

UK Digital Economy Research: 2019

Research developing a framework for measuring the digital economy, including estimates and future plans.

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1 . Main points

- This article presents a methodology to estimate gross value added (GVA) for two different definitions of the digital economy, drawing from international guidance and utilising currently available data sources.
- Using the most specifically defined but narrow definition of the digital economy, digital products made up 4.6% of GVA in 2019.
- Adding in the more loosely defined "products affected by digitalisation", the digital economy made up 26.3% of GVA in 2019.
- User feedback is welcomed on priorities for future research, including the utilisation of additional datasets for information on digitally ordered and delivered products, measuring data as an asset, and valuing free digital products.

2 . Overview of digital economy measurement

The digitalisation of goods and services is one of the defining economic changes of the late twentieth and early twenty-first century. Measuring the extent to which the digital revolution has changed the face of the economy and the ways humanity engages with technology, goods, and services has been one of the key priorities of the Office for National Statistics (ONS) since the publication of the [Bean Review in 2016](#). This publication summarises numerous strands of research work and statistical development into a single compilation of these important facets of technological innovation within the modern economy.

Nothing characterises this rapid change like the growth of the internet, which fundamentally changed how businesses operate, as well as how people work, communicate, and make transactions. Between 2005 (the first year for which consistently comparable data are available) and 2020, [the number of households in Great Britain with internet access increased from 55% to 96%](#). Recognising that the internet came into being in recognisable form in 1983, this achievement of near universality took only 37 years.

A growing economic and statistical interest in this digitalisation, and the associated idea of a "digital economy", has led to several important developments in economic statistics in recent years as part of an international effort to keep pace with this rapid implementation of technology.

In 2020 the G20 encouraged progress toward the priority areas identified by a digital roadmap report authored by the Organisation for Economic Cooperation and Development (OECD). Drawing on a core framework discussed within that roadmap, the global initiative to update the System of National Accounts has been considering the role that digital supply and use tables could have in offering unified, flexible, comparable data on the digital economy.

As part of this international agenda, and as part of a broader programme of research into the digital economy, the ONS has developed a methodology to utilise already available data sources to create estimates of some key components of the digital economy against a set of internationally agreed definitions. While this draws from international guidance (such as the [OECD's digital roadmap report](#)) and the work of other National Statistics Organisations, the work represents only a start to this programme. This publication presents the methodology implemented, presents initial results, and finally an outline of future developments.

We would appreciate feedback from users on any or all of these to help inform the priorities for the programme in the future.

3 . Methodology of digital economy measurement

The methodology can be broken down into three main steps:

1. Develop a conceptual definition of the digital economy, based on a report by the Organisation for Economic Cooperation and Development (OECD) and the current availability of data.
2. Use the supply side of [Supply and Use Tables \(SUTs\)](#) to expand products into their digital and non-digital components and calculate their output.
3. Use the domestic output table from the supply-use framework to estimate which industries are producing this output and use the intermediate consumption table to estimate the corresponding gross value added (GVA).

Defining the digital economy

[The OECD report for the G20 digital economy task force](#) proposed an expansive definition of the digital economy to incorporate all economic activity reliant on digital means: "The Digital Economy incorporates all economic activity reliant on, or significantly enhanced by the use of digital inputs, including digital technologies, digital infrastructure, digital services and data. It refers to all producers and consumers, including government, that are utilising these digital inputs in their economic activities

In addition, it also identified that measuring the digital economy can bring most benefit to users through a tiered definitional framework. This draws out the different dimensions of the digital economy so they can be both calculated and analysed separately. Drawing on this framework, five separate dimensions are put forward for what might be included in a definition of the digital economy, depending on user need:

- digital products inside the [System of National Accounts \(SNA\) 2008](#) production boundary
- non-digital products significantly affected by digitalisation (such as facilitated home-schooling throughout the coronavirus (COVID-19) pandemic)
- products that are "digitally ordered" (such as goods and services ordered and paid for through e-commerce sites)
- products that are "digitally delivered" (such as a digital album bought and downloaded over the internet)
- digital products currently outside the SNA production boundary (for example, data)

The work presented here will focus on the first two dimensions of this framework: digital products (digital intermediary services are currently excluded), and non-digital products significantly affected by digitalisation (referred to as "digitally affected" products). We plan to expand upon the work presented here to include other dimensions as part of future research.

