Investment in intangible assets in the UK QMI

Quality and methodology information for investment in intangible assets in the UK. Includes strengths and limitations, methods, and data uses and users.

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Table of contents

1 . Output information

- Statistical designation: official statistics in development
- Frequency: annual
- How compiled: based on multiple Office for National Statistics (ONS) data sources and other government department data
- Geographic coverage: UK
- Related publications: Investment in intangible assets in the UK: 2021 bulletin

2 . About this QMI report

This quality and methodology information report contains information on the quality characteristics (including the European Statistical System's five dimensions of quality) of the Investment in intangible assets in the UK: 2021 bulletin and the methods used to create it.

The information in this report will help you to:

- understand the strengths and limitations of the data
- learn about existing uses and users of the data
- understand the methods used to create the data
- help you to decide suitable uses for the data
- reduce the risk of misusing data

3 . Important points

- Intangible assets are produced fixed non-financial assets; they are used repeatedly or continuously in a production process for more than one year, and do not have a physical embodiment.
- Intangible assets include software, research and development (R&D), design, branding, firm-specific human capital such as training, and organisational capital.
- Intangible assets have become increasingly prominent in the economy over recent decades and are thought to be important contributors to economic growth and productivity growth.
- The Investment in intangible assets in the UK: 2021 bulletin includes some intangible assets that are not included within the asset boundary in the UK National Accounts (uncapitalised assets); therefore, it is broader in scope than intellectual property products (capitalised assets) in the official measures of business investment, which are included within the UK National Accounts.
- Estimates of investment in intangible assets cover both purchases of assets from other businesses (purchased investment), and in-house creation of assets for use by the business (own-account investment).

4 . Quality summary

Overview

Our Investment in intangible assets in the UK: 2021 bulletin is an annual release published alongside our Investment in intangible assets dataset. These are official statistics in development and we advise caution when using the data. This is because the method is continuously under review as there is no internationally agreed definition or methodology for the measurement of investment in intangibles. The bulletin uses several official data sources included in Section 6: Methods used to produce the data.

Uses and users

Intangible assets have become increasingly prominent in the economy over recent decades and are thought to be important contributors to economic growth and productivity growth.

As such, these data are of primary interest to researchers and policymakers interested in the modern economy, economic growth, and productivity. Users include the Intellectual Property Office (IPO), the Department for Business and Trade (DBT), HM Treasury, the Bank of England, and think tanks. Certain parts of the data are also of interest to industry bodies. Finally, there is considerable academic interest in our intangible investment estimates and they have been used in a range of academic papers.

Internally, these estimates are used in releases such as UK inclusive income, which aims to explore our beyond gross domestic product (GDP) initiative. This work looks to develop a more comprehensive approach to measuring prosperity and well-being.

As we present estimates for assets not within the asset boundary of current national account guidelines (uncapitalised estimates), our estimates provide alternative perspectives on GDP and the UK National Accounts.

Strengths and limitations

Strengths

These statistics provide a broad and comprehensive view of intangible investment in the UK. As they go beyond definitions and boundaries used in the national accounts and other official statistics, these estimates can be seen as more complete than other related statistics. For example, estimates of gross fixed capital formation (GFCF) in intellectual properties products cover only some of the intangible assets included in this release. Similarly, estimates of business expenditure on research and development (BERD) covers only research and development (R&D).

To compile these estimates, a range of official data sources are used (see Section 6: Methods used to produce the data). These estimates therefore apply the best available data source to each asset.

This release is not subject to the National Accounts Revisions Policy. As such, it can implement methodological and data updates more quickly than other related estimates, and therefore reflect the latest developments in economic measurement.

The Investment in intangible assets in the UK: 2021 bulletin accounts for revisions to several sources used in our estimation of both purchased and own-account tangible and intangible investment. Consequently, estimates presented include updated methodological and survey collection data from each source. We take on yearly data revisions from our suppliers to ensure we are in line with their latest releases. These include:

- Business Investment (BI), including updates for several data sources for own-account software data (ONS)
- Supply and use tables (ONS)
- Annