representative at the national level with regard to age, gender, region and socio-economic status. Unless otherwise specified, the results presented in this section are for all countries, where the data has been weighted to be representative of the average individual across the UK, Germany and France.

3.1.1 Current usage of services reveals a multitude of data relationships within and across sectors

In the majority of categories included in the survey, most users use multiple providers rather than a single one, highlighting the ease with which people may access different services online.

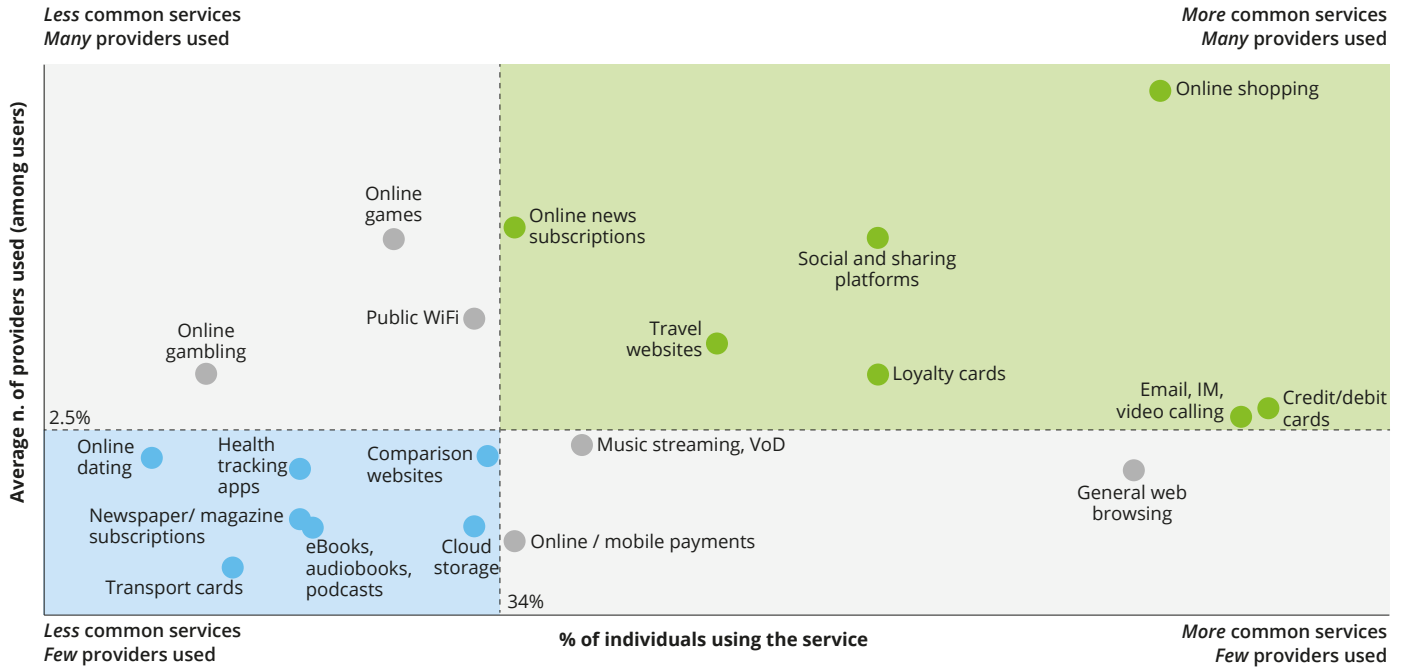
Figure 23. Categories where use of multiple providers is prevalent



Source: Deloitte Data Relationships survey (2017). Weighted base = users of each service. All countries. 'Don't know' responses excluded.

The use of several providers is particularly prevalent for services that are more widely used. Nevertheless, as shown in Figure 24 below, the use of multiple providers is also commonplace for some less common activities, such as online gaming, online gambling and the use of publicly available WiFi networks.

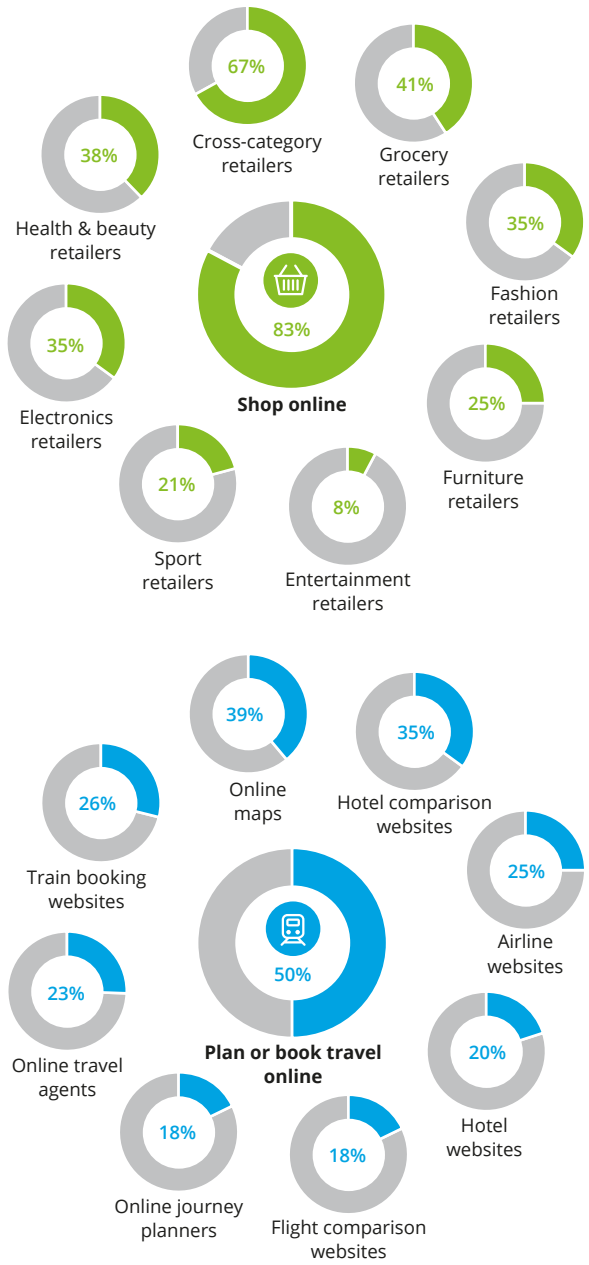
Figure 24. Number of providers used by users of niche and mainstream services



Source: Deloitte Data Relationships survey (2017). Based on users of each service. All countries. 'Don't know' responses excluded. Dotted lines are illustrative and are set between the 10th and 11th data points along each axis.

The diversity of choice is reflected in usage within these categories, as well as across different sectors. For example, online shoppers and users of online retail and travel planning or booking websites are engaging with various types of providers specialising in different areas of service.

Figure 25. Use of different types of providers within online retail and travel



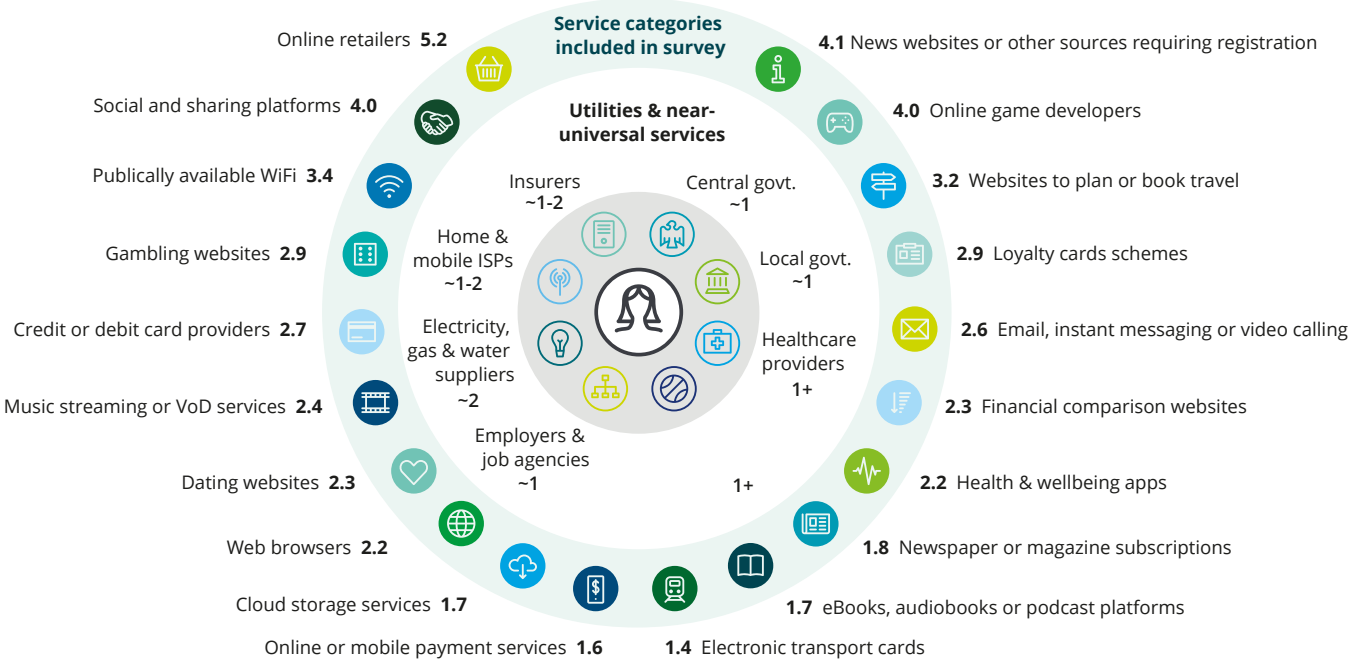
Source: Deloitte Data Relationships survey (2017). All countries. Weighted base=6007.

Overall, internet users in the UK, France and Germany hold data relationships with an estimated 24 providers on average, across the select categories included in the survey.[102] The survey results are limited to the specific categories explored in the survey and the typical number of substantive data relationships for individuals in the UK, Germany and France rises to around 35 when taking into account other activities and services that are almost universal, such as:

- Subscribing to energy, gas and water services: ~2 providers used on average.[103]
- Subscribing to fixed and mobile internet: ~1-2 providers used on average.[104]
- Taking out insurance policies: ~1-2 providers used on average.[105]
- Interacting with employers, local Government, central Government, healthcare providers and membership organisations.

The breadth of these relationships and additional relationships as part of near-universal services is illustrated in Figure 26.

Figure 26. Number of data relationships held by users of each service on average



Source: Deloitte Data Relationships survey (2017). All countries. 'Don't know' responses excluded.

The findings vary across individuals; for example, for the 10% of individuals who use a particularly wide range of services, the estimated overall number of data relationships is around 60 on average and in some cases exceeds 100. The set of services and providers used are different for each individual, meaning that the total number of providers individuals interact with across the categories is estimated to be in the order of hundreds.

The number of data relationships suggested by survey data, taking into account other potential data relationships as discussed above, appears consistent with existing evidence. For example, in the UK, France and Germany it is estimated that the average smartphone user uses more than 25 applications per month,[106] which may include multiple applications from the same provider but would not include other data relationships that are not app-based. Similarly, estimates of the number of online accounts held by each individual across all online services range from 25 to 90,[107] potentially increasing to around 200 in years to come.[108]

3.1.2 Detailed data is created through interactions with various providers

Individuals tend to generate or share multiple types of information about themselves across several of the data relationships captured by the survey. By registering for services, individuals typically provide contact details and other information about themselves such as date of birth. Individuals may create further information about themselves explicitly – for example by creating user profiles or saving favourites – but also implicitly, as the use of digital services generates a stream of detailed data that can be analysed to infer or derive individuals' interests, preferences and characteristics.

The same or similar data is often created across several providers

In some cases, the same data may be created across a number of providers. For example:

- **Names, email addresses and other details** (such as socio-demographic characteristics) are commonly generated across all online services that require registration or creation of a user profile. This generally applies for all data relationships considered in the survey.[109]

- Comprehensive **browsing histories** are created with ISPs and web browsers. Partial browsing histories may be shared with various other third parties collecting data through cookies, such as advertising networks, analytics companies and websites themselves.

- **Transaction data** is generated with financial institutions and payment service providers when using credit or debit cards, and may be captured by other organisations when using online or mobile wallets.

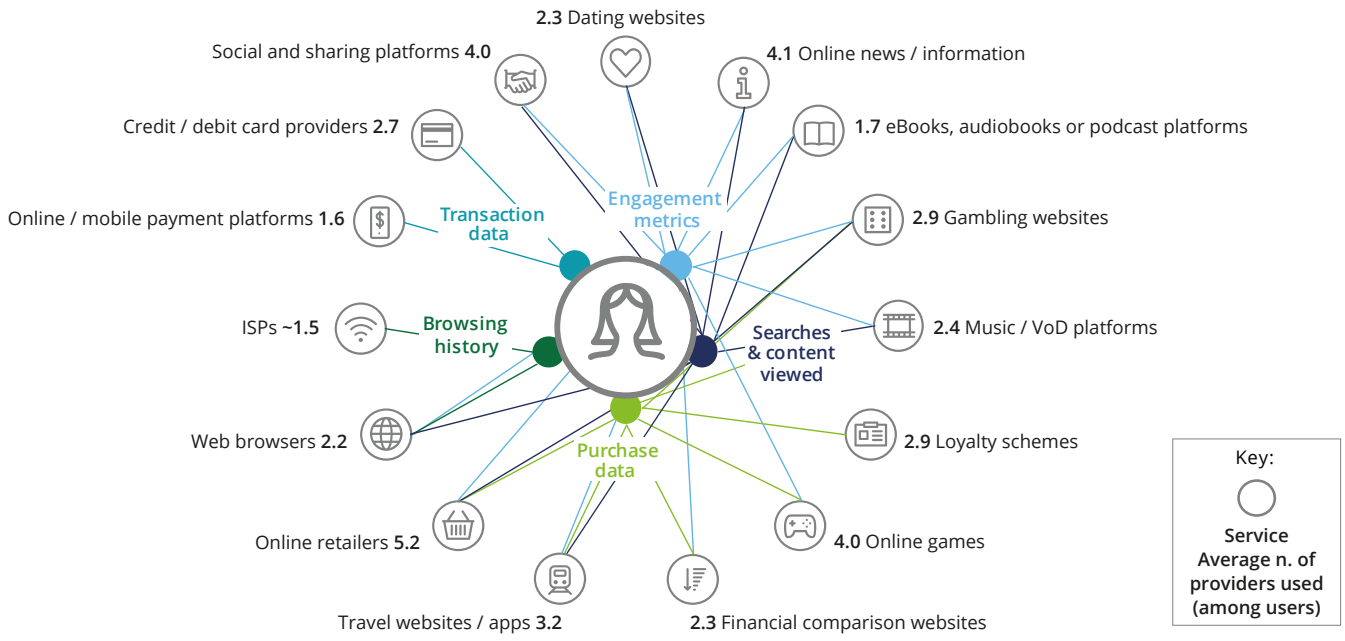
- **Location data** may be generated when using various applications or websites. According to Pew Research Centre, around one in four applications use permissions to access the device's precise location,[110] which roughly equates to around 800,000 applications.[111] Less accurate location data may also be inferred by online services based on a user's IP address.

In other cases, similar *types* of data may be generated across a number of providers. For example:

- Granular **purchase data,** at the level of specific products purchased, is created when interacting with online retailers and loyalty card providers, in each case capturing a particular subset of an individual's purchases. This is data of a similar nature to transaction data, though with greater granularity.

- **Searches, content viewed and other engagement metrics** (such as clicks**,** product or content ratings, comments, reviews or saved lists) are generated in a variety of contexts as part of using specific services, potentially revealing which types of content or topics the user is interested in.

Figure 27. Examples of the types of data typically shared with different providers



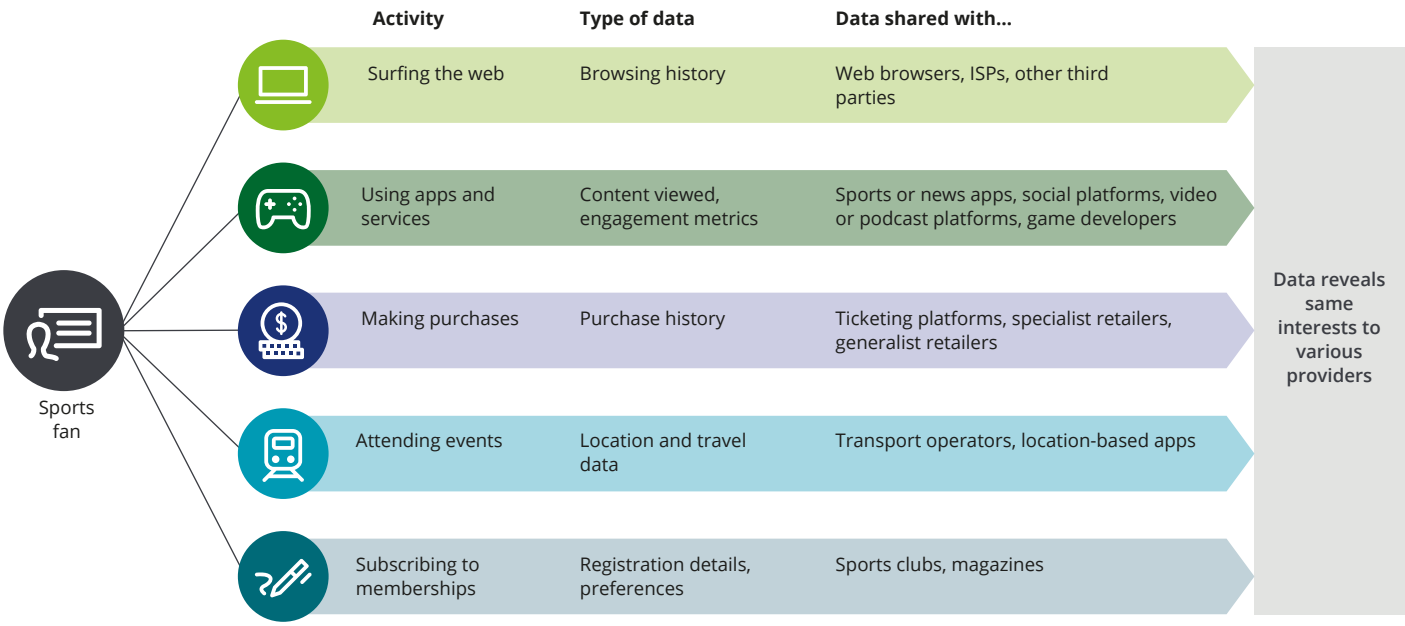
Source: Deloitte Data Relationships survey (2017) and Deloitte analysis. The diagram is illustrative and the types of data shared may depend on the specific individual, service and provider in each case. Indicative number of ISPs based on external data.[112]

Many providers are able to understand individual characteristics, habits, interests and preferences from different types of data

Individuals will create data with different providers that reflects their particular characters, habits, interests and preferences. Even where the types of data and the context vary, organisations may achieve similar insights about their users.

For example, a follower of a particular sport or team may reveal information about this interest through several data relationships in different contexts. Activities such as browsing relevant websites, engaging with various of relevant applications and content, or even travelling to sports events all generate different types of data that providers may use to understand the individual's interests. The same logic holds in other contexts: while the specific types of data involved can vary, there are often opportunities for service providers to build a similar understanding of individuals.

Figure 28. Example of different types of data indicating personal interests to various providers



Source: Deloitte

Many of the services also involve repeated interactions, allowing providers to maintain and update individual profiles. For example, online retailers use browsing histories, items viewed, time of day, registration information, purchase and return history to infer individual preferences.[113]