It is important to note that several of these categories could be quite expansive, and because of their broad scope, this could hinder their analytical use. For example, as the ability to order goods and services via digital channels becomes more and more common, the concept of "digitally ordered" may become less analytically useful as a tool to examine the "cutting edge" that many associate with the digital economy. This represents one of the challenges of measuring the digital economy. Its fast pace of evolution means that definitions and categorisations can quickly become obsolete or lose their analytical purpose.

This is one of the key reasons that the framework being worked toward will be multi-dimensional, so that different dimensions can meet different user needs, for example the different needs of someone looking for well-established definitions as well as someone looking for more experimental "cutting edge" definitions. But for this same reason it is also important for the framework to be flexible and incorporate new dimensions quickly as the digital economy itself changes at pace.

These dimensions are not all mutually exclusive. A product can, for example, be both digitally ordered and digitally delivered (for example, a digital album ordered online and downloaded over the internet). However, digital products and digitally affected products are mutually exclusive by definition.

Within the first dimension of this framework, digital products (inside the SNA 2008 production boundary) can be divided in four categories of their own:

1. Information and communication technology (ICT) goods, such as computers and peripheral equipment, communication equipment, consumer electronic equipment and miscellaneous ICT components and goods; this group can broadly be considered as "hardware" goods.
2. Digital services (excluding cloud computing services and digital intermediary services); these include manufacturing services for ICT equipment, business and productivity software and licensing services, leasing or rental services for ICT equipment and other ICT services.
3. Priced cloud computing services; in line with a [report by a Eurostat task force on price and volume measures for service activities](#), this includes:

- software publishing services for software as a service (SAAS), included in classification of products by activity, CPA, 58.2
- computer programming services for platform as a service (PAAS), included in CPA 62.01)
- data processing, hosting, application services and other IT infrastructure provisioning services for infrastructure as a service (IAAS), included in CPA 63.11.1

4. Priced digital intermediary services (such as the service of matching two independent parties to a transaction via a digital platform in return for an explicit fee), which are sometimes referred to as priced digital intermediary platforms as well.

A detailed list of the specific products included in ICT goods, digital services, and cloud computing services (as used in this research) can be found in the [OECD's Guidelines for Supply-Use tables for the Digital Economy](#). However, as these are primarily presented using central product classification (CPC) product classifications, they are [first mapped to CPA product classifications](#) to align with the product classifications used in the Office for National Statistics' (ONS) surveys.

Within the second dimension of the framework, the definition of "non-digital products significantly affected by digitalisation" is drawn from the OECD guidelines. As currently specified, this list includes:

- land transport services and transport services via pipelines (CPA division 49)
- accommodation services (CPA division 55)
- food and beverage serving services (CPA division 56)
- motion picture, video and television programme production services, sound recording and music publishing (CPA division 59)
- publishing services (CPA division 58)
- financial and insurance services (CPA section K)
- advertising and market research services (CPA division 73)
- travel agency tour operation and other reservation services (CPA division 79)
- education services (CPA section P)
- gambling and betting services (CPA division 92)

Digitally affected products are intended to capture production, which has been, or is likely to be, heavily affected by digitalisation. So, for example, while education services are not themselves digital, the increased availability of virtual learning environment technology means it is possible to deliver education services digitally, so education services have been affected by digitalisation. But as this example highlights, not all production of digitally affected products might be considered "digital" and instead could better be considered as an upper estimate for the portion of the economy most affected by digitalisation (which is not already included in "digital products").

While this article uses the "digitally affected products" as defined in the OECD guidelines, it should be highlighted that these will be subject to future research and reviewed regularly to ensure their relevance and timeliness. The products currently included already show evidence of being artefacts of their time. While these have been internationally agreed, they fail to recognise the impact of the digitalisation on various economic activities, which we might want to now include, for example parts of CPA 86 health services (consider the rapid development of coronavirus (COVID-19) vaccines using digital technologies, or on-line doctor's consultations), or parts of CPA 71 architecture (the near-universal use of computer-aided design software).

As the narrower measure of the digital economy (digital products) is better defined, it serves as a more analytically useful vehicle for the analysis of the digital economy. The broader measure of the digital economy (including digitally affected products) has its value in understanding the general extent to which the "digital economy" would be broader if products affected by digitalisation were included, but should be treated with more caution because of its less specific and slightly outdated product definitions.

