Report for SAS

The Value of Big Data and the Internet of Things to the UK Economy

February 2016

Making Business Sense

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Authorship and acknowledgements

This report has been produced by Cebr, an independent economics and business research consultancy established in 1992. The report's authors are Cebr Director Oliver Hogan, Senior Economist Laura Holdgate and Economist Rajini Jayasuriya. The views expressed herein are those of the authors only and are based upon independent research by them.

The report does not necessarily reflect the views of SAS.

London, February 2016

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EXECUTIVE SUMMARY

Cumulative value of big data + IoT to the UK economy from 2015-2020

£322bn **£54bn** **2.7%**

The value of big data and the Internet of Things (IoT) epitomise the power of information. Big data is enabling organisations to collect and analyse data in new ways, helping to transform businesses, industry, government services and people's lives. It refers not only to the size of the data sets, but also to the speed at which the data is created and analysed, along with the variety of tools or data analytics solutions that can be used.

Added to the capabilities of big data is the new power in the IoT. The IoT refers to devices and objects that collect and transmit data via the Internet. The opportunities posed by the IoT are expansive, and they have the potential, just like big data, to revolutionise the way businesses and governments operate, and the way people live.

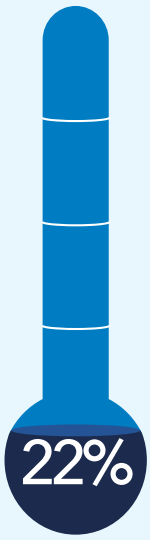
It is becoming increasingly apparent that for the full potential of big data and the IoT to be realised, both technologies should be used together. The IoT provides a tool through which the most interesting and relevant data can be collected. However, just collecting data is not enough. Big data analytics solutions offer insights into how this data can be interpreted, enabling decision makers in business and government alike to reach meaningful conclusions and decisions that support business success. Likewise, more informed decision making by government could lead to better and more targeted policy.

This report details the findings of research undertaken by the Centre for Economics and Business Research (Cebr) on behalf of SAS. The objective of the study was to examine the value of big data and the IoT to a range of specific industries and to the UK economy as a whole. This report builds on the findings presented by Cebr's 2012 report "Data equity: Unlocking the value of big data". It presents updated estimates of the value of big data across the original time period examined (2012–2017) but is based on real data revealed through a survey of businesses and government. We compare our findings on this basis with the findings of the entirely assumptions-based analysis carried out for the first report.

The study then looks to the future, presenting estimates of the value of big data between 2015 and 2020. Further, we account for more recent developments by considering the potential value of the IoT over the same time period.

The combined economic value of big data and the Internet of Things

Equivalent to...



OVER A 5TH OF THE UK'S NET PUBLIC DEBT 2014-15

or

2X NHS EDUCATION & DEFENCE BUDGET COMBINED IN 2015

Over the next five years (2015 to 2020), our estimates suggest that the value to the UK economy of big data analytics and the IoT combined could accumulate to £322 billion (expressed in 2015 prices) (see Table 1). This is roughly equivalent to an average of £54 billion per year, or **2.7% per year of annual GDP between 2015 and 2020.** This is equivalent to **twice the size of the combined education, NHS and defence budgets** for 2014–2015, and **over one-fifth (22%) of the size of the UK's net public debt** (of c. £1.5 trillion in 2014/15).

In 2015, we estimate the economic benefit of big data and the IoT to total £46 billion (2015 prices), equivalent to about 2.1% of GDP. The economic value of big data and the IoT is expected to grow as the use of big data analytics by businesses becomes more prevalent, and as adoption of the IoT rises. **By 2020, we expect the combined contribution of big data and the IoT to reach £62 billion** (2015 prices), or 3% of GDP.

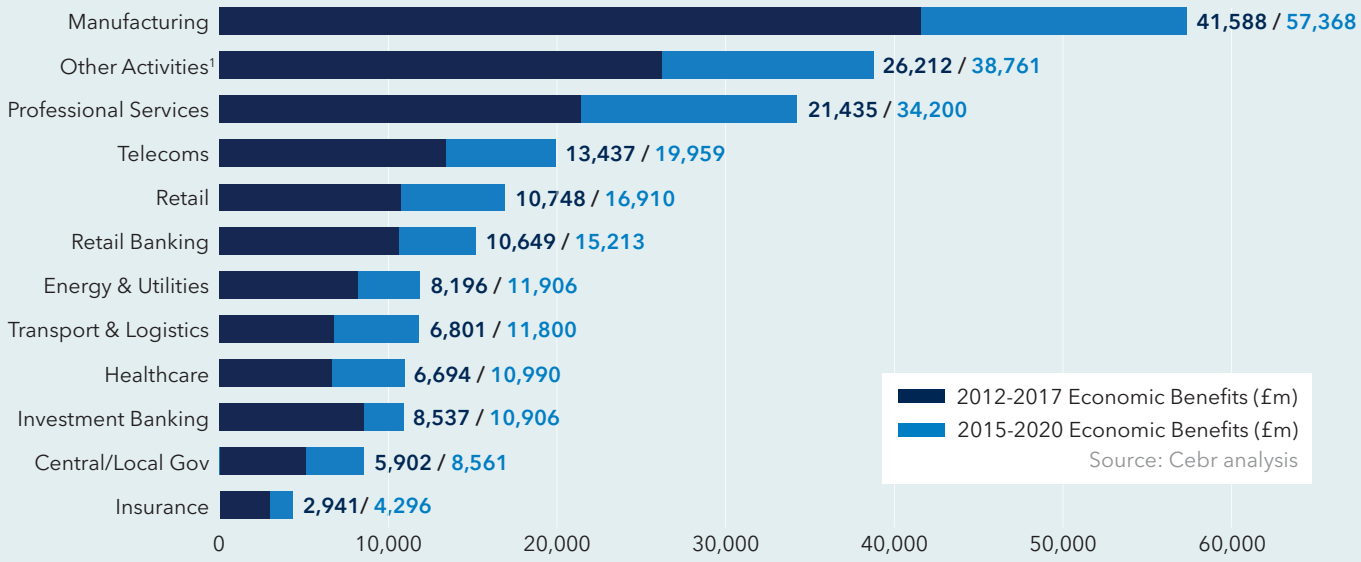
Table 1: Combined economic benefits of big data and the IoT 2015 & 2020, and cumulative 2015–2020

Comibined impacts of big data and the Internet of Things	2015 Economic benefits (£m)	2020 Economic benefits (£m)	2015–2020 Cumulative economic benefits (£m)
Absolute GDP contributions	46,124	61,814	322,211
% contribution to GDP	2.1%	3.0%	2.7% (avg. p.a.)

Source : Cebr analysis

Economy-wide benefits of big data

Figure 1: 2012–2017 and 2015–2020 Cumulative economic benefits of big data analytics to industry, £m, 2015 prices



Driving the combined economic benefit of £322 billion between 2015 and 2020 is the value generated through big data analytics. Table 2 illustrates that between **2012 and 2017, the benefits of big data and the analytics solutions that unlock those benefits are expected to total £162 billion, or on average £27 billion per year.** This is approximately **1.4% of annual GDP.**

From 2015 to 2020, we estimate the total benefit to the UK economy of big data analytics to amount to £241 billion, or £40 billion on average per year. This is equivalent to an average of **2.0% of GDP.** The growth in the value of big data analytics over time is a function of the rising rates of big data adoption across industries. **In 2012, the value of data equity was estimated to equate to £12 billion** (2015 prices) or 0.7% of GDP. As more businesses adopt big data analytics, gains made through efficiency, innovation and business creation accumulate. **By 2020, the value of big data analytics is expected to reach £46 billion** (2015 prices) or 2.2% of GDP.

Table 2 also illustrates the mechanisms through which the total benefits of big data analytics are accrued.

Table 2: 2012–2017 and 2015–2020 Cumulative economic benefits of big data analytics, £m, 2015 prices

	2012–2017 Economic benefits (£m)	2015–2020 Economic benefits (£m)
Efficiency benefits	145,521	220,373
Innovation benefits	8,341	12,416
Creation benefits	8,470	8,082
Total data equity benefits	162,331	240,870

Source: Cebr analysis

As illustrated by Figure 1, the **industry expected to accrue the greatest economic benefits from big data is manufacturing.** The total value of big data is expected to accumulate to £57 billion by 2020 for this industry. This can be **attributed to the diversity of firms in the industry, and the variety of areas in which efficiency gains achieved through the use of big data and big data analytics can be made**, such as improved supply chain management and enhanced customer intelligence.

Economy-wide benefits of the Internet of Things

Figure 2: 2012–2017 and 2015–2020 Cumulative economic benefits of the Internet of Things to industry, £m, 2015 prices

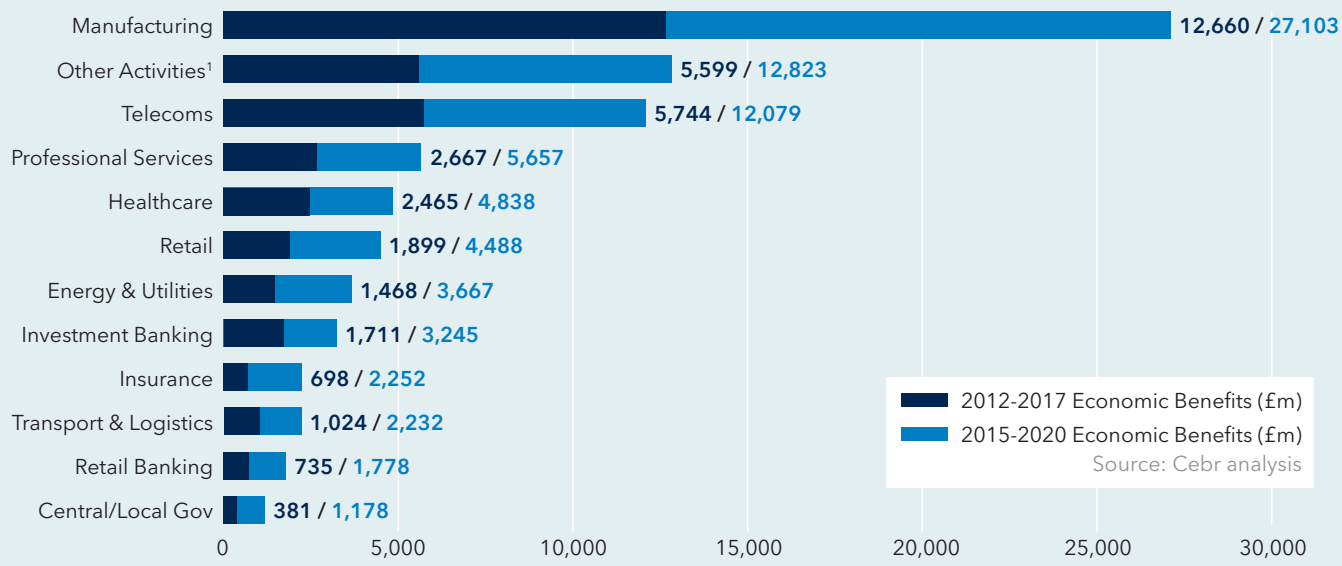


Table 3 displays the total economic benefit predicted to arise from the use of the IoT. **Over the time period 2015 to 2020**, the total **benefit of the IoT** is expected to total **£81 billion**, equivalent to an **average of £14 billion per year, or 0.7% of annual GDP.** Currently, the adoption of the IoT is still low among industries, similar to the levels of big data adoption assumed in our 2012 study. We estimate that **in 2015, the value of the IoT is roughly equal to £13 billion** (2015 prices). However, as adoption rates rise, and businesses benefit from efficiency, innovation and creation gains, the value of the IoT is predicted to increase. **By 2020, the economic benefit of the IoT is expected to rise to £16 billion** (2015 prices), representing a 0.8% share of forecasted GDP.

Table 3: 2015–2020 Cumulative economic benefits of the Internet of Things, £m, 2015 prices

	2015-2020 Economic benefits (£m)
Efficiency benefits	72,540
Innovation benefits	4,504
Creation benefits	4,297
Total IoT benefits	81,341

Source: Cebr analysis

As is the case with big data analytics, **the manufacturing industry is expected to experience the greatest economic benefits from use of the IoT, accumulating to £27 billion by 2020** (Figure 2). Similarly, we expect central/local government to accrue the lowest economic benefit across the period 2015 to 2020, reflecting the relatively low rate of IoT adoption during this time.

[1]Other Activities captures all of the industries that do not fall under the defined sectors in the tables. These include: agriculture, mining, construction, food & beverage services, accommodation services and other service activities (creative arts & entertainment, sports activities and household activities).

Adoption of big data and the Internet of Things

Big data analytics

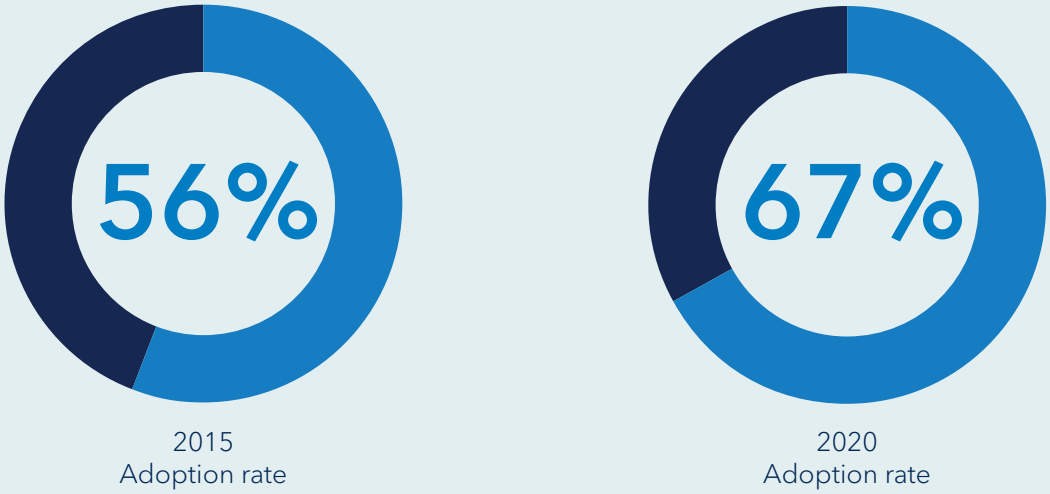


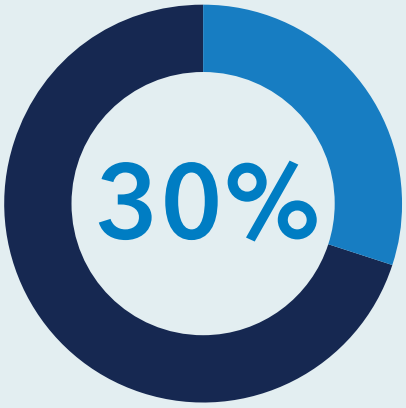
Figure 3: Current (2015) and future (2020) adoption rates of big data analytics and the Internet of Things, average across all UK industries examined

Underpinning the economic value of big data and the IoT is the extent to which these tools have been adopted by businesses. We used information gleaned from survey responses to identify the current rates of adoption of big data, big data analytics and the IoT. We also used the findings of the survey to predict how these rates will develop up to 2020. The survey questions were designed to establish the proportion of businesses in an industry that are using big data and has implemented big data analytics solutions. Similarly, IoT adoption represents the proportion of firms in an industry that uses the IoT.

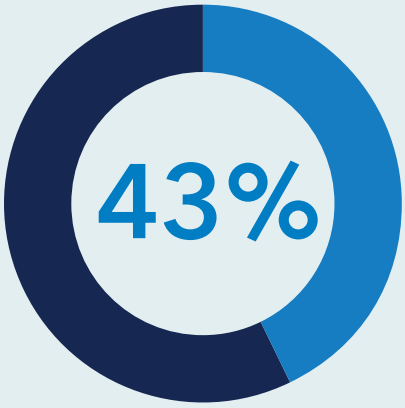
Figure 3 illustrates that, on average in 2015, **56% of businesses in the UK have adopted some form of big data analytics solutions**. By comparison, the adoption of the IoT stood at 30% in 2015. By 2020, the adoption of big data analytics is expected to rise to 67% on average, while adoption of the IoT is expected to increase to 43%.

The telecoms industry has the highest current rates of big data analytics adoption and IoT adoption at 67% and 61% respectively. However, by 2020, businesses in the **retail banking industry are expected to be the leaders in terms of big data**

Internet of Things



2015
Adoption rate



2020
Adoption rate

Source: Cebr analysis

analytics adoption, with the telecoms industry falling to fourth place.

But collecting and storing big data is only the beginning. It is the application of analytics solutions that allows business to harness the benefits of big data. To create an accurate picture of big data and IoT adoption in our economic modelling and analysis, we use a measure of adoption that takes into account the intensity with which businesses are using big data analytics solutions in each industry. To achieve this, we weight the proportion of businesses in each industry that have implemented big data analytics solutions, with an intensity rating based on the average number of solutions they have implemented. On average, the majority of firms have implemented between one and three big data analytics solutions. The measure of adoption used in our modelling therefore takes account of the intensity with which businesses are adopting and using big data in each industry.

INTRODUCTION

This is an update of the Centre for Economics and Business Research's (Cebr) 2012 study[2] , on behalf of SAS, that quantified the economic benefits of big data or 'data equity' to the UK.

This report not only provides an update to the original research, but also considers recent developments and trends in the realms of big data, including the Internet of Things (IoT), and the resulting benefits to the UK. economy.

1.1 What is big data?

In recent years, big data has become increasingly important to all kinds of businesses. Large volumes of highly detailed data from the various strands of a business provide the opportunity to deliver significant financial and economic benefits to firms and consumers. More data can lead to more accurate analysis, which can lead to better decision making, greater operational efficiencies, cost reductions and reduced risk.

Big data

In 2001, the now mainstream definition of big data was coined by Doug Laney. This defines the "three Vs of big data: volume, velocity and variety".[3] Volume refers to the amount of data, variety refers to the types of data, and velocity refers to the speed of data processing.

Big data enables businesses to make the most of both historic and real-time data that is generated through supply chains, production processes and customer behaviours. Those businesses that are able to identify the best ways to harness the impacts of big data are likely to experience benefits in terms of increased innovation and strong financial performance. Through these channels, big data is a way in which businesses are able to outperform their competitors.

Big data is often considered in relation to large firms, but SMEs can also use big data to better understand their customers and reduce costs across the business. Whilst big data collection and storage can be expensive due to the vast quantities of information involved, cloud computing can be used by SMEs as a solution to this problem[4]. As is the case for larger businesses, if SMEs fail to understand the importance of big data they may lose out to competitors who are using big data to gather insights with a view to improving performance. Therefore, big data can help businesses, both large and small, to maintain their competitive advantage.

Big data analytics

Big data analytics describes the software solutions that are used to handle big data. These solutions can include data mining, advanced analytics, data visualisation and in-database analytics.

Over time, the value of big data ('data equity') that can be unlocked through analytics continues to increase as a result of new technological innovations, including the IoT. The information collected through big data analytics can provide businesses with insights that enable them to make smarter and faster business decisions. It can reveal client preferences, market trends and inadequacies in supply chain processes. When the data is analysed to reveal these insights, the business user can then seek to capitalise on the resulting opportunities.

[2] Cebr (2012), "Data equity, unlocking the value of big data", London.
[3] ETA Group (2001), "3D Data Management: Controlling Data Volume, Velocity, and Variety," February 2001.
[4] Cloud computing refers to the practice of using a network of remote servers hosted on the Internet to store, manage and process data, rather than a local server or personal computer, i.e. renting computer power from an external provider when necessary to collect and store data

1.2 The Internet of Things

Since the last study was conducted, the IoT has become increasingly important and has grown in prominence. The IoT is essentially an extension of big data, linking smart objects to the Internet that are then able to share information and complete tasks. This growing number of smart, connected products can present opportunities to businesses by providing insights that can enhance productivity and increase revenue.

The more objects that are connected, the more powerful the IoT becomes. Embedded with sensors, actuators and communications capabilities, objects from bridges to packages being shipped are beginning to generate and transmit information on a massive scale and, in some cases, to adapt and react automatically to changes in the environment. The IoT includes ideas such as smart homes and connected appliances, as well as smart cities.

The IoT can help businesses in multiple different ways – from enabling them to get products to the marketplace faster to helping them adapt to regulatory requirements – as well as helping them to increase efficiency and to innovate, which fosters greater competition. Similar to big data, insights from IoT devices have the ability to yield substantial gains in efficiency for businesses, which lead to increased growth potential.

Where businesses use sensors on equipment, they are able to continuously monitor the performance of machines and schedule maintenance only when necessary. This can limit machine downtime, reduce maintenance costs and extend the lives of machines. In addition, spare parts can be ordered only when required, reducing the need to stockpile additional inventory and ensuring just-in-time replenishment. Furthermore, the IoT can change the way in which businesses compete. Connected products can provide insights into customer behaviour and help businesses adapt to preferences and demand.

However, just like big data, the IoT adds to the challenge for businesses of managing and making the most of such large amounts of information. Whilst it is important that a business has the appropriate technology in place, it must also have the ability to share data and make data-driven decisions, at the same time encouraging staff at every level to learn to interpret real-time data, and understand the power of the information it yields.

It is indisputable that business can gain a lot from the IoT, with those best able to manage the difficulties of implementation, and to make investments in the required systems and capabilities, set to gain the most.

1.3 Purpose and objectives of the report

This report is a refresh of Cebr's original research on the value of big data that was conducted in 2012. The objective of this report is to identify the value of big data that has already been 'unlocked' by organisations in the public and private sectors, and to forecast the further economic benefits that could be realised up to 2020.

Whilst the original study focused solely on the role of big data, this study goes beyond the scope of the Cebr (2012) report by considering the opportunities to businesses that are emerging through the growth of the IoT. Further, in contrast to the previous study, this report incorporates results revealed through primary research. By surveying businesses on their use of big data and the IoT, this report aims to paint an updated, more accurate picture of how big data and the IoT are being used, and of the benefits they are offering.

As with the original study, we consider the impact of big data and the IoT across each of the following sectors: retail banking, insurance, investment banking, retail, central government, healthcare, transport and logistics, telecommunications, energy and utilities, manufacturing, and professional services. These results are then aggregated to estimate the aggregate economic benefits that accrue from the use of big data and the IoT in the UK.

1.4 Approach, methodology and limitations

This report and the underlying study constitute an attempt to establish the gross supply-side impacts arising from the use of big data, the IoT and analytics solutions that allow the benefits of the resulting data to be harnessed by business. The report considers three sources of benefit: efficiency impacts, business innovation impacts and business creation impacts.

The business efficiency gains are based on what survey respondents indicated as the boost in turnover and reductions in cost that these businesses claim to have realised as a result of their investments in big data and the IoT. These efficiency gains reflect the ability of business to achieve more for less, which improves its performance and enhances its ability to add value to the economy. We consider six mechanisms through which the information and insights gathered through the use of big data and the IoT deliver these efficiencies, namely customer intelligence, supply chain management, quality management, risk management, performance management and fraud detection.

These direct efficiency benefits are the largest source of impact of big data and the IoT, but it is important to note a number of caveats around the estimates:

- Initial outlay not considered: the investment required by businesses to enable them to collect and store big data, to collect and store data from the IoT, and to run the analytics solutions required to harness the benefits of these data were not considered as part of our assessment.

- New business or business-stealing: neither was it possible to establish the extent to which increases in turnover reported by survey respondents is due to new business or just as a result of achieving a jump on competitors and stealing business from them. The latter would imply little net impact, whereas the former would produce a net boost. The reality is likely to sit somewhere in the middle.

The business innovation and business creation impacts are an attempt to measure some of the wider supply-side impacts that are likely to flow from the aforementioned efficiency improvements. Business innovation arises from the increase in retained earnings for investment in innovation and R&D, and the productivity impact that such investments can deliver. The business creation impacts arise from the boost to profits as a result of the business efficiency gains, and the signal this sends to potential new entrants. These new businesses create jobs and add further value to the economy.

At the same time, other potential impacts were beyond the scope of this report, including:

- The extent to which better performance and the resulting efficiencies are shared with employees through higher wages and salaries; the boost to consumer spending that this would provide; and the direct and multiplier impacts that this can generate.

- The extent to which greater profitability results in higher dividend payouts to shareholders; the boost to household consumption expenditure that this would likewise provide; and the direct and multiplier impacts that this would generate.

- Public sector savings that could be re-allocated to the public spending initiatives that are in most need of funding, or passed onto the public through lower taxes.

- The increased tax take from greater and more productive economic activity, and the possibility of contributing more to or to more public sector projects or, again, reducing rates of taxation.

Consequently, there are impacts that could be subtracted as well as added to the estimates presented in this report. On balance, therefore, we would say that these are reasonable estimates of the gross value of big data and the IoT to the economy. Net impacts are trickier to measure but would be expected to be lower for the reasons outlined in this sub-section.

1.5 Structure of the report

The report is structured as follows:

Section 2: Approach and methodology
Sets out how we have approached the study and the adjustments made to the previous methodology, both in light of the survey and the introduction of the new dimension of the IoT.

Section 3: Benefits of big data and the Internet of Things to business
Presentation of the survey results in terms of how big data and the IoT can benefit businesses.

Section 4: Current and prospective adoption rates
Using the survey results, we illustrate the current and prospective adoption rates that feed into the modelling of the economic benefits of big data and the IoT.

Section 5: The value of big data and the Internet of Things to the UK economy
Here we present the results of our macroeconomic modelling of the value to the UK economy of big data and the IoT.

APPROACH AND METHODOLGY

This study follows a similar approach to Cebr's original 2012 study which evaluated the impact of big data on the UK economy[5]. However, the Cebr (2012) report relied on the available literature at the time to form the assumptions underlying the calculation of the economic benefits. This time, the results of a survey are used to supplant, wherever possible, and complement, wherever necessary, the original assumptions. Furthermore, this study takes into account recent developments, specifically the possibilities arising from the growth of the IoT.

2.1 Overall approach

As in the original study, the 'data equity' valuation model analyses three broad sources of benefits which arise from the use of big data and the IoT: business efficiency gains, business innovation gains and business creation gains. Although distinct in their definitions, these gains are cut from the same cloth. Specifically, each of these efficiency gains propagates the other and, therefore, cannot be interpreted in isolation. These three sources of benefit are discussed in greater detail later in this section.

The modelling follows a three stage approach, which is briefly summarised below:

1: Identify the benefits of big data and the IoT to businesses
Here, we sought to understand the benefits of big data and the IoT at an enterprise level, focusing on three broad sources of benefit – business efficiency, innovation and creation impacts. These benefits were estimated using responses to the survey, alongside official data from the Office for National Statistics (ONS) and the Department for Business, Innovation and Skills (BIS).

2: Determine the current and prospective rates of adoption
We derived the adoption rates for both big data and the IoT from responses to our survey of businesses. This differed from

[5]Cebr (2012), "Data equity, unlocking the value of big data", London.

the original study, in which we were dependent upon existing research to assess industry 'potentiality', through which we estimated adoption. Our use of primary research in this study enables us to paint a more accurate picture of both current and future adoption of the technologies across sectors, based on the take-up of big data analytics, the number of solutions being adopted and the scope of their use.

3: Calculate the sector and economy-wide benefits of big data and the IoT

Once new enterprise-level benefits and sector adoption rates were established, the data equity valuation model could be updated. The model was refreshed with the most recent official data from the ONS and Cebr's in-house macroeconomic forecasts. From this, we generated estimates of the benefits of big data and the IoT at the industry sector level, as well as of the aggregate benefit to the UK economy as a whole. These estimates cover the period 2012–17 to provide a comparison with the 2012 study (on big data), as well as from 2015–20 to give an indication of the benefits that can be expected to arise from both big data and the IoT in the future.

2.2 Business efficiency gains

There are a number of 'channels' through which 'data equity' benefits are unlocked. As in the previous study, we consider six mechanisms through which the information and insights gathered through the use of big data and the IoT can help businesses to improve performance and add greater value to the economy. These channels, or mechanisms, allow firms to optimise their operations by, for example, reducing costs and/or expanding revenues. The six mechanisms we identify are as follows:

- Customer intelligence
- Supply chain management
- Quality management
- Risk management
- Performance management
- Fraud detection.

As an increasing number of firms across every industry sector successfully implements and utilises these six mechanisms, there will be resulting efficiency improvements that have the potential to enhance the international competitiveness of UK industries.

The Cebr (2012) report established which industries were likely to be the key beneficiaries of each mechanism through a literature review, and the development of a 'potentiality' index. For this study, the survey results inform these assumptions and allow a deeper understanding of the mechanisms through which industries benefit from big data. As a result, inevitably, the degree to which different industry sectors benefit from each mechanism varies compared with the previous study. This, including how businesses benefit from the new opportunities offered by the IoT, is set out in Section 3.

2.3 Business innovation gains

The study also considers the impact of big data and the IoT on firm innovation and new product development: arising through efficiency gains which lead to improved profitability and increased investment in R&D. As in the previous study, we quantify this by modelling the effect of an increase in data-driven R&D expenditure and the resultant impact on future long-term sales in each industry.

Both big data and the IoT can increase operational efficiency, which in turn enhances profitability. As a result of the increased profitability, businesses are able to reinvest profits in product innovation, which is informed by analytics. Therefore, big data and the IoT also have the potential to increase revenue by aiding the creation of new products.

Following the same methodology as the previous study, we establish the proportion of gross operating surplus (an approximation for profit) spent on R&D within each industry using the ONS' supply and use tables. R&D expenditure is defined as spending on research and development, and advertising and market research activities. The economic literature was used to identify the elasticity, or responsiveness, of industry's output to R&D investment. Those industries that demonstrate a higher elasticity are expected to experience greater returns from R&D investment and thus are more likely to harness the benefits of using big data and the IoT.

2.4 Business creation gains

Big data and the IoT can result in opportunities, and increase the incentives, for business creation. Barriers to entry are reduced through the efficiency benefits and the signals from those firms that are already harnessing the benefits of big data analytics and the IoT, about the availability of improved profitability. This enhances the incentives for businesses to enter new markets.