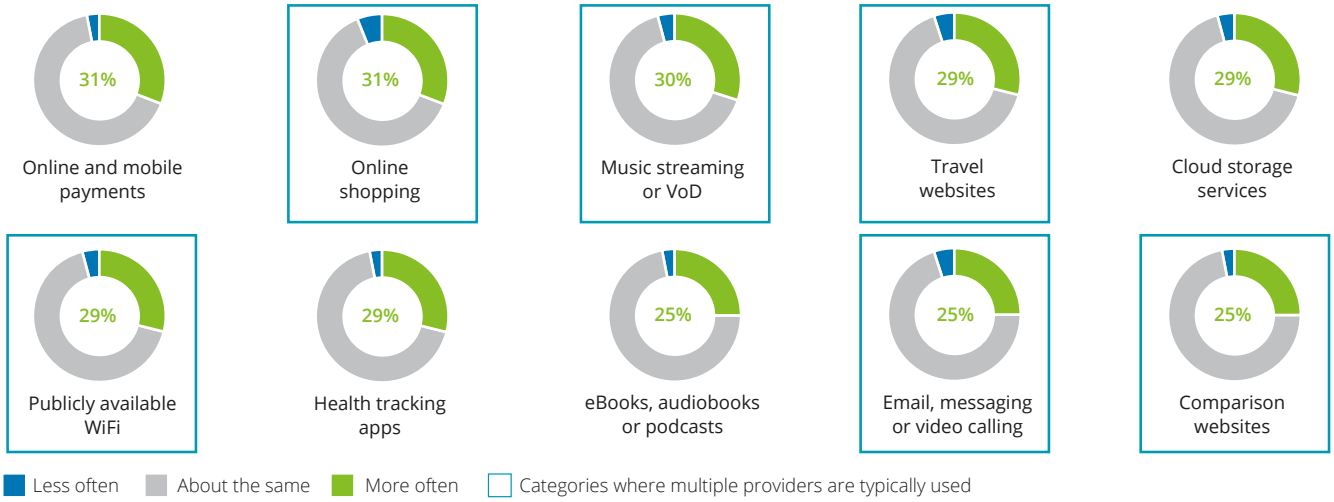
Even where the types of data and the context vary, organisations may achieve similar insights about their users.

3.1.3 Data relationships are likely to broaden further in the future

Individuals expect to make greater use of a range of digital services

Survey responses indicate that a significant proportion of individuals expect to make more use of services that involve data generation or sharing in the future, while only a small minority of individuals expect their use of any particular service to decrease. Responses are notably skewed towards increasing, rather than decreasing, use of services, even though it may be difficult for people to anticipate such changes.

Figure 29. Categories where individuals are most likely to expect increasing use over the next five years



Source: Deloitte Data Relationships survey (2017). Weighted base = 6007. All countries. 'Don't know' responses excluded

Use is reportedly most likely to increase for a variety of digital services, including services that are already widely used, such as online shopping, as well as services that are still relatively new but gaining popularity, such as health tracking applications. This suggests that users will create more data across providers in all of these sectors as their use intensifies. In sectors such as online shopping and music or video streaming, where multiple providers are typically used, several providers may see usage and data volumes increase.

Changes in usage could also lead to the number of data relationships expanding further. Responses from both current users and non-users of services show a tendency towards increasing future use, suggesting that more people are likely to adopt digital services that are still gaining popularity, establishing data relationships with new providers.

Responses are notably skewed towards increasing, rather than decreasing, use of services, even though it may be difficult for people to anticipate such changes.

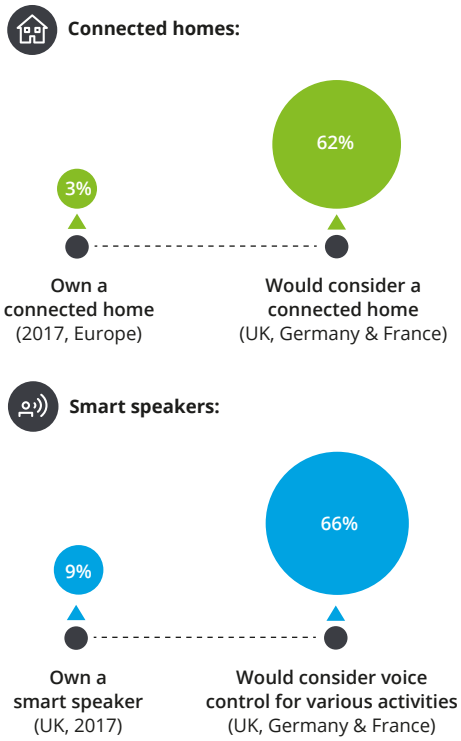
Use of new devices is expected to contribute to increased data generation

> "*The average rate per capita of data-driven interactions per day is expected to increase 20-fold in the next 10 years as our homes, workplaces, appliances, vehicles, wearables, and implants become data enabled.*"
>
> IDC (2017), 'Data Age 2025'

The development and adoption of new IoT devices also has the potential to increase data creation both across individuals' existing data relationships and as a consequence of new data relationships. For example, wearables are now reportedly owned by almost 10% of individuals in the EU4[114] and 12% plan to buy one in the next year.[115] Similarly, smart speaker use in the US is estimated to have more than doubled in 2017, reaching around 35 million.[116]

IoT devices may strengthen user engagement with digital services that they already use, but they could also introduce individuals to new services from other providers. One smart speaker reportedly already offers around 15,000 third-party applications.[117] Other connected home devices are also seeing wider adoption and involve generating detailed data, with a variety of applications that users may choose to use.