Expanding the supply and use table

Using these definitions of the first and second tier of the digital economy, we use data from [UK Manufacturers' Sales by Product \(PRODCOM\)](#) and the [Annual Survey of Goods and Services \(ASGS\)](#) to expand the product categories in the SUT supply table into their respective digital products (including ICT goods, digital services, and cloud services), digitally affected products, and non-digital components.

These estimates of output by product are then translated into output by industry using the domestic output table to give an estimate of output (by industry) of digital products, digitally affected products, and non-digital output. It is worth highlighting that this process assumes that the production profile of products by industries is the same for the digital sub-component of a product as for its non-digital sub-component. So, for example, if the proportion of "computer, electronic and optical products" produced by the telecommunications industry were 60%, both the digital and non-digital components of "computer, electronic and optical products" would have the assumption that 60% of their respective output is produced by the telecommunications industry.

Finally, digital and digitally affected output (by industry) is translated into gross value added (GVA) using the ratio of output to GVA for each industry from the intermediate consumption table of the SUTs. Here, the ratio of output to GVA for each industry is assumed to be the same for each industry's digital and non-digital component.

Limitations

This research is intended as the first stage of a research programme, and it is worth highlighting several limitations, which we would expect to improve upon in future research. The limitations can be grouped together into limitations because of data availability, and limitations because of assumptions.

Data availability

First, to expand the set of data sources available to populate the digital supply-use framework, we are currently looking into the use of the newly redesigned Digital Economy Survey (formally the E-Commerce Survey) as a source of data on:

- ICT goods
- digital services (excluding cloud services)
- cloud services
- digital intermediary services
- digitally ordered products
- digitally delivered products

Secondly, the ONS have been working with the Bureau of Economic Analysis (United States) as part of the UN's InterSecretariat Working Group for National Accounts (ISWGNA) Task Team on Digitalisation, to consider how "free" digital products would be recorded and valued in a satellite account; this work would form a foundation for measurement of the output of these products, and their inclusion in a framework for measuring the digital economy in future research.

It is also worth noting that some of the product categories used to identify digital "hardware" products (such as the first dimension of the framework) will still contain some non-digital components; this is largely a result of the age of the current international frameworks, which define product classifications and may be addressed as part of current international consultations to update product and industry classifications in line with the modern economy.

Finally, all data in this article are presented in current price terms (without adjusting for inflation), and as such it is not yet possible to say whether the GVA of the digital economy has increased or fallen "in real terms".

Assumptions

- the product-industry production relationship is the same for the digital and non-digital components
- the ratio of output to GVA for each industry is the same for each industry's digital and non-digital component

Finally, it should be highlighted that, while this methodology draws on OECD guidelines, which several countries are feeding into, at this point of research into the digital economy there remain differences in how countries define different dimensions of the digital economy. For example, [Statistics Canada](#) and the [US Bureau of Economic Analysis](#) use a similar, but distinct, concept to "digital products", which they call "digital enabling infrastructure". Similar to "digital products", this contains IT goods and digital services, but (for example) also includes the construction of buildings in which digital economy producers create digital economy goods and services. However, both Canada and the US employ similar methodologies to calculate GVA for the digital economy — starting with a product-based definition and using supply and use tables to translate this into GVA. The US also point out a similar assumption in their methodology to the second assumption mentioned earlier in this paper, highlighting similar approaches across countries to overcome data limitations.

4 . Results

Gross value added (GVA) for two mutually exclusive parts of the digital economy have been estimated. The first are digital products, which, as defined, exclude digital intermediary services. The second are non-digital products affected by digitalisation, which will be referred to as "digitally-affected" products for simplicity, recognising the internationally agreed definition of these products is already relatively outdated and excludes key products.