These new firms lead to further competition within the market, which has a positive impact on the UK's economic output and consumer welfare from increased competition, including lower prices for products and services, greater output and increased choice.

The business creation gains are based on quantifying the effects of big data and the IoT on the number of business start-ups. This value is calculated by estimating the productivity of SMEs, and by considering the impact of reduced barriers to entry that result from the efficiencies that accrue from big data analytics and the IoT.

2.5 Employment impacts

An increase in the number of new businesses can have a positive impact on employment. Furthermore, as big data and the IoT help businesses to realise efficiency gains, businesses may be able to increase their salary budgets as more money can be spent on wages in light of improvements in both productivity and profitability.

Big data and the IoT can also result in increased demand for employees in data-specific roles, for example software programmers and data analysts. This demand can be expected to continue to grow as businesses adopt more data-driven technologies and the IoT becomes increasingly prevalent across different industries.

2.6 Implications of recent developments and trends

Internet of Things

Unlike the previous study, this report presents the benefits to the UK economy and industries of the IoT as well as big data. The modelling for the IoT drew heavily upon the assumptions made for the initial big data modelling, as the IoT is essentially an expansion of big data.

As well as these key assumptions, the IoT model drew on the survey results to inform estimates of the current and future adoption rates, as well as the efficiency mechanisms through which some of the benefits of the IoT can be realised.

Therefore, the report presents two sets of results: one on the impact of big data and one on the impact of the IoT, both on industries and on the UK economy as a whole. As explained in later sections, these estimates should be viewed separately from one another.

Difficulties faced by firms implementing big data

In January 2015, McKinsey published an article,[6] stating that achieving the level of impact from big data that it foresaw in 2011 had proved difficult. The article highlights the key challenges faced by businesses in implementing big data analytics. Some of the issues noted by McKinsey (and other researchers) that have dampened the adoption of big data analytics are highlighted below:

- Data analytics leaders have faced challenges in terms of getting their senior teams to understand its potential and to have confidence in big data.
- Management approval processes have not kept up with the advancements in data analytics solutions. This can result in businesses falling behind.
- ·Analytics may lack focus or a clear business justification.
- Lack of robustness in analytics solutions.
- Difficulties in finding employees with the right skills.

We take account of these challenges to businesses and McKinsey's recent findings in the development of our modelling assumptions.

[6] See McKinsey & Company (2015), "Getting big impact from big data", January. Available at http://www.mckinsey.com/insights/business_technology/getting_big_impact_from_big_data

2.7 Modelling adjustments

Given that a survey was undertaken as part of this study, a number of adjustments have been made to the original 'data equity' model to accommodate this new evidence that was not available for the original study. Specifically, the survey has been used to produce more accurate estimates of the adoption rates and the business-level benefits from the efficiency mechanisms. These are the channels through which different industry sectors benefit from big data and the IoT, as detailed in Section 2.2. Each adjustment is discussed in more detail below.

Adoption rates

The survey undertaken for this research asked businesses a number of questions on their current and future expected use of big data and the IoT. From these it was possible to establish more accurate estimates of the take-up of both big data and the IoT across industries.

We use these adoption rates, adjusted to take into account the number of big data analytics solutions employed and hence the intensity with which big data analytics is used, in the model. These replace the adoption rate estimates in the original study, which were based on a combination of data from existing literature, as well as an industry 'potentiality' analysis. The adoption rates used in the model are discussed in greater detail in Section 4.

Efficiency mechanisms

The survey data are also used to adjust the previous efficiency mechanism assumptions. This differs from the original study, where the assumptions underlying the workings of the efficiency mechanisms were also based on a literature review. The survey has demonstrated that all industries have the capacity to benefit from all of the efficiency mechanisms, at least to some extent. This is quite distinct from the original study, in which the efficiency mechanisms were associated with only subsets of the industries. This was based on a judgement about which mechanisms would have most applicability to which industries.

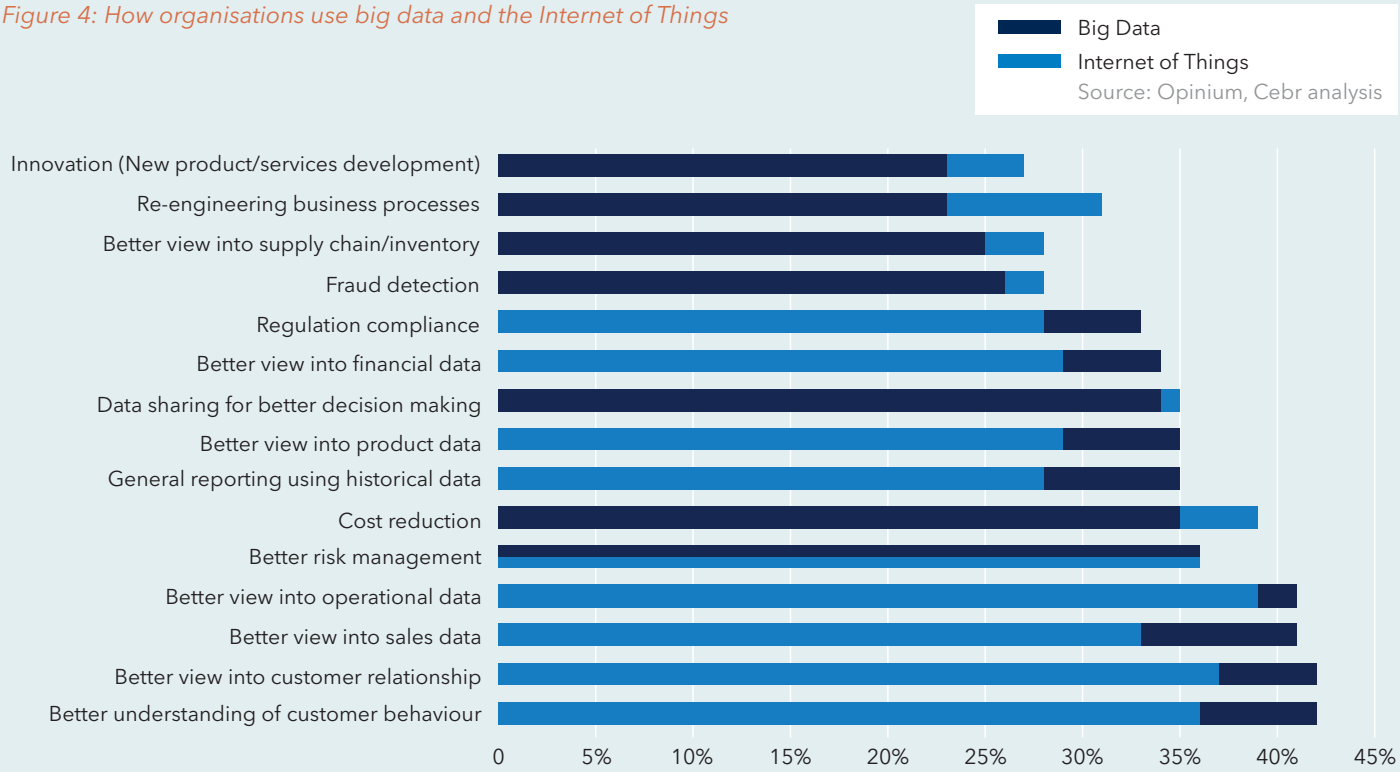
BUSINESS-LEVEL BENEFITS OF BIG DATA AND INTERNET OF THINGS

This section presents the findings of the survey carried out as part of this research, along with the data and methodologies used to identify and quantify the expected benefits of big data and the IoT to businesses. The symbiotic relationship between big data and the IoT means that there is potential for overlap between the benefits that accrue from their application. While our survey was designed to distinguish between the impacts of big data and the IoT, in reality their effects are likely to be intertwined.

As in the previous study, the benefits of big data were modelled to capture the ways in which businesses can achieve economic success – by increasing revenues, reducing costs, or creating new products and delivering other innovations. We apply the same methodology to identify the benefits that accrue from the IoT. As highlighted in the previous section, big data and the IoT can also reduce barriers to entry to markets and, as a result, encourage new entry. This can provide a further boost to competition and innovation to the benefit of businesses and consumers alike.

3.1 How businesses are using big data and the Internet of Things

Figure 4: How organisations use big data and the Internet of Things



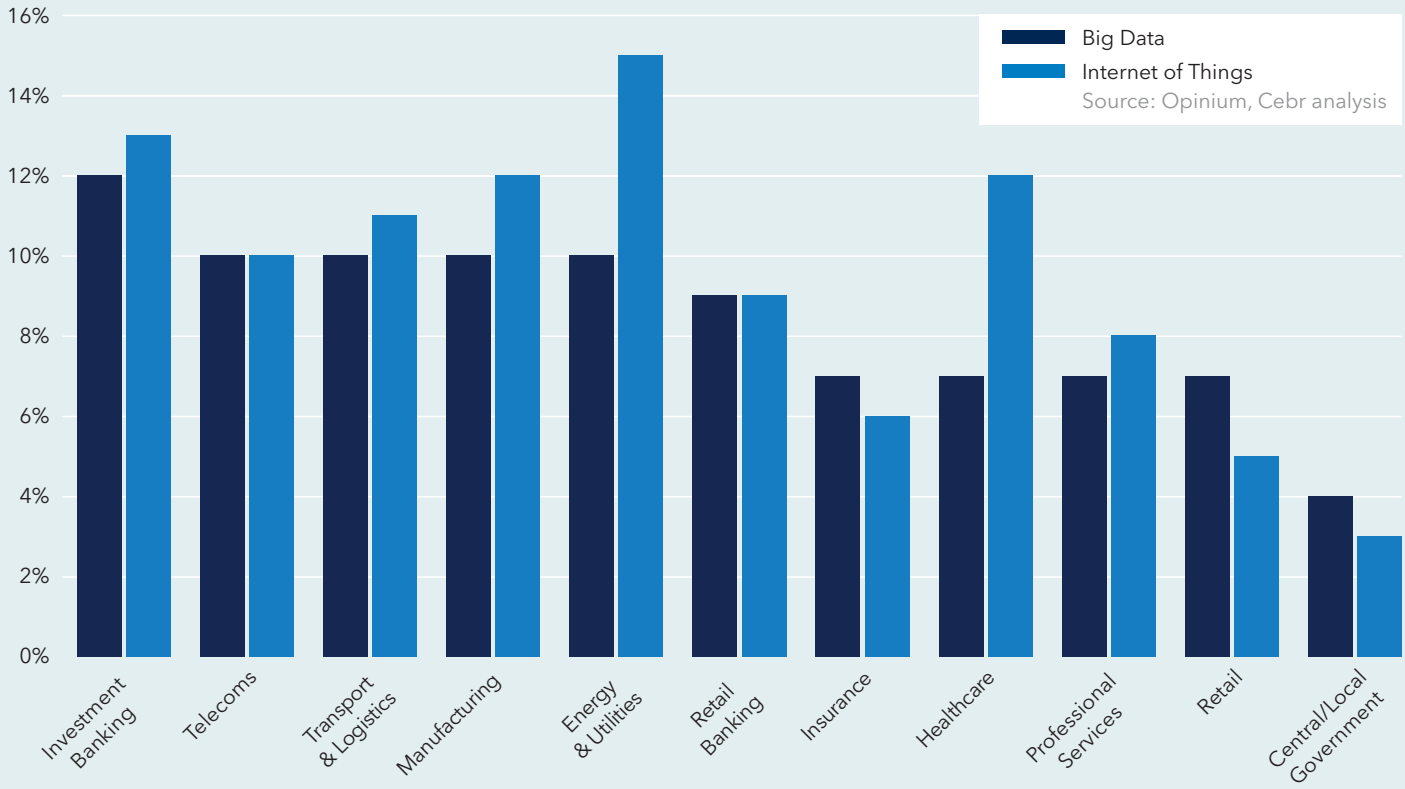
There are a number of ways in which businesses can use big data and the IoT. Popular examples include better customer intelligence, fraud detection and risk management.

Figure 4 illustrates the survey responses to the question of how organisations use big data and the IoT.

The data suggests that insight into customer behaviour is one of the most popular uses of big data, with over two-fifths (42%) of organisations stating that they use big data for these purposes. By comparison, a similar proportion of businesses (39%) tend to use the IoT to reduce costs and gain insight into operational data. The variety of ways in which businesses are using big data and the IoT is demonstrated by the absence of a use that is significantly more popular than all others.

3.2 Cost savings and revenue growth opportunities

Figure 5: Average increase in revenue by industry, as a result of big data and the Internet of Things

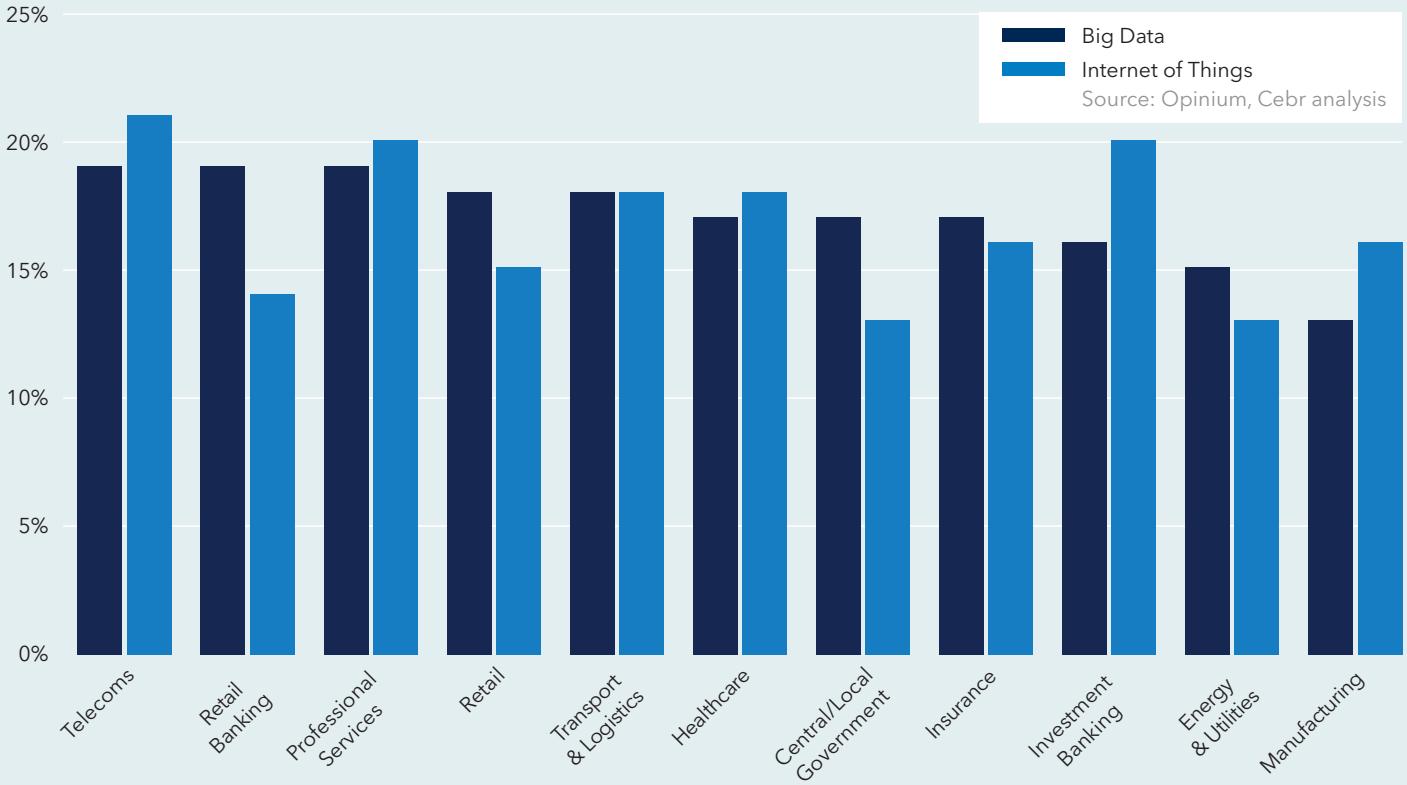


Big data and the IoT can lead to both cost savings and revenue growth for businesses. This results in increased business profitability. The survey undertaken for this study asked organisations across each industry to express how much their revenue had increased due to their investment in big data and big data analytics solutions. The same question was asked about the IoT, with the results for each presented in Figure 5.

The survey results reveal that 84% of businesses experienced an increase in revenue due to investment in big data, while a fraction more (85%) reported a boost in revenue from investment in the IoT. However, Figure 5 illustrates the revenue increase was more marked for certain industries compared with others. Investment banking reported, on average, a 12% increase in revenue as a result of investment in big data and a 13% increase in revenue due to investment in the IoT. Meanwhile, the impact on revenues in retail and central/local government was relatively less significant. Retail revenues increased by 7% due to big data and 5% due to IoT, and central/local government revenues increased by 4% and 3% respectively. It is also interesting that many industries report experiencing a greater increase in revenues as a result of the IoT than as a result of big data, with a marked difference between the two in healthcare, and the energy and utilities industries.

The survey also asked businesses about the cost savings achieved through the use of big data and the IoT. These cost savings can be achieved through, for example,

Figure 6: Percentage cost savings arising from investment in big data and the Internet of Things, by industry



reductions in input costs through supply chain analytics or a reduction in labour costs through quality management analytics.

The survey results reveal that 93% of businesses that have invested in big data have experienced a cost saving, while 91% of businesses that had invested in the IoT reported a reduction in costs.

Figure 6 illustrates the value of the cost savings achieved by different industries as a result of their investment in big data and the IoT. The percentage savings achieved through investment in big data is fairly similar across industries, with telecoms, retail banking and professional services experiencing the largest cost savings, at an average of 19%. The manufacturing industry reported the smallest cost savings, of approximately 13%.

Similar to the effects of big data, the cost savings achieved through investment in the IoT are less significant for some industries than others. For example, the retail banking, and energy and utilities industries report a cost saving of approximately 13%. Other industries, such as telecoms and investment banking have experienced greater cost savings through investment in the IoT. This discrepancy could be a result of the length of time businesses in these sectors have been using the IoT. The sectors experiencing the greatest gains could be doing so due to early implementation of the IoT compared with other industries, and could therefore be benefiting from first-mover advantage.

3.3 Product innovation

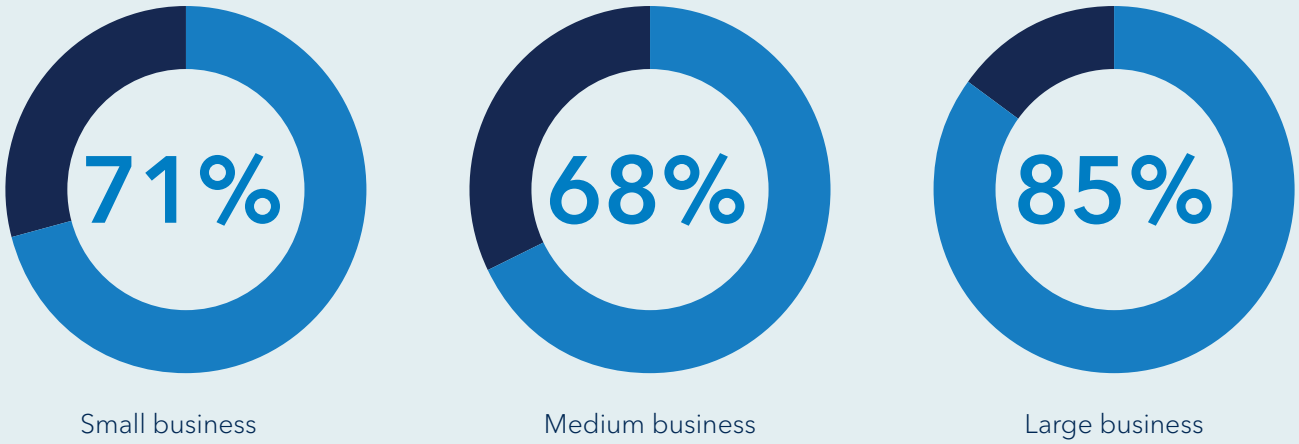


Figure 7: Percentage of respondents who think big data and the Internet of Things can help their organisation to innovate

Source: Opinium, Cebr analysis

As noted in earlier sections, big data and the IoT can help businesses to innovate. This occurs as a result of increased profitability – a direct result of the efficiencies that accrue from using analytics solutions. Businesses are able to reinvest the profits in product innovation, which in turn allows businesses to benefit from cost savings and boosts in revenue.

The survey asked respondents whether they considered there to be potential for big data and the IoT to help their organisations to innovate, with the results illustrated in Figure 7. Across all respondents, large businesses were most likely to say that big data and the IoT can help them to innovate (85%), compared with 71% of small businesses.

Across industries, all had a majority of respondents agreeing that big data and the IoT can help them to innovate. 89% of retail banking respondents reported that big data and the IoT can help their organisation to innovate, compared with 67% of businesses in the professional services sector.

3.4 Business creation

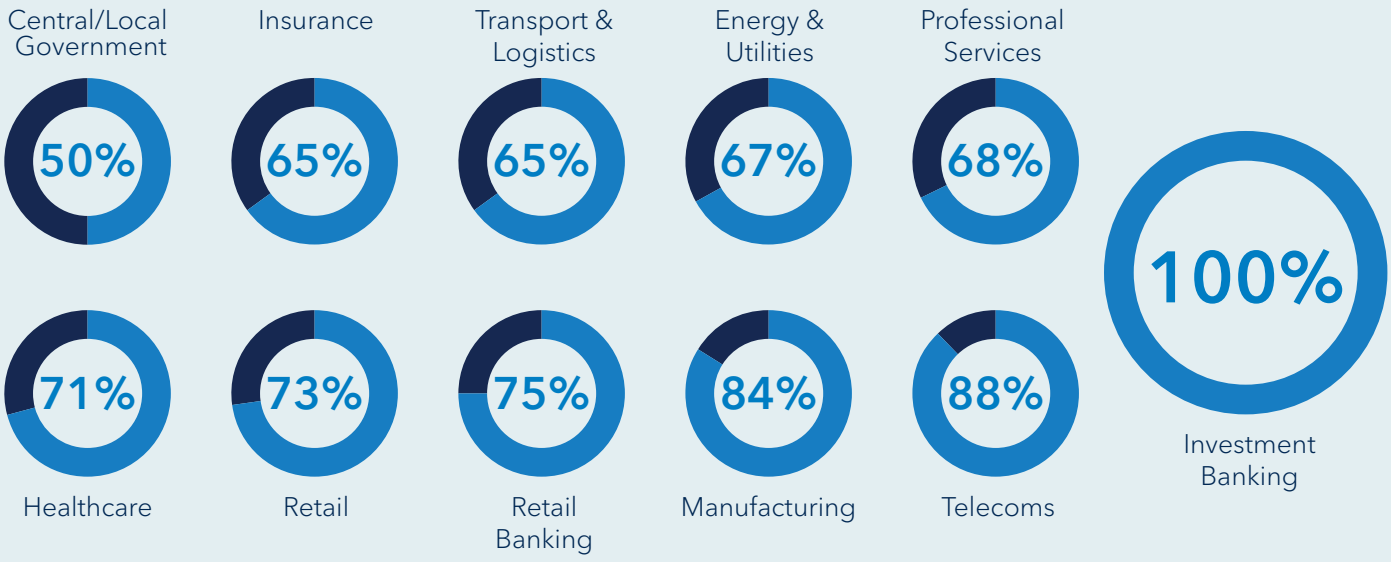


Figure 8: Respondents that say big data and/or the Internet of Things have helped the business enter or establish its market position

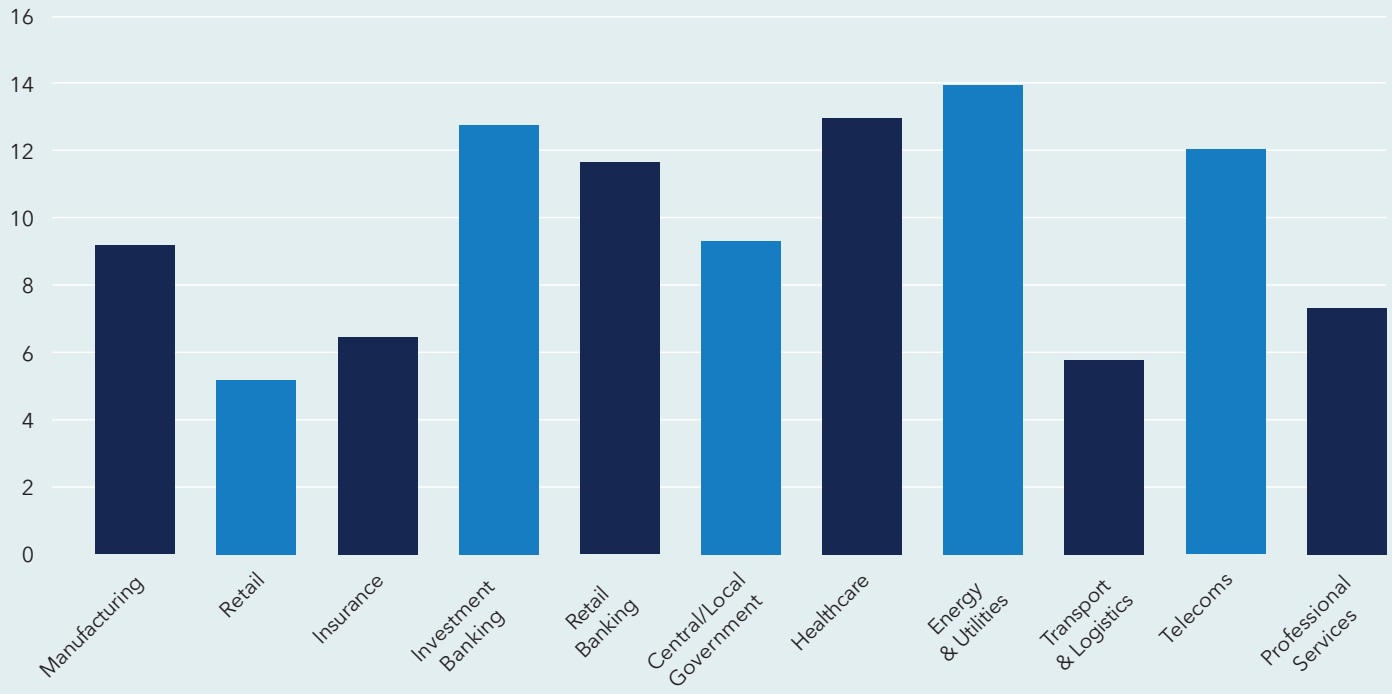
Source: Opinium, Cebr analysis

Big data and the IoT can also aid business creation, which in turn adds value to the UK economy through increased output and employment. The increase in profitability, which arises from the efficiency gains accrued from the use of big data and the IoT, can encourage further entrepreneurship and entry of start-up businesses to the market. This situation arises as the above-normal profit signals the potential for new entrants. New entry leads to greater competition and increased output, and benefits consumers through lower prices and greater choice.

The survey asked respondents to express whether big data and/or the IoT had helped their organisation to enter or establish their position in the market. Figure 8 illustrates the responses by industry. Across all industries, the majority of businesses agreed that big data and/or the IoT had helped them establish their market position. 100% of respondents in investment banking felt that this was the case, whilst only 50% of those in central/local government agreed. This supports the assertion that big data and the IoT can help business creation.

3.5 Employment

Figure 9: Average number of new jobs created per firm as a result of big data, big data analytics and the Internet of Things



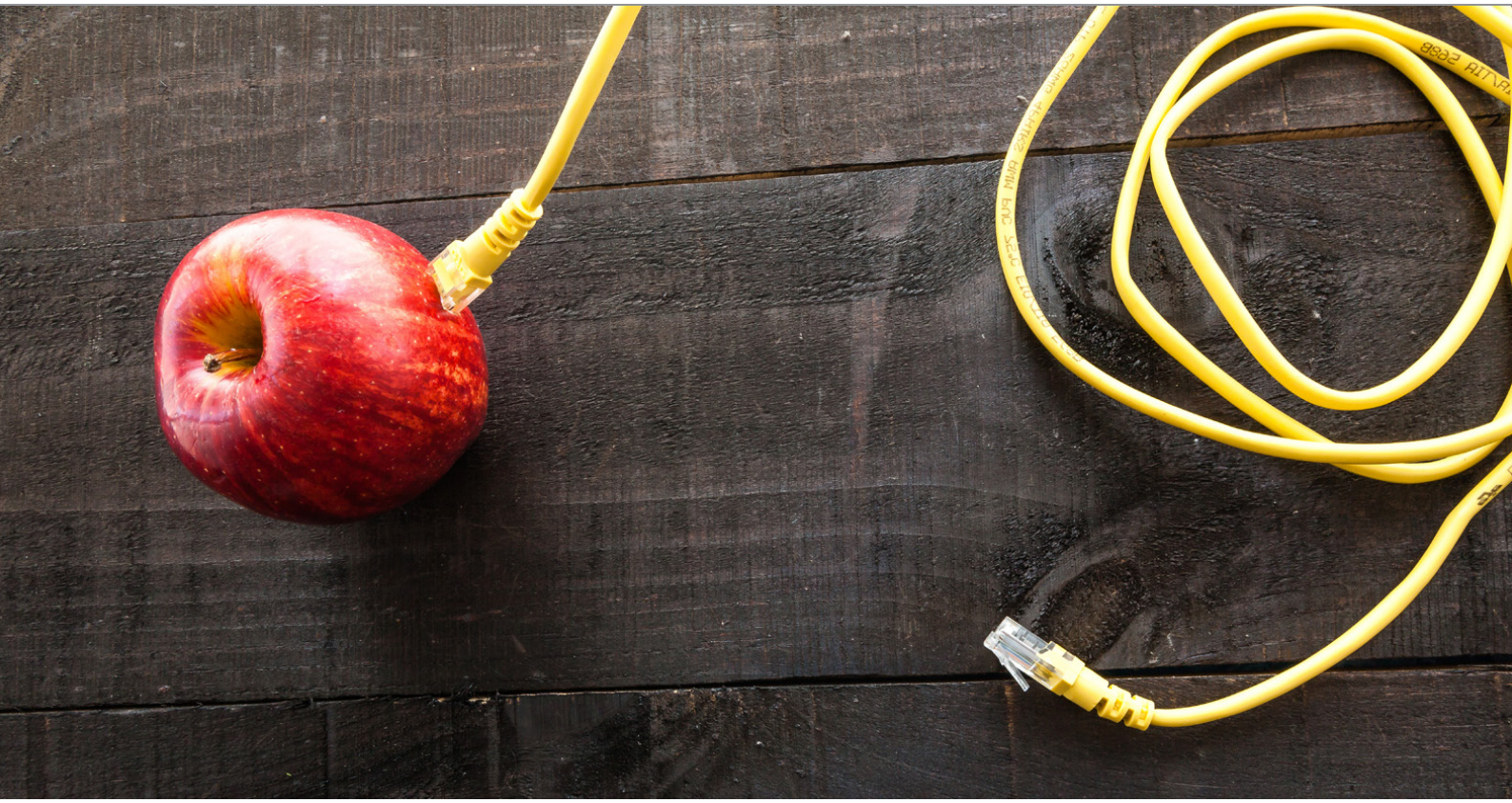
Source: Opinium, Cebr analysis

The increased business creation arising from the use of big data and/or the IoT will have a knock-on impact on employment. In addition, there is likely to be an increase in employment due to businesses needing to recruit specialists in the field of data analytics so as to fully utilise the data that they are collecting. Further, as firms expand and grow from the gains made through the use of big data and the IoT, other areas of the business are likely to require increased employment.

The average number of additional jobs created per firm in each industry as a result of big data and/or the IoT is illustrated in Figure 9. The energy and utilities industry experienced the largest average increase in jobs per firm, with each business increasing its employment by 13 people on average. By comparison, the retail industry experienced the smallest rise in employment, with each business hiring, on average, 5 more people as a result of big data and/or the IoT.


Resource > Your Chart
Business Chart - Visual
Business Chart
Interactive User
1,505
Space Usage (750 Mb)
18,321
Realtime Dashboard
37.91%
31.88%
Focus on Your Finances
Target

CURRENT AND PROSPECTIVE ADOPTION RATES



This section presents the findings from the survey as to the current and future patterns of adoption and use of big data, the IoT and big data analytics. The previous study relied on an assumptions-based assessment of prospective adoption rates for big data analytics across industries. This report, and the study that led to it, benefited from businesses' responses to our survey, which asked questions directly about current usage of big data, big data analytics and the IoT. The survey also requested from respondents a forecast of how this is likely to develop up to 2020. This report should therefore provide a more accurate snapshot of current and future adoption levels.

4.1 Current patterns of adoption

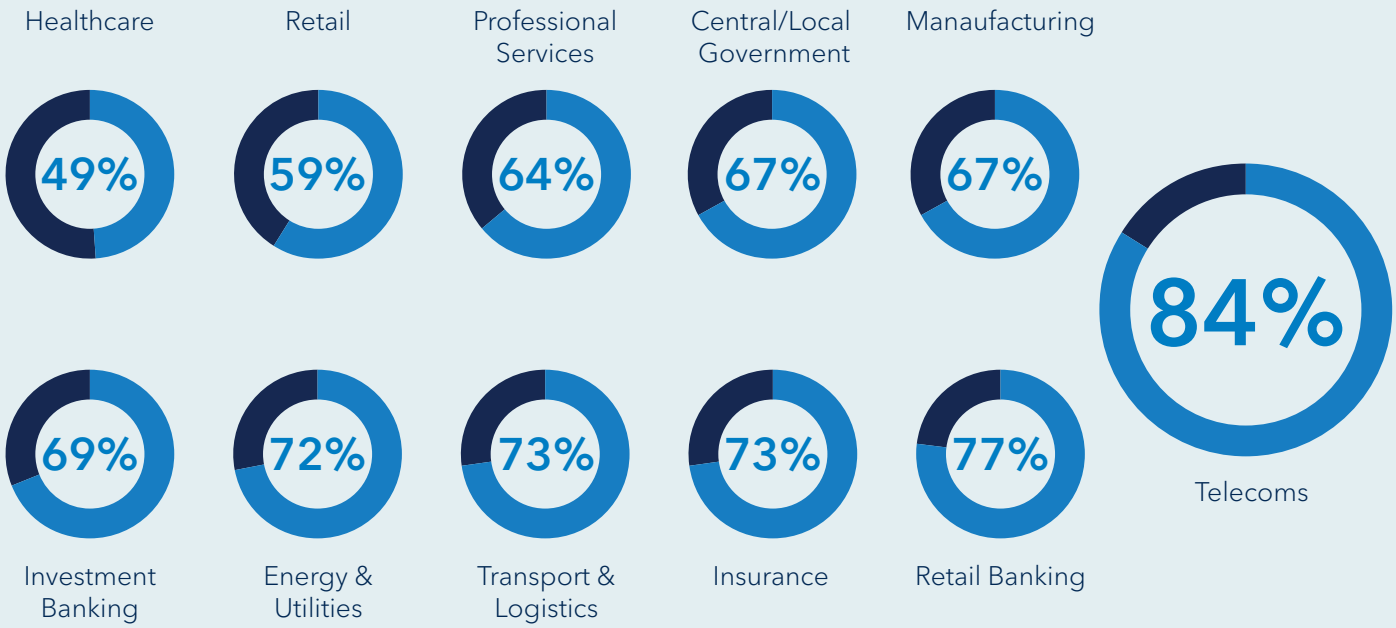


Figure 10: Organisations that collect and store big data

Source: Opinium, Cebr analysis

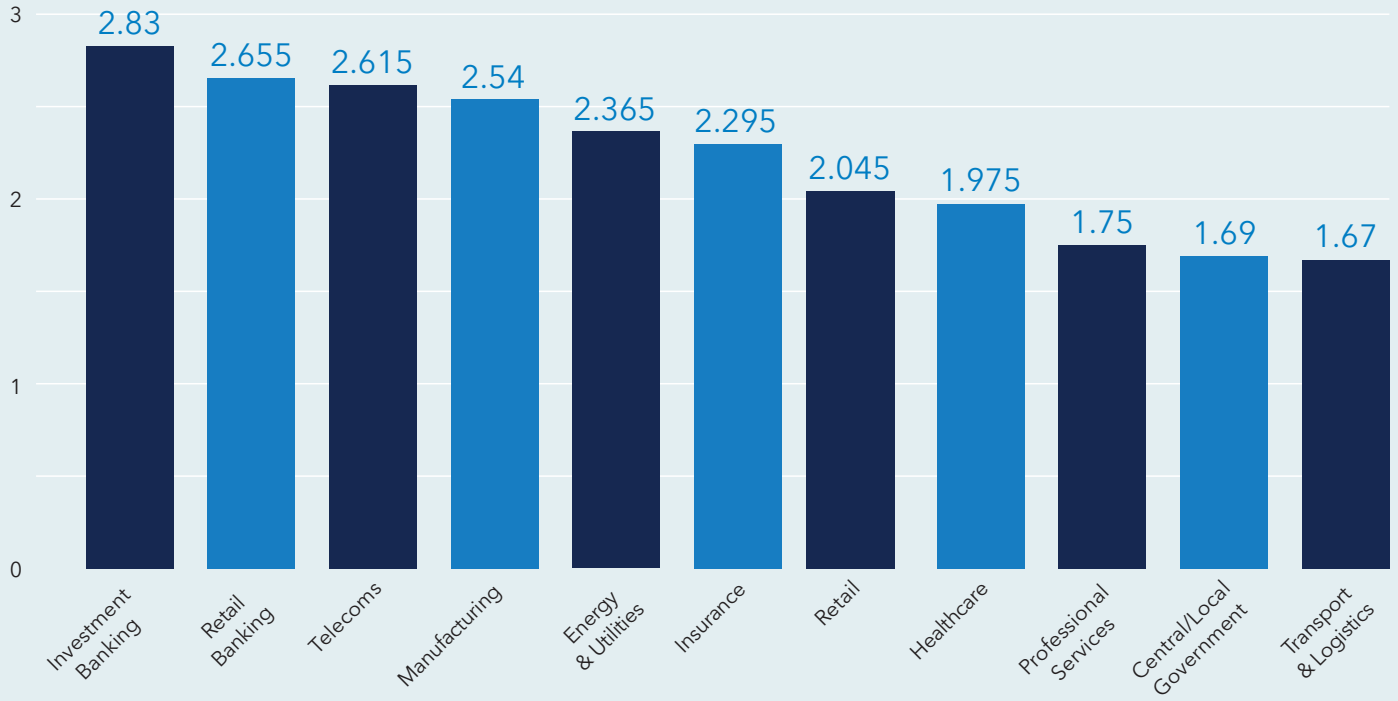
This sub-section presents the current rates of adoption of big data and the IoT across each industry, based on our survey results. For this purpose, 'adoption of big data' is defined as the proportion of businesses in an industry that has implemented big data analytics solutions. Similarly, we define the 'adoption of the IoT' as the proportion of firms that uses the IoT. Sectors with the greatest rates of adoption are likely to experience the greatest benefits as a result of using big data, analytics and the IoT.

Big data and big data analytics

Figure 10 illustrates the percentage of organisations within the various industries of interest that collect and store big data. From this it is evident that, across all industries, there is a high proportion of businesses that use big data. Telecoms is the most prevalent user, with 84% of businesses from this industry reporting that they collect or store big data. Meanwhile the healthcare industry reports just 49% of businesses collecting and storing big data.

Collecting and storing big data is only the starting point. It is the application of analytics solutions to these data that allows businesses to harness the benefits of big data (the 'data equity'). To create an accurate picture of the adoption of big data analytics solutions in our modelling, we have taken into account not only the proportion of businesses in each industry that have implemented such solutions, but also the number of analytics solutions they have implemented. Our measure of adoption therefore takes into account the intensity with which businesses are adopting and using big data in each industry.

Figure 11: Average number of big data analytics solutions implemented per business



Source: Opinium, Cebr analysis

The numbers of analytics solutions that have been implemented by firms within each industry of interest are presented in Figure 11. Across each industry, the majority of firms have implemented between one and three big data analytics solutions, on average.

Table 4 illustrates the 2015 adoption rates for big data analytics based on the results of the survey. This shows that on average, 56% of UK businesses are using some form of big data analytics. The table also demonstrates the differences across industries. Telecoms, and energy and utilities have the highest rates of adoption at 67%, whilst healthcare has the lowest rate of adoption at 36%. These adoption rates are quite significantly higher than those established through the assumptions-based approach used in the previous study. Some industries have moved up or down the rankings; for example, energy and utilities has a high adoption rate relative to other industries when it was comparatively lower in the previous study. The opposite is true of manufacturing.

Table 4: 2015 Big data analytics adoption rates

	2015 Big data analytics adoption
Telecoms	67%
Energy & Utilities	67%
Retail Banking	66%
Transport & Logistics	63%
Investment Banking	62%
Insurance	57%
Manufacturing	57%
Other Activities	56%
Professional Services	53%
Retail	48%
Central/Local Government	43%
Healthcare	36%
Whole of UK	56%

Source: Opinium, Cebr analysis

Table 5: 2015 Internet of Things adoption rates

	2015 Internet of Things adoption
Telecoms	61%
Energy & Utilities	41%
Retail Banking	35%
Transport & Logistics	33%
Investment Banking	30%
Insurance	30%
Manufacturing	29%
Other Activities	25%
Professional Services	21%
Retail	21%
Central/Local Government	14%
Healthcare	14%
Whole of UK	30%

Source: Opinium, Cebr analysis

Internet of Things

To identify industries' adoption of the IoT, we again use businesses' responses to our survey. The survey asked respondents across each industry whether they currently use the IoT. The adoption rates varied significantly by industry but, as with big data, telecoms had the highest adoption rate at 61%.

For modelling purposes, we apply the same intensity-based adjustment to these business adoption rates. The motivation is the same – it is not just whether a business has adopted and is using the IoT, but the intensity with which it is doing so. Because the analytics solutions are likely to be the same whether they are applied to big data or data from the IoT, we use the same big data analytics solutions intensity rating to give the 'adjusted' IoT adoption rates which we use in our modelling.

4.2 Growth potential

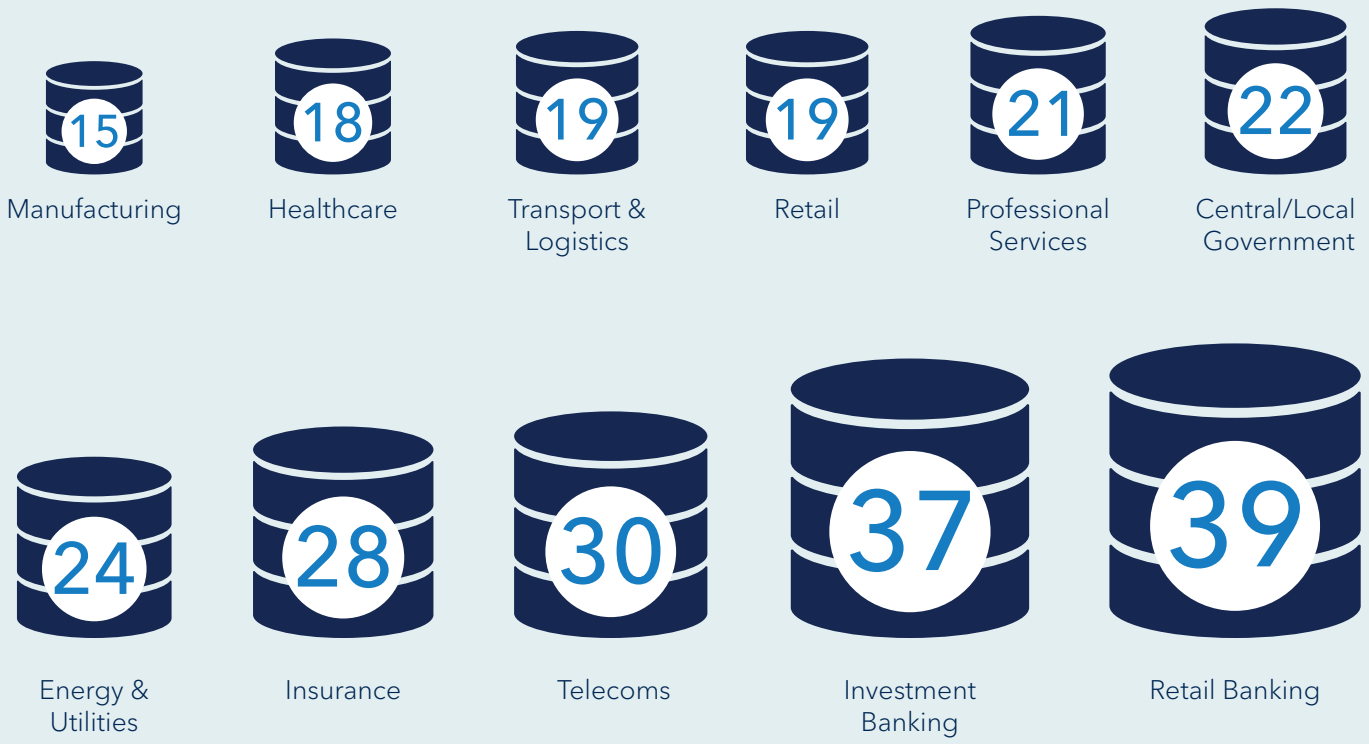


Figure 12: Average amount of data stored by businesses in the last 12 months, Terabyte (TB)

Source: Opinium, Cebr analysis

To inform our estimation of the future adoption rates, we considered the growth potential of big data and the IoT. This takes into account a number of different factors, from IT intensity to the level of investment made by businesses.

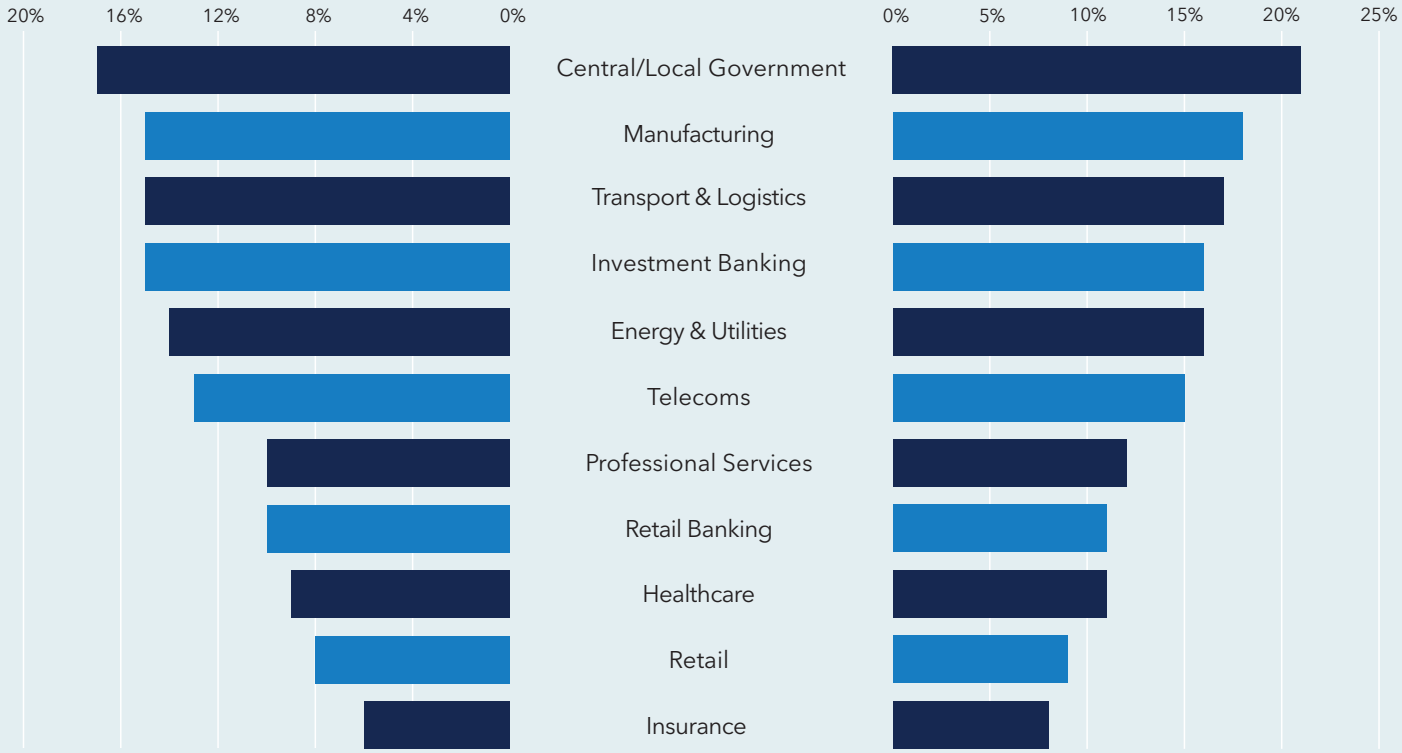
Amount of data stored

The amount of data stored per firm can be indicative of the big data intentions within each industry. Industries that store large amounts of data will be more likely to want to apply high-performance analytics solutions to them, if not now, at least at some point in the future. Figure 12 illustrates the average amount of data stored by businesses in each industry over the past 12 months.

These findings suggest that industries such as retail and investment banking, and telecoms are more likely to want to make greater use of big data in the future than other industries. Meanwhile, industries such as healthcare and retail appear less likely to be highly intensive big data users in the future. These survey findings are actually consistent with the conclusions drawn from the literature review that underpinned the previous study.

Figure 13: Organisations' average increase in investment in big data and the Internet of Things over the past year

Figure 14: Organisations' average expected increase in investment in big data and the Internet of Things over the next five years



Source: Opinium, Cebr analysis

Investments in big data and the Internet of Things

Over the past year, businesses report having significantly increased their investment in big data, the IoT and analytics solutions. Across all industries, less than 15% of respondents said that they had made no investment in the past year. Central/local government has made the largest average increase of 17% in investment over the last year. The retail and insurance industries saw investment increase the least, but still by a healthy 6–8%. All industries appear to be growing their capabilities in this area.

The survey results also suggest that many organisations expect to continue making investments in both big data and the IoT over the next five years. Once again, central/local government intend to make the greatest increases in investment, by 21%. One motivation for this increased investment in big data and the IoT could be a link with the Government's 'digital by default' initiative, which aims to offer public services digitally, making their access simpler, clearer and faster.

Other than government, the manufacturing, telecoms, transport and logistics, investment banking, and energy and utilities industries have investment growth intentions in the range of 15–18%. Future investment growth ranges between 8% and 12% for healthcare, professional services, retail banking, retail and insurance.

4.3 Future adoption rates

Figure 15: Future (2020) big data adoption rates, based on survey results

Source: Opinium, Cebr analysis

This section sets out the expected future adoption rates for both big data and the IoT, again based on our survey findings. Similar to the methodology used to estimate current adoption rates, we account for how we expect the intensity of adoption of big data analytics solutions to develop over time.

Big data

Our estimate of the future adoption rates for big data analytics is informed by the data collected through the survey responses. Specifically, the survey asked respondents whether they planned to implement big data analytics solutions in future. The findings are shown in Figure 15 and suggest that, on average across all industries, adoption will grow from 56% (Table 4) to 67% by 2020.

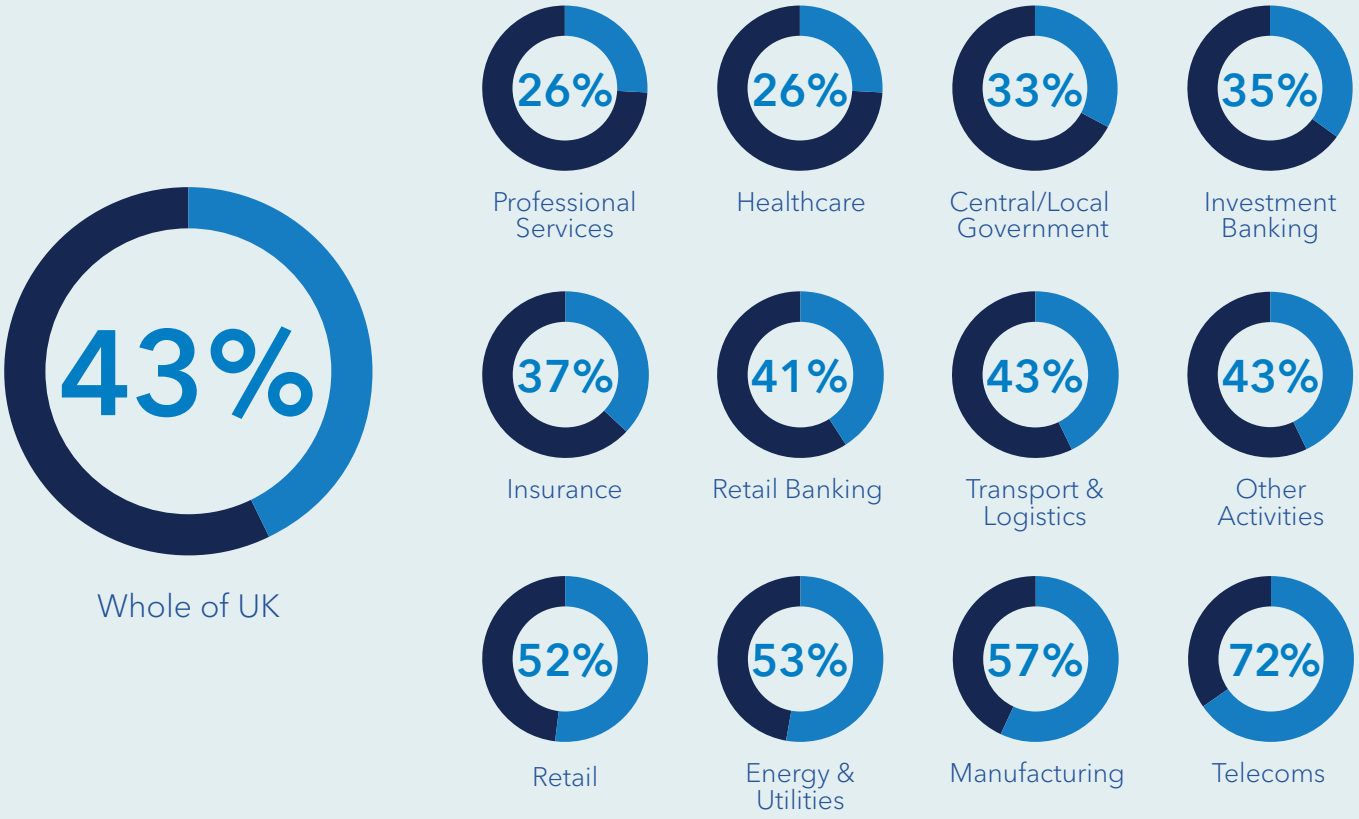


Figure 16: Future (2020) Internet of things adoption rates, based on survey results

Source: Opinium, Cebr analysis

Internet of Things

We also use the survey to inform our modelling assumptions around the future rates of IoT adoption. These future adoption rates are based on a survey question that asked respondents whether they plan to use the IoT over the next two years. Our estimates of the future adoption rates, based on these responses, are presented in Figure 16. Telecoms is expected to continue to be the highest adopter at 72%, whilst other industries such as professional services and healthcare are set to be lesser adopters at 26%. The most significant growth is expected in energy and utilities, and insurance.

VALUE OF BIG DATA AND INTERNET OF THINGS TO THE UK ECONOMY

In this section, we present our findings on the value of big data, the IoT and the analytics solutions applied to them to harness that value. We provide estimates for the UK as a whole and for the industries of interest.

We first present our aggregate value of 'data equity' and IoT estimates. Next we look at the how big data drives our aggregate estimate, before examining each of the efficiency, business innovation and business creation benefits that make up the totals. We then present a corresponding set of results for the IoT.

In the case of big data, we also present refreshed results covering the time period examined in the previous study, 2012–2017. We then look to the future, and reveal estimates of the value of big data and the IoT to industries and the UK economy between 2015 and 2020.

5.1 The combined economic value of big data and the Internet of Things

This sub-section presents our estimates of the aggregate value of big data analytics and the IoT. **Over the next five years (2015 to 2020), our estimates suggest that the value to the UK economy of big data analytics and the IoT combined could accumulate to £322 billion (expressed in 2015 prices)** (see Table 6). This is roughly equivalent to an average of £54 billion per year, or **2.7% per year of annual GDP between 2015 and 2020.** This is equivalent to **twice the size of the combined education, NHS and defence budgets** for 2014–2015, and **over one-fifth (22%) of the size of the UK's net public debt** (of c. £1.5 trillion in 2014/15).

Table 6: Combined economic benefits of big data and the Internet of Things, 2015 & 2020, and cumulative 2015–2020

Combined impacts of big data and the Internet of Things	2015 Economic benefits (£m)	2020 Economic benefits (£m)	2015-2020 Cumulative economic benefits (£m)
Absolute GDP contributions	46,124	61,814	322,211
% contribution to GDP	2.1%	3.0%	2.7% (avg. p.a.)

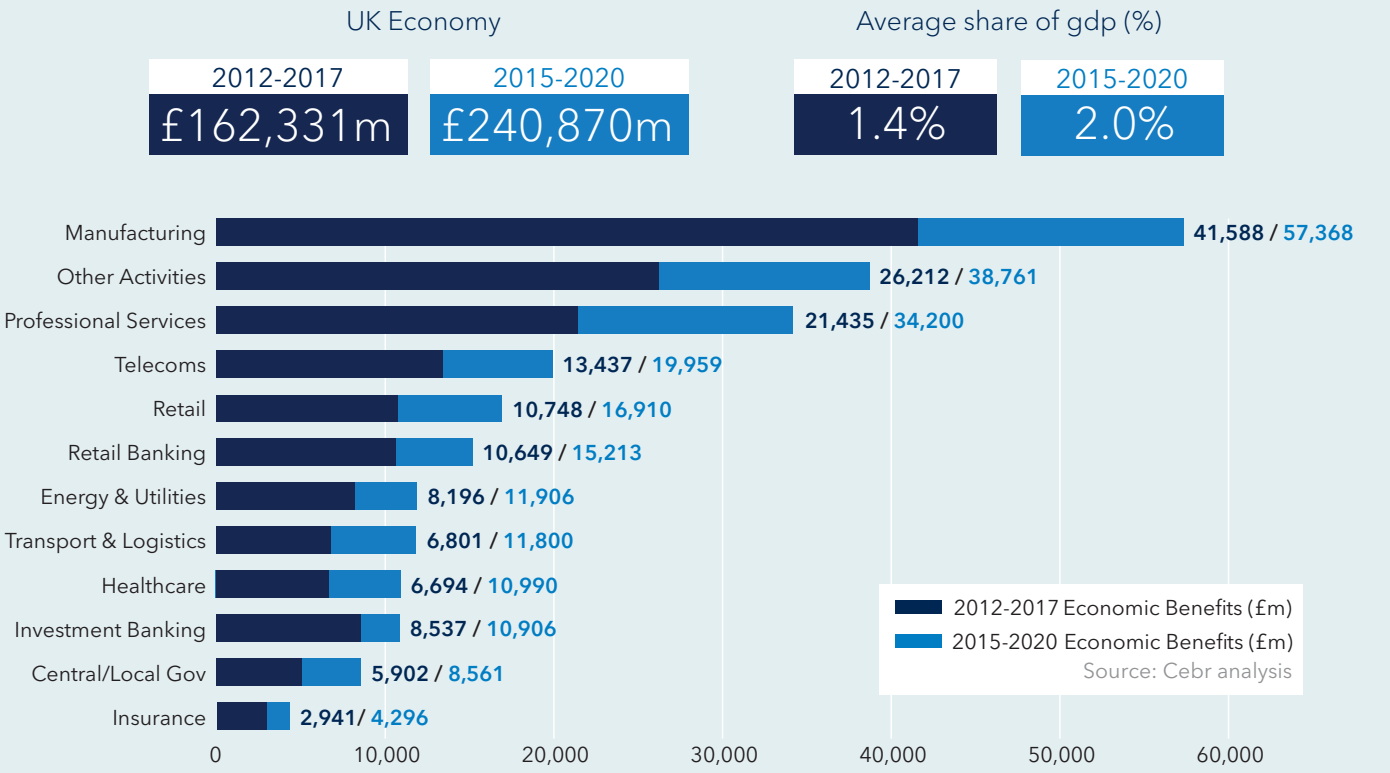
Source: Cebr analysis

In 2015, we estimate the economic benefit of big data and the IoT to total £46 billion (2015 prices), equivalent to about 2.1% of GDP. The economic value of big data and the IoT is expected to grow as the use of big data analytics by businesses becomes more prevalent, and as adoption of the IoT rises. **By 2020, we expect the combined contribution of big data and the IoT to reach £62 billion** (2015 prices), or 3% of GDP.