Figure 30. IoT adoption and potential future use

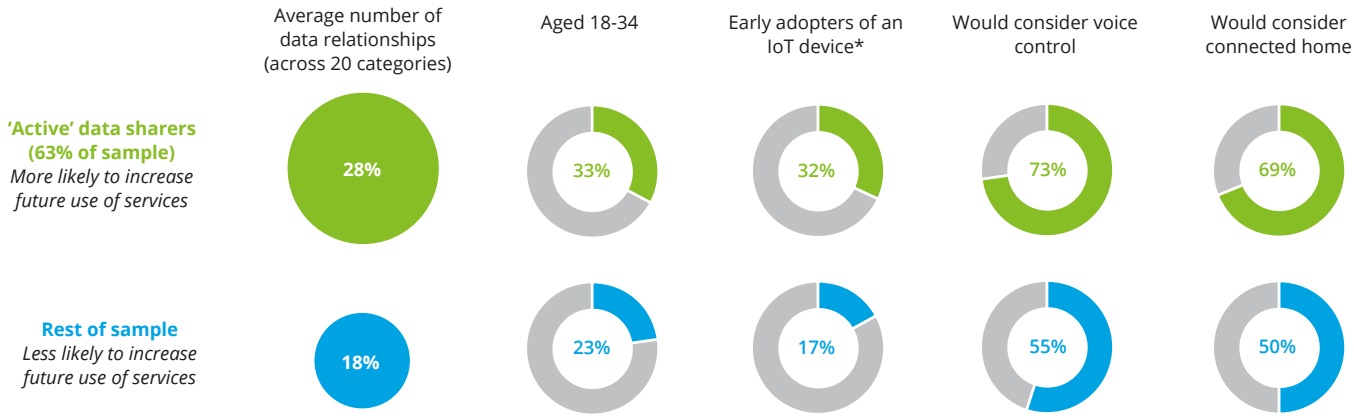


Source: RadioCentre (2017), 'Getting vocal'; Berg, 'Smart homes and home automation'; Deloitte Data Relationships survey (2017).

'Active' users are most likely to create further proliferation of data relationships

'Active' users – typically younger people – are driving data growth across a broad range of data relationships. These individuals are defined as those who are particularly likely to increase future use of services. They already hold a significantly wider range of data relationships than other people, and through higher use of IoT devices and digital services, this group is likely to make the largest contribution to future data growth, creating more data across a wide range of providers.

Figure 31. Profile of 'active' data sharers

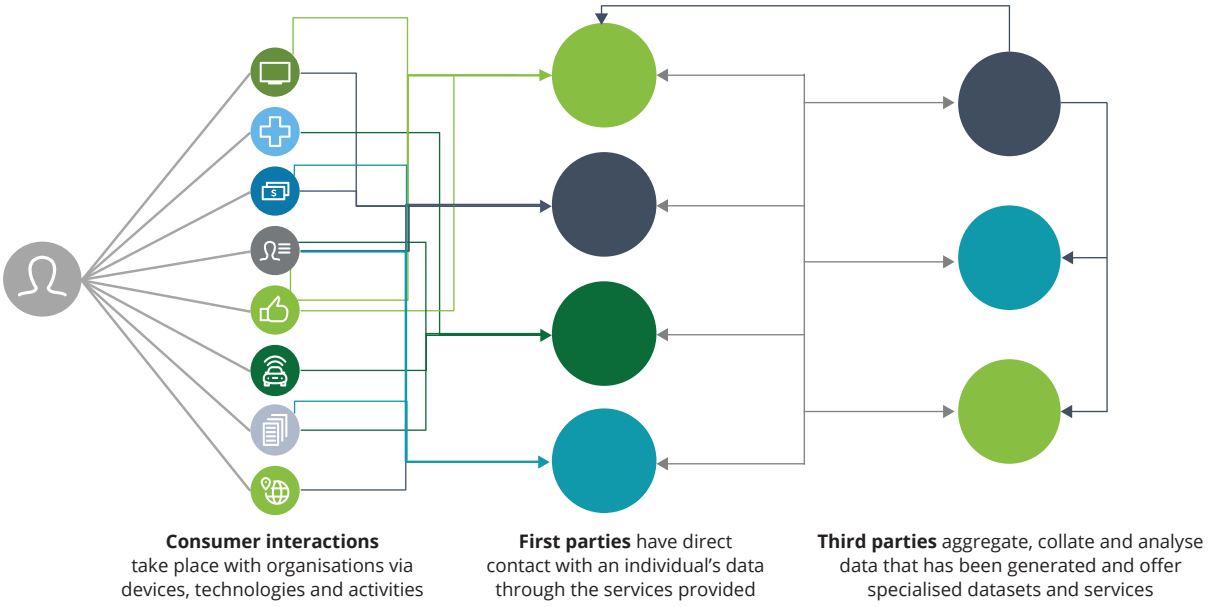


Source: Deloitte Data Relationships survey (2017). Weighted base = 6007. All countries. Future use of services excludes 'Don't know' responses. *Includes wearables, AR/VR devices, smart speakers, smart security devices or other connected home devices.

3.2 A wide ecosystem of organisations is capturing and analysing data

A wide ecosystem of data collectors, aggregators and analytics companies has emerged to support the process of data collection and use. As noted by the OECD, "*a global data ecosystem is emerging in which, more than ever before, data and analytic services are traded and used across sectors and across national borders*".[118]

Figure 32. The global data ecosystem



Source: Deloitte analysis

Individuals create data with retailers, service providers, device manufacturers, application developers and public bodies alike as they interact directly with them. However, there may be further data flows, as these organisations may share data with other parties as part of delivering services to the customer, for such purposes as completing transactions, checking credit scores or preventing fraud, or to receive specialised services such as data analytics, customer database maintenance, market research or other expert advice. Data may also be shared externally for other reasons; for example, private companies may share data externally in anonymised or aggregated form for the purposes of research and governments release various types of data as open data for commercial and non-commercial re-use.

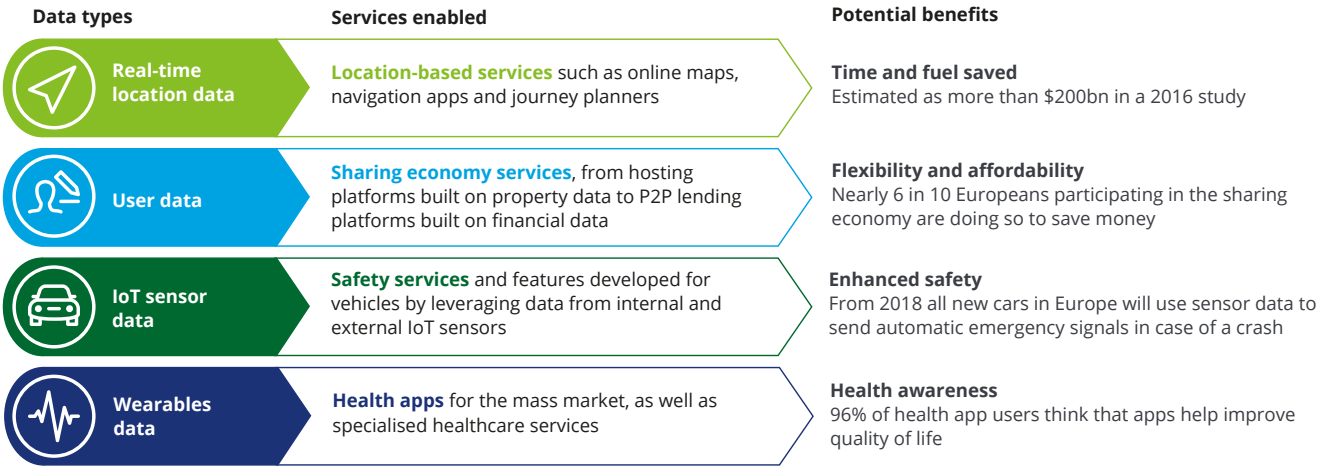
Overall, a range of third parties now exist to make data more widely available by licensing or exchanging data and insights. Various types of organisations are involved in aggregating, collating, and analysing data from various sources, for example credit reference agencies; fraud prevention agencies; demographic modelling providers; data brokers; lead generation providers; open data portals; price comparison websites and switching services.[119]

The availability of external data sources may allow organisations to enhance their own datasets. Third-party providers in the private sector offer data and insights to support a variety of activities, from understanding the decision-making process and preferences of individuals, to preventing fraud or improving the effectiveness of their marketing activities. This may take the form of tailored analysis and bespoke data sets for specific clients, or standardised datasets and tools available to all. For example, third party firms are helping organisations to learn from online discussions of their brands or products (sometimes referred to as 'social listening', 'opinion mining' or 'sentiment tracking').[120]

3.3 Through data, individuals can receive personalised or improved services

Where data is generated by interacting with organisations, it may be used in combination with digital technologies to enable new services that would not otherwise be possible.

Figure 33. Examples of services enabled by data



Source: Deloitte analysis; McKinsey Global Institute (2016), 'The age of analytics: Competing in a data-driven world'; ING (2015), 'International Survey: Mobile banking, new technologies and financial behaviour'; European Commission (2015), 'eCall in all new cars from April 2018'; Research Now (2015), 'US Survey, mHealth Apps: Supporting a Healthier Future'.

While new services built on data offer a range of potential benefits to users, there could also be risks associated with the introduction of new services and technologies. Therefore, it may be necessary for appropriate safeguards to be put in place, mitigating specific risks while still allowing the potential benefits to be realised. As an illustration in the context of the examples above, this might include measures to: protect passenger safety in the event of any system failure when 'smart' safety features are in place; minimise the risk of data security breaches when users provide biometric data; maintain service quality levels in the sharing economy; and ensure that appropriate access to 'traditional' in-person health care remains possible as new devices and applications are increasingly adopted.

Data about individuals is also frequently used to create profiles that allow various forms of personalisation. For example:

	Online shoppers can customise certain products before buying and may benefit from sophisticated personalisation tools that offer tailored recommendations, which reportedly can reduce the need for shoppers to return products by 10-70%.[121]
	Users of the music streaming service Spotify receive a personalised 'discover weekly' playlist. More than 40 million people listened to this playlist within a year of launch.[122]
	Users of video streaming service Netflix receive personalised recommendations based on AI and machine learning technology. Netflix can reportedly predict the next shows its subscribers would enjoy, with 85 – 90% accuracy.[123]
	Online blogs, social media platforms and content providers can offer a personalised experience based on user preferences. For example, Pinterest provides users with a personalised 'home feed' based on the users' stated interests.[124]

As data relationships expand and deepen, with new technologies developing in parallel, the data being generated has the potential to enable new services and solutions. Technologies such as artificial intelligence and machine learning can become more accurate and sophisticated as data volumes grow, creating opportunities for innovative services to be built around data. Virtual personal assistants may offer convenient and intuitive services, and virtual agents could improve user experiences across sectors such as retail, utilities, health care and education.[125]

> *"More data – the world creates about 2.2 exabytes, or 2.2 billion gigabytes, of it every day – translates into more insights and higher accuracy because it exposes algorithms to more examples they can use to identify correct and reject incorrect answers"*
>
> McKinsey Global Institute (2017), 'Artificial intelligence: the next digital frontier?'