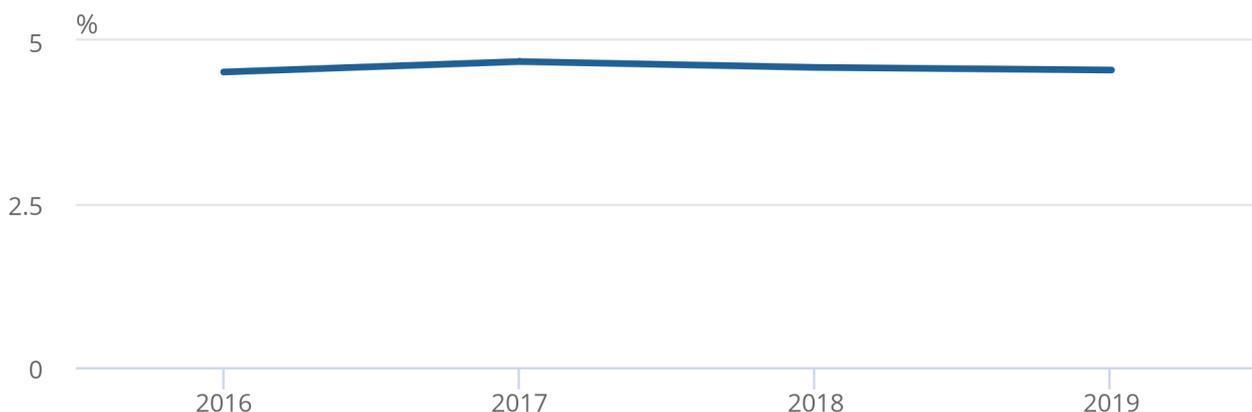
Focusing first on the narrower definition of the digital economy, the combined GVA of digital products has made up around 4.6% of whole economy GVA each year between 2016 and 2019. Figure 1 shows the time series for the digital product share of GVA over this time period. While the series remains relatively flat over time, there have been movements, in particular from a low of 4.52% in 2016 to a high of 4.68% in 2017.

Figure 1: The digital economy (defined narrowly) has made up around 4.6% of the total UK economy since 2016

UK, 2016 to 2019, Digital product gross-value added (current basic prices) as a proportion of whole economy gross value added

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Source: Office for National Statistics

For context, this meant that in 2019 the digital economy (according to this narrow definition) was of a similar size to the transport or the government administration industries. Figure 2 shows the sizes of GVA for most industries in 2019, as well as for this narrow definition of the digital economy. At £91.9 billion, the size of the digital economy is bigger than several industries, such as agriculture, mining and quarrying, and hotels and catering. However, it remains much smaller than the largest industries such as retail and wholesale.

Figure 2: The digital economy (narrowly defined) is comparable in size to many other industries

UK, 2019, gross-value added (basic prices) by industry and for the digital economy (limited to digital products)

Source: Office for National Statistics

Notes:

1. While the industry definitions are mutually exclusive with each other, this definition of the digital economy is not. Each industry will, to a greater or lesser extent, contain some amount of the "digital economy". Figure 2 indicates the GVA associated with digital product creation by every industry, as well as the remaining GVA.

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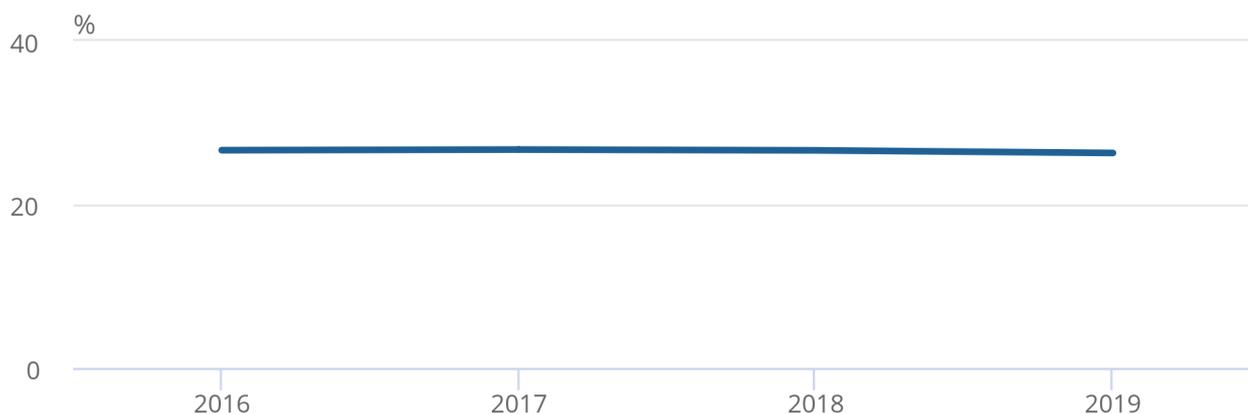
A broader definition of the digital economy, including both digital and digitally affected products, as currently defined, also remained fairly flat over the period 2016 to 2019, but made up a substantially higher portion of whole economy GVA: 26.6% on average over the period (Figure 3). Trends over time for this definition of the digital economy are broadly similar to the narrow definition — largely flat over the four years, with a small increase in 2017, followed by small declines in the following years.

Figure 3: The digital economy (defined more broadly) has made up over 26% of the total UK economy since 2016

UK, 2016 to 2019, gross value added (current basic prices) from digital products and products affected by digitalisation, as a proportion of whole economy gross value added

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UK, 2016 to 2019, gross value added (current basic prices) from digital products and products affected by digitalisation, as a proportion of whole economy gross value added



Source: Office for National Statistics

For both definitions of the digital economy, when interpreting changes over time it is important to note that Figures 1 and 3 do not strip out price effects over time. To analyse growth in parts of the economy over time, volume figures (typically chained volume measures, or CVMs) are needed, which account for changes in prices. As we do not yet have CVM figures for the digital economy, we cannot comment on whether it is growing. It is also possible for the digital economy to grow in CVM terms while shrinking as part of the whole economy in current price (CP) terms (unadjusted for price changes). This can happen if CVM growth is driven by falling prices. For this reason, developing appropriate price deflators for the digital economy is a priority to analyse the digital economy over time.

5 . Future developments

There are several possible next steps for this research programme, and the Office for National Statistics (ONS) would appreciate feedback from users on those areas, which should be given priority and focus. To provide feedback, please email Cliodhna.Taylor@ons.gov.uk.

The ONS's primary framework for research into the digital economy are the digital supply and use tables (DSUTs), included as part of the [G20 digital roadmap](#), and explained in more detail in a [handbook from OECD](#). DSUTs contain several new concepts and distinctions, which require research into the practical feasibility, use, and elaboration of these concepts, methodologies to be able to estimate them, and how to utilise new and existing data sources to compile the data. Much of the next steps for digital economy research can be considered as part of a broader programme to test, and where possible populate, this DSUT framework.

Additional data on the digital economy

As part of the transformation of our data collection methods in this area, the ONS has developed a digital economy survey, which will now include questions aimed at measuring several additional dimensions of the digital economy, as well as improving measurement of the two dimensions presented in this article. In particular, questions will be added on digital orders, digitally delivered products, digital intermediary platforms, and cloud computing. Data collected from these new questions will feed into future research articles and could potentially be used to populate much of a DSUT at an aggregate level.

In addition, our research and development programme aimed at improving the sources and methods used to compile deflators (these allow us to create chained volume measures, such as measures which strip out the effect of inflation) includes deflators required for the digital economy. This will allow for better analysis of growth.

Digital trade

Following on from the [UK trade development plan: 2020](#) and as part of the ONS's strategic plan to develop digital trade statistics, we are conducting research into the feasibility of using existing trade data and the methods described in this article to measure estimates of imports and exports associated with different definitions of the digital economy. This research includes exploring digital intermediary platforms (DIPs) and how they may contribute to digital trade. An article of findings will be published later in 2022. In addition, we are continuing to explore opportunities to utilise new data sources, such as using the transformed digital economy survey (previously known as the e-commerce survey).

Data as an asset

The ONS is one of a small number of NSIs, including Stats Canada, the US BEA and Eurostat, who are working to develop new methods to inform how data could be conceptualised as an asset, as well as the methodologies and data sources which would be needed. This work could ultimately feed into the DSUT product rows, even though it currently sits outside of the System of National Account 2008 (SNA) production boundary.

Free digital products

The ONS has been working with BEA as part of the UN's InterSecretariat Working Group for National Accounts (ISWGNA) Task Team on Digitalisation, to [consider how "free" digital products would be recorded and valued in a satellite account](#). Additional work is still needed to research how data could be collected to populate such a satellite account, but the outcome of this work could form part of the DSUT product rows, currently sitting outside of the System of National Account 2008 (SNA) production boundary.

6 . Glossary

Digital products

Products that are ICT goods or digital services and fall within the production boundary of the System of National Accounts 2008

Digitally-affected products

See non-digital products significantly affected by digitalisation

Non-digital products significantly affected by digitalisation

Products that are not ICT goods or digital services but which may have been particularly affected by digitalisation and lie within the production boundary of the System of National Accounts 2008. As defined by the OECD's [Guidelines for Supply-Use tables for the Digital Economy](#)

Production boundary

Under the 2008 System of National Accounts 2008, the production boundary is generally defined as "activity carried out under the control and responsibility of an institutional unit that uses inputs of labour, capital, and goods and services to produce outputs of goods or services. There must be an institutional unit that assumes responsibility for the process of production and owns any resulting goods or knowledge-capturing products or is entitled to be paid, or otherwise compensated, for the change-effecting or margin services provided."