The remainder of this section presents our estimates of the components that make up the aggregate benefit of big data analytics and the IoT. We begin by discussing our estimates of the economic benefit of big data, before looking at the contribution made through the use of the IoT.

5.2 The value of big data

Figure 17: 2012–17 and 2015–20 Cumulative economic benefits of data equity by industry, £m (2015 prices)



Total 'data equity' estimates

In 2015, McKinsey stated that the level of impact expected from big data that it reported in its May 2011 report had proved difficult to achieve.[7] There are successful companies, such as Amazon and Google, where data analytics are the foundation of the enterprise. But, for most legacy companies, success in data analytics has been limited to a few tests or to narrow slices of the business, with very few firms achieving a significant impact from big data. McKinsey's survey found that three-quarters of analytics' leaders had achieved revenue or cost improvement through big data of less than 1%. This suggests that, while more businesses are storing big data, they are yet to utilise them to their full potential and are therefore yet to realise their full impacts. These findings are not inconsistent with the results of this study. When compared with the estimates presented in our previous study, there is a suggestion of a similar over-expectation in terms of the benefits of big data that could be realised in the 2012–2017 period.

Figure 17 sets out the cumulative economic benefits by industry of big data over the periods 2012–17 and 2015–20.

These benefits incorporate the efficiency, business innovation and business creation benefits, and the expected impact on job creation.

The differences between the original findings and those presented in this study are, at least in part, due to the fact that the calculation of the benefits is now based on information received through a business survey, as opposed to being founded on assumptions based on a review of existing literature, as in the original study. The other key factors are the differences in adoption rates and the newly introduced analysis of adoption intensity in this study.

Figure 17 illustrates that between 2012 and 2017, the total equity benefit of big data analytics is expected to total £162 billion, or on average £27 billion per year. This is equivalent to roughly 1.4% of GDP per year. This compares with the previous study's estimate of 2.5% of GDP per year. But this, again, is consistent with over-expectation and a consequent overestimation of the extent to which the benefits of big data could be realised, and is consistent with McKinsey's recent conclusions.

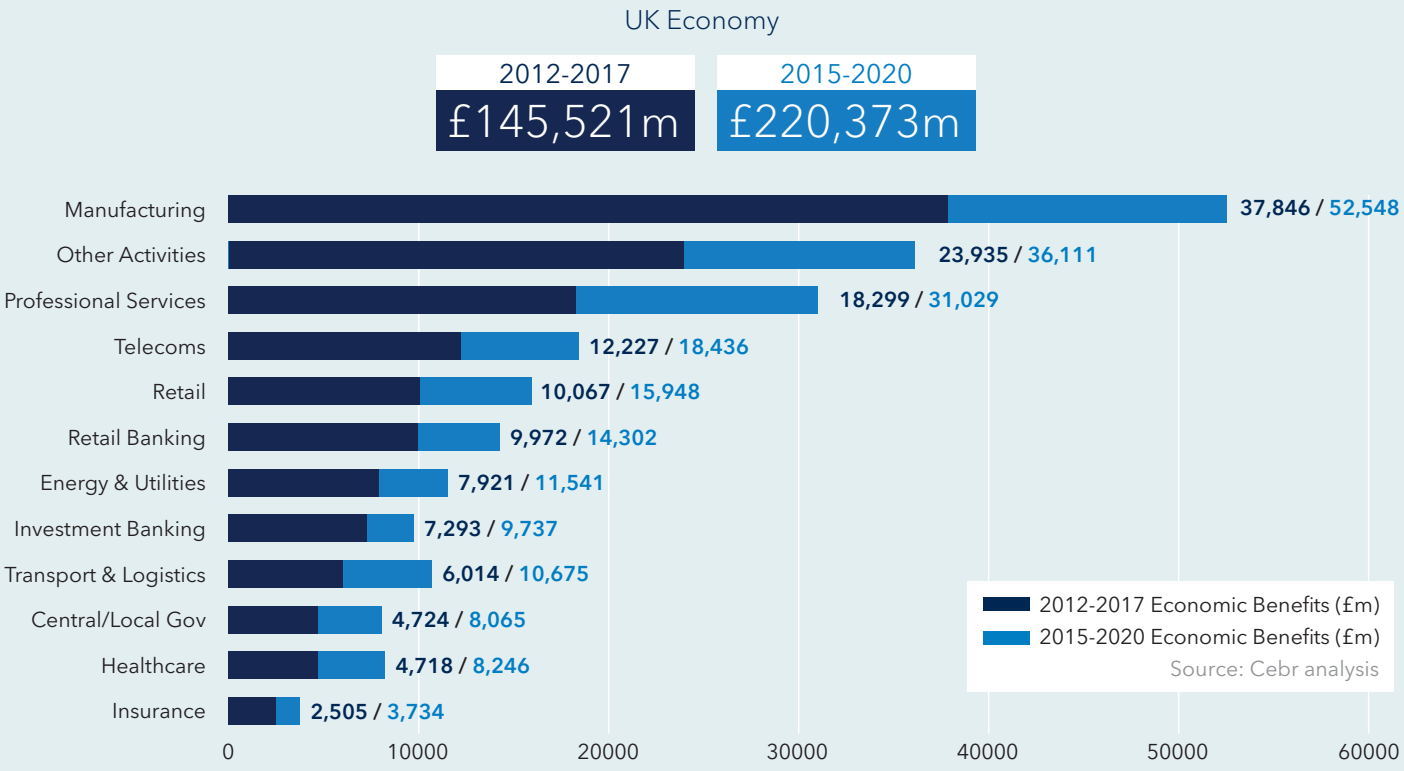
Looking for a moment at the individual years, in 2012 our data equity valuation is predicted to have equated to £12 billion (2015 prices) or 0.7% of GDP. As the adoption of big data analytics

has grown across industries, and continues to grow further, the benefits that accrue through efficiency, innovation and creation benefits accumulate, reaching £46 billion (2015 prices) or 2.2% of GDP by 2020. Between 2015 and 2020, we estimate the benefits at an average of £40 billion per year (2015 prices), equivalent to 2.0% of GDP per annum.

The greatest beneficiary of big data is expected to be the manufacturing sector, with the total value of big data analytics expected to accumulate to £57 billion over the whole period 2015–2020. This can be attributed to the diversity of firms in the industry and the variety of areas in which efficiency gains, achieved through the use of big data analytics, can be made. The industries expected to experience the lowest benefit are firms within the central/local government and the insurance industries.

[7] See McKinsey & Company (2015), "Getting big impact from big data", January, and McKinsey & Company (2011), "Big data: The next frontier for innovation, competition and productivity", May.

Figure 18: 2012–17 and 2015–20 Cumulative economic benefits from business efficiency gains, £m (2015 prices)



Business efficiency benefits

Efficiency benefits are the main mechanism through which economic improvements, as a result of big data analytics, are realised. These efficiency benefits mean that business processes become more cost effective through better customer intelligence and fraud detection, and through improved supply chain, performance, quality, and risk management. Savings through these channels in turn lead to enhanced output and value added. Figure 18 sets out the cumulative economic benefits arising from business efficiency gains over the periods 2012–17 and 2015–20.

Building on the findings of the previous study, our efficiency benefits are now calculated using survey data. This enabled us to paint a clearer picture of the channels through which different industries have experienced efficiency benefits from the use of big data analytics. As a result, the efficiency benefits are slightly higher than those presented in the original study, with the benefits from different channels distributed differently across each industry as a result of the primary research findings. Between 2015 and 2020, we expect the efficiency gains that businesses accrue through the use of big data analytics to accumulate to £220 billion.

Customer intelligence

One channel through which businesses can make efficiency gains from the use of big data is better insight into customer intelligence. Table 7 illustrates the cumulative 2012–17 and 2015–20 customer intelligence efficiency benefits. Compared with the previous study, the total benefits from customer intelligence are slightly lower in 2012–17. Between 2015 and 2020, we predict the efficiency gains achieved through big data analytics to total a cumulative £63 billion.

Table 7: 2012–17 and 2015–20 Cumulative customer intelligence efficiency benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Manufacturing	9,499	13,188
Other Activities	6,961	10,503
Professional Services	5,942	10,075
Telecoms	3,646	5,498
Retail	3,593	5,691
Retail Banking	2,713	3,892
Energy & Utilities	2,147	3,128
Investment Banking	1,734	2,315
Transport & Logistics	1,696	3,010
Central/Local Government	1,300	2,219
Healthcare	1,059	1,850
Insurance	831	1,239
UK Economy	41,120	62,609

Source: Cebr analysis

Supply chain management

Big data analytics can also enable businesses to make significant cost savings through better supply chain management. Table 8 refreshes the 2012–17 efficiency benefits for supply chain intelligence, alongside the benefits over the period 2015–20. The manufacturing sector is expected to experience £8 billion in efficiency gains through the supply chain management mechanism over the period 2015–20, and is the largest beneficiary. The central/local government sector is expected to benefit the least through this channel, by a significant margin.

Table 8: 2012–17 and 2015–20 Cumulative supply chain intelligence efficiency benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Manufacturing	6,156	8,547
Other Activities	3,806	5,742
Professional Services	2,069	3,509
Energy & Utilities	1,685	2,455
Telecoms	1,653	2,492
Retail	1,458	2,310
Retail Banking	1,432	2,054
Investment Banking	1,356	1,811
Transport & Logistics	971	1,724
Healthcare	573	1,002
Insurance	482	718
Central/Local Government	401	685
UK Economy	22,043	33,049

Source: Cebr analysis

Quality management

Table 9 sets out the economic benefits from quality analytics over the periods 2012–17 and 2015–20. Compared with the previous study, we expect a far wider range of industries to benefit from the use of big data for quality management. This reflects the information collected through the survey. However, consistent with the results of the original study, the manufacturing sector is expected to be the main beneficiary of quality improvements. This is likely to arise as scrap rates and machinery downtime are reduced through the use of big data analytics techniques.

Table 9: 2012–17 and 2015–20 Quality analytics efficiency benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Manufacturing	10,972	15,235
Other Activities	5,461	8,239
Professional Services	3,537	5,998
Telecoms	2,609	3,934
Retail Banking	2,410	3,457
Investment Banking	2,124	2,836
Retail	2,116	3,352
Energy & Utilities	1,769	2,577
Healthcare	1,263	2,207
Transport & Logistics	1,232	2,187
Central/Local Government	1,226	2,093
Insurance	513	765
UK Economy	35,232	52,878

Source: Cebr analysis

Risk management

Table 10 presents the economic benefits arising from risk management analytics. These analytical risk management tools are expected to contribute a cumulative £38 billion in efficiency savings across the business economy in the period 2012–17. Although this is significantly higher than the estimate in our original study, it is again a reflection of the truer picture revealed by the evidence gathered in our business survey.

Table 10: 2012–17 and 2015–20 Risk management efficiency benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Manufacturing	9,499	13,188
Other Activities	6,505	9,815
Professional Services	5,541	9,396
Telecoms	3,188	4,806
Retail Banking	2,843	4,077
Energy & Utilities	2,147	3,128
Retail	2,039	3,229
Investment Banking	1,734	2,315
Transport & Logistics	1,674	2,972
Healthcare	1,279	2,235
Central/Local Government	1,153	1,969
Insurance	599	893
UK Economy	38,200	58,023

Source: Cebr analysis

Performance management

Table 11 presents the economic benefits from performance management analytics over the periods 2012–17 and 2015–20. The total efficiency benefits from performance management improvements through the use of big data analytics are expected to amount to a cumulative £9 billion in the period 2012–2017 and £14 billion in the period 2015–2020.

Table 11: 2012–17 and 2015–20 Performance management efficiency benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Manufacturing	1,620	2,250
Professional Services	1,210	2,051
Other Activities	1,202	1,814
Telecoms	1,131	1,705
Retail	862	1,365
Central/Local Government	601	1,026
Retail Banking	550	788
Healthcare	539	942
Transport & Logistics	440	782
Investment Banking	345	461
Energy & Utilities	173	252
Insurance	58	86
UK Economy	8,731	13,523

Source: Cebr analysi

Fraud detection

Table 12 illustrates the economic benefits from fraud detection tools over the periods 2012–17 and 2015–20. We predict efficiencies gained by businesses through better fraud detection could total £290 million in the period 2015–2020.

Table 12: 2012–17 and 2015–20 Fraud detection efficiency benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Manufacturing	100	140
Central/Local Government	43	74
Retail Banking	24	34
Insurance	22	33
Healthcare	5	9
UK Economy	194	290

Source: Cebr analysi

Business innovation benefits

As described in Section 2.3, the efficiency gains examined above are likely to lead to and foster innovation benefits. Table 13 illustrates the 2012–17 and 2015–20 business innovation benefits. As with the previous study, the manufacturing sector is expected to see the biggest benefits from innovation, which could total £4 billion between 2015 and 2020. This industry incorporates a majority of high-technology and medium-technology firms, and as a result has quite a high level of R&D spending. This industry is therefore likely to see benefits arising from big data analytics through new product development.

The other key beneficiaries of business innovation benefits vary slightly from the previous study; this is, in part, due to revised GDP forecasts used in our calculations, which have affected a number of sectors.

Table 13: 2012–17 and 2015–20 Business innovation benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Manufacturing	3,139	4,356
Other Activities	1,098	1,657
Telecoms	687	1,035
Retail Banking	578	829
Retail	511	809
Transport & Logistics	447	794
Investment Banking	443	591
Professional Services	438	743
Healthcare	308	539
Insurance	283	421
Energy & Utilities	224	326
Central/Local Government	185	316
UK Economy	8,341	12,416

Source: Cebr analysis

Business creation and employment

As explored in Section 2.4, excess profits, generated from efficiency gains and as a result of innovation, in turn lead to business creation and increased employment. Table 14 and Table 15 illustrate that the professional services sector is expected to be one of the main beneficiaries in terms of both business creation benefits arising from big data analytics, and subsequent employment benefits. Through the additional value added by each business created as a result of the efficiencies accrued through big data, the economy is expected to achieve a boost accumulating to £8 billion across the period 2015 to 2020.