Online blogs, social media platforms and content providers can offer a personalised experience based on user preferences.

4. Conclusion

Declining IT costs, rapidly improving connectivity, innovative devices and technologies has provided people with access to a variety of digital services across all sectors. As a result, individuals are routinely generating and providing data as they interact with different types of organisations, receiving enhanced or personalised services in many cases. Organisations of different types and sizes are using data to innovate, gain insights and improve business processes.

The diversity of data relationships across economic sectors means that a wide variety of data is being created. A unique feature of the digital economy is that it allows individuals to generate and share data seamlessly through everyday use of digital services and devices. As people engage with these, they are likely to reveal similar information about their characteristics and interests across a number of different providers, whether this is done through the purchases they make, the web pages they browse, the searches they make, the applications they download or the content they engage with. This information helps organisations to innovate, improve service delivery and personalise the user experience. Measures to protect individual privacy and data security will continue to play an important role to ensure that data generation and use is aligned with individual preferences.

The proliferation of data relationships appears set to continue in the future, as new devices and digital services are perpetually developed and launched to meet demand for greater connectivity and convenience. This exponential growth in data represents a substantial opportunity for data to enable innovation across all sectors of the economy, including through technologies such as IoT, AI and machine learning, which appear likely to see participation from a broad set of players including manufacturers, operating systems, third-party developers and service providers across sectors. The role that data can play in innovation looks likely to increase over time, as data skills and capabilities improve across organisations and as the wider ecosystem evolves to offer ever superior tools and solutions for organisations to use data.

Annex: Country breakdown of survey results

For reference, this annex presents results of the Deloitte Data Relationships survey split by country, showing the estimated average numbers of 'data relationships' across different categories.

Table 1. Average number of providers used (among users of each service) below shows the average number of providers that are used by the users of each service.

Table 1. Average number of providers used (among users of each service)

Category	UK	Germany	France
Applications to track my health, fitness, training or sleep	1.9	1.9	3.0
Cloud storage services	1.7	1.7	1.9
Credit/debit cards, whether used online or offline	2.4	2.1	3.4
eBooks, audiobooks or podcast platforms	1.7	1.7	2.0
Electronic transport cards	1.3	1.4	1.5
Email, instant messaging or video calling	2.5	2.5	2.7
Financial comparison websites registered with to receive personalised quotes	2.3	2.2	2.0
General web browsing	2.0	2.3	2.2
Loyalty cards	3.2	2.2	3.6
Music streaming and video-on-demand services	2.7	2.3	2.0
News websites, forums or other online sources of information that require registration	3.3	4.7	4.4
Online and mobile wallets, online money transfer services or peer-to-peer lending	1.7	1.6	1.5
Online dating	2.2	2.4	1.9
Online gambling	2.7	3.0	3.3
Online games	4.7	3.2	4.4
Online shopping	5.3	4.9	5.3
Publicly available WiFi	2.8	3.6	3.6
Social or sharing platforms (social networks, blogging platforms, professional networking and collaborative economy services)	3.4	3.8	5.2
Subscription(s) to newspapers or magazines (print editions)	1.5	1.9	1.9
Websites for planning or booking travel/holidays	3.4	3.3	2.6

Table 2 opposite shows the average number of providers used by the average individual based on the total sample, taking into account that each service is only used by a subset of all individuals.

Table 2. Average number of providers used (total sample)

Category	UK	Germany	France
Applications to track my health, fitness, training or sleep	0.5	0.3	0.4
Cloud storage services	0.6	0.5	0.5
Credit/debit cards, whether used online or offline	2.3	1.7	3.2
eBooks, audiobooks or podcast platforms	0.5	0.3	0.2
Electronic transport cards	0.2	0.2	0.2
Email, instant messaging or video calling	2.1	2.2	2.2
Financial comparison websites registered with to receive personalised quotes	1.1	0.8	0.2
General web browsing	1.6	1.7	1.6
Loyalty cards	2.4	1.2	1.8
Music streaming and video-on-demand services	1.3	0.8	0.6
News websites, forums or other online sources of information that require registration	1.2	1.4	1.2
Online and mobile wallets, online money transfer services or peer-to-peer lending	0.7	0.7	0.3
Online dating	0.1	0.2	0.1
Online gambling	0.5	0.2	0.4
Online games	1.2	0.9	0.9
Online shopping	4.6	4.1	3.9
Publicly available WiFi	1.1	1.0	0.9
Social or sharing platforms (social networks, blogging platforms, professional networking and collaborative economy services)	2.4	2.3	2.8
Subscription(s) to newspapers or magazines (print editions)	0.2	0.4	0.4
Websites for planning or booking travel/holidays	2.0	1.5	1.1
Weighted base	*2002*	*2002*	*2003*

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Notes

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