We expect that the benefits of big data outlined above could lead to the creation of approximately 157,000 new jobs by 2017 and a further 41,000 new jobs by 2020. As described in Section 2.4, big data analytics leads to reduced barriers to entry that result in increased business creation as firms enter the market, and in turn, to job creation. Furthermore, as big data becomes increasingly prevalent, there will be increased demand for people with data analytics skills, as well as talents in other areas of the business, as the firms expand.

Table 14: 2012–17 and 2015–20 Business creation benefits, £m (2015 prices)

	Cumulative 2012–17 (£m)	Cumulative 2015–20 (£m)
Professional Services	2,697	2,427
Healthcare	1,667	2,206
Other Activities	1,179	993
Investment Banking	802	578
Manufacturing	603	463
Telecoms	524	487
Transport & Logistics	340	332
Central/Local Government	183	180
Retail	171	153
Insurance	154	141
Retail Banking	99	82
Energy & Utilities	52	39
UK Economy	8,470	8,082

Source: Cebr analysis

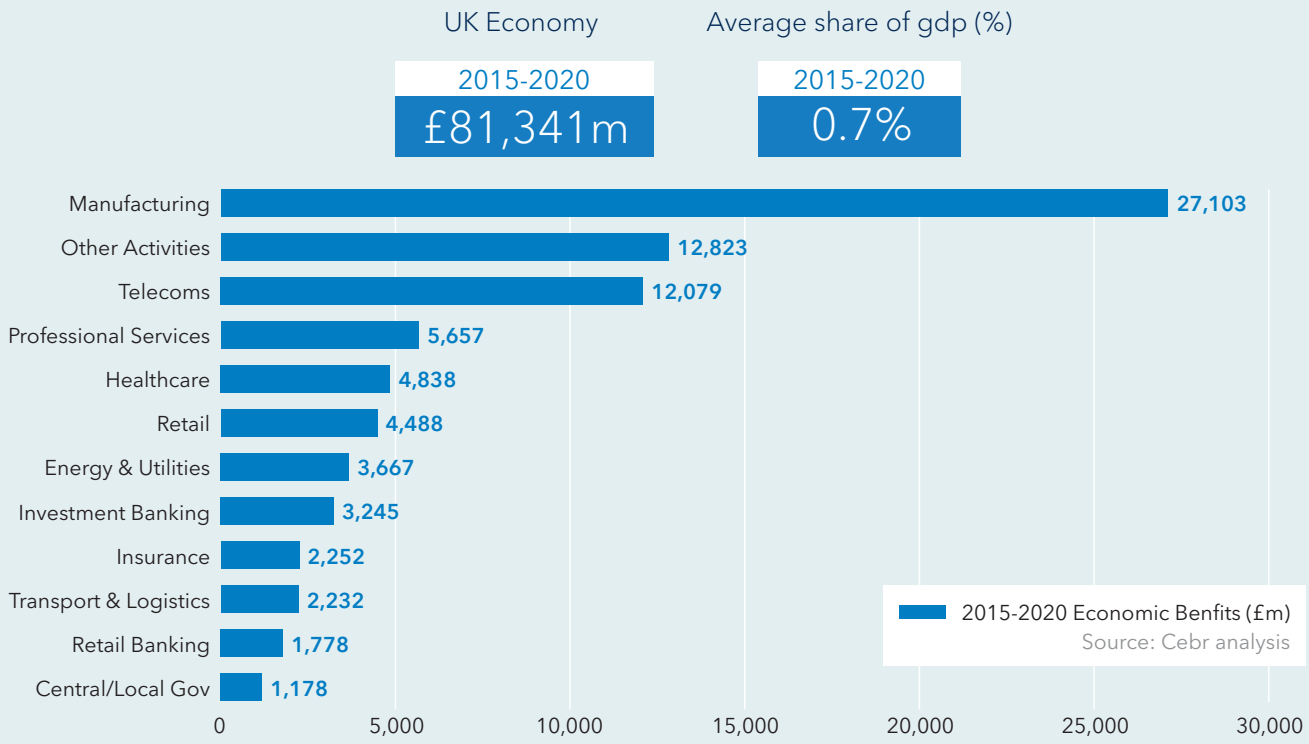
Table 15: 2012–17 and 2015–20 Employment benefits – total additional jobs created

	2012–17	2015–20
Other Activities	39,075	27,623
Professional Services	35,801	26,337
Healthcare	27,883	23,274
Manufacturing	17,515	11,737
Telecoms	9,696	6,974
Transport & Logistics	7,495	5,749
Central/Local Government	5,867	4,568
Retail Banking	4,728	3,276
Retail	4,450	3,243
Investment Banking	3,201	2,086
Energy & Utilities	910	618
Insurance	355	262
UK Economy	156,974	115,746

Source: Cebr analysis

5.3 Internet of Things

Figure 19: 2015-2020 Cumulative economic benefits by industry of the Internet of Things, £m (2015 prices)

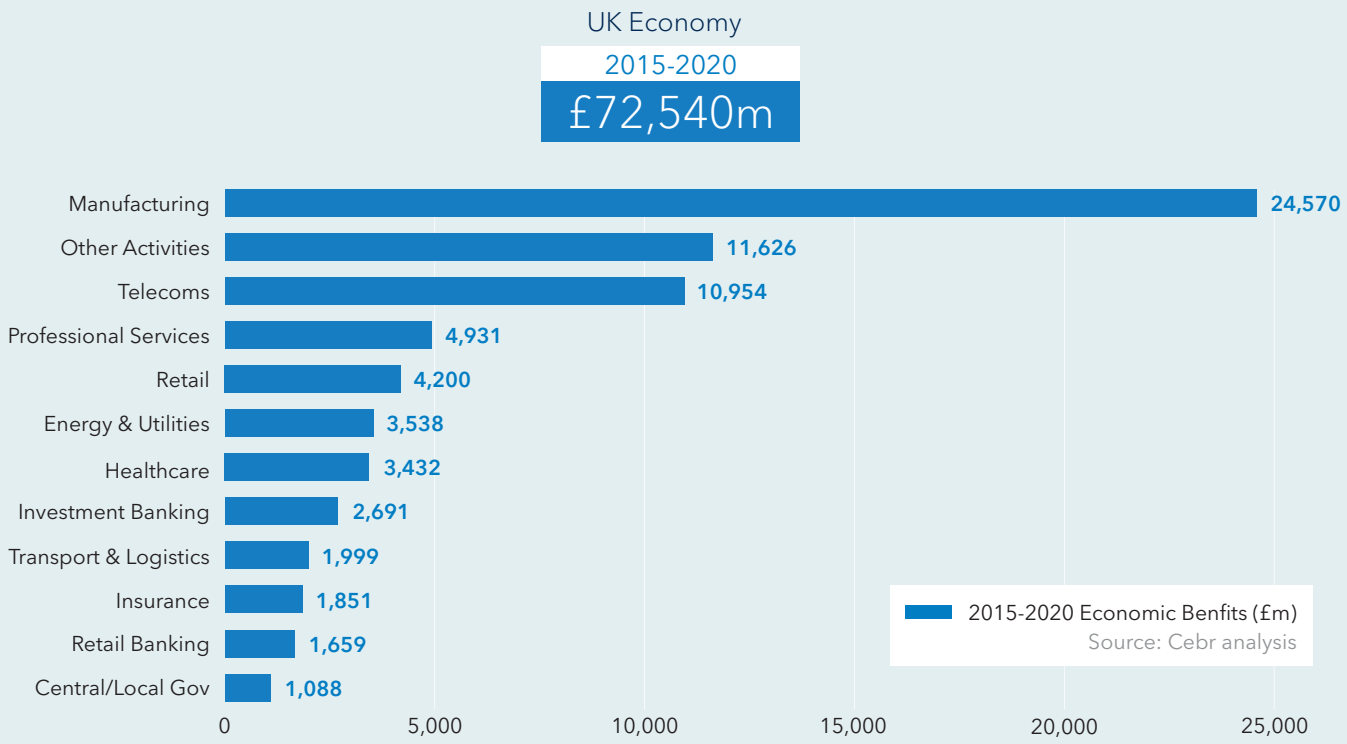


Total economic benefits

This section goes beyond the findings of the previous study to examine the economic benefits of the IoT. As the IoT is a relatively new phenomenon, we only look forward to evaluate how we expect the value of the IoT to develop in the near future. We then examine the determinants of the economic benefits, exploring how efficiency gains, and innovation and creation benefits are accrued through the use of the IoT. In reality, the symbiotic relationship between big data and the IoT implies that the benefits of the IoT cannot be viewed in isolation from the benefits arising from big data. Instead, there is likely to be an overlap between benefits that accrue as a result of businesses using both big data analytics and the IoT.

In Figure 19 we present the total expected benefits arising through the use of the IoT over the period 2015–20. Overall the total benefit of the IoT to the UK economy is predicted to total £81 billion, equivalent to an average of £14 billion per year, or 0.7% of annual GDP. This reflects the rate of adoption of the IoT across industries. With implementation still very low among industries, the value of the IoT is predicted to be approximately worth £13 billion (2015 prices) or 0.7% of GDP in 2015. By 2020, the economic value of the IoT is expected to rise to £16 billion (2015 prices), or 0.8% of GDP. Similar to the case of big data, the manufacturing sector is predicted to be the biggest beneficiary of the IoT.

Figure 20: 2015–20 Cumulative economic benefits for business efficiency gains of the Internet of Things, £m (2015 prices)



Business efficiency benefits

Figure 20 sets out the cumulative economic benefits for business efficiency gains. The efficiency gains that accrue from the use of the IoT are expected to total £72 billion between 2015 and 2020. The manufacturing sector is set to experience the greatest benefits by a significant margin. By comparison, the public sector is expected to benefit the least.

Customer intelligence

Table 16 illustrates one channel through which businesses can accrue efficiency benefits through the use of the IoT. Between 2015 and 2020, the efficiency gains achieved through improved insight into customer intelligence is expected to total £18 billion.

Table 16: 2015–2020 Cumulative customer intelligence efficiency benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Manufacturing	6,004
Other Activities	3,084
Telecoms	3,053
Professional Services	1,456
Retail	1,097
Energy & Utilities	1,040
Healthcare	978
Investment Banking	721
Transport & Logistics	490
Central/Local Government	305
Insurance	190
Retail Banking	120
UK Economy	18,537

Source: Cebr analysis

Supply chain management

Table 17 presents the efficiency gains achieved through improved supply chain management, arising from the use of the IoT. Between 2015 and 2020, these gains are expected to total nearly £12 billion.

Table 17: 2015–2020 Cumulative supply chain intelligence efficiency benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Manufacturing	4,042
Other Activities	1,865
Telecoms	1,458
Retail	700
Energy & Utilities	673
Retail Banking	537
Insurance	536
Professional Services	516
Investment Banking	396
Healthcare	369
Transport & Logistics	311
Central/Local Government	97
UK Economy	11,500

Source: Cebr analysis

Quality management

Similar to the case of big data, manufacturing industry is expected to benefit the most from efficiency gains made through the use of the IoT to achieve better quality management. These gains to the economy are estimated to total £17 billion between 2015 and 2020.

Table 18: 2015–2020 Quality analytics efficiency benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Manufacturing	7,431
Other Activities	2,575
Telecoms	2,113
Professional Services	1,093
Healthcare	823
Investment Banking	709
Energy & Utilities	670
Retail	599
Transport & Logistics	569
Insurance	356
Retail Banking	287
Central/Local Government	243
UK Economy	17,469

Source: Cebr analysis

Risk management

Risk management efficiency gains that accrue to businesses through the use of the IoT are expected to total £20 billion between 2015 and 2020.

Table 19: 2015–2020 Risk management efficiency benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Manufacturing	6,004
Other Activities	3,491
Telecoms	3,401
Professional Services	1,575
Retail	1,218
Energy & Utilities	1,069
Healthcare	978
Insurance	750
Investment Banking	721
Transport & Logistics	505
Retail Banking	358
Central/Local Government	271
UK Economy	20,341

Source: Cebr analysis

Performance management

The manufacturing and telecoms industries are expected to benefit the most from performance management efficiencies gained through the use of the IoT. Across the period 2015–2020, the economic benefits of these efficiency gains will total £5 billion.

Table 20: 2015–2020 Performance management efficiency benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Manufacturing	1,024
Telecoms	928
Other Activities	612
Retail	586
Retail Banking	349
Professional Services	292
Healthcare	282
Central/Local Government	164
Investment Banking	144
Transport & Logistics	124
Energy & Utilities	86
Insurance	18
UK Economy	4,609

Source: Cebr analysis

Fraud detection

The sectors that benefit from big data analytics fraud detection efficiencies also gain from the IoT. The public sector is expected to accrue efficiency benefits totalling £8 million between 2015 and 2020, while the whole economy is predicted to experience efficiency gains valued at £84 million across the same time period.

Table 21: 2015–2020 Fraud detection efficiency benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Manufacturing	64
Retail Banking	9
Central/Local Government	8
Healthcare	2
Insurance	1
UK Economy	84

Source: Cebr analysis

Business innovation benefits

The innovation benefits that accrue to businesses through the use of the IoT are expected to total £5 billon across the 2015–2020 period, as illustrated in Table 22. Similar to the case of big data, the manufacturing industry is expected to be the greatest beneficiary of these innovation gains.

Table 22: 2015–2020 Cumulative business innovation benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Manufacturing	2,039
Telecoms	615
Other Activities	534
Healthcare	224
Retail	213
Insurance	209
Investment Banking	164
Transport & Logistics	149
Professional Services	118
Energy & Utilities	100
Retail Banking	96
Central/Local Government	43
UK Economy	4,504

Source: Cebr analysis

Business creation and employment

Table 23 and Table 24 illustrate the value of the business and job creation that arises as a result of efficiencies achieved through the use of the IoT. The additional value added by the extra businesses that are able to start up and enter markets as a result of excess gained from using the IoT is predicted to total £4 billion between 2015 and 2020 (see Table 32).

Further, we expect around 67,000 jobs to be created in the period 2015 to 2020 as a result of the IoT encouraging the start-up of new firms, the expansion of existing businesses and a greater demand for skilled workers (see Table 33).

Table 23: 2015–2020 Cumulative business creation benefits of the Internet of Things, £m (2015 prices)

	Cumulative 2015–20 (£m)
Healthcare	1,182
Other Activities	663
Professional Services	607
Telecoms	509
Manufacturing	494
Investment Banking	390
Insurance	192
Transport & Logistics	85
Retail	75
Central/Local Government	48
Energy & Utilities	29
Retail Banking	22
UK Economy	4,297

Source: Cebr analysis

Table 24: 2015–2020 Employment benefits – total additional employment created by the Internet of Things

	2015–20
Other Activities	18,741
Healthcare	13,064
Manufacturing	12,924
Telecoms	7,635
Professional Services	6,747
Retail	1,608
Transport & Logistics	1,533
Investment Banking	1,474
Central/Local Government	1,222
Retail Banking	919
Energy & Utilities	467
Insurance	357
UK Economy	66,691

Source: Cebr analysis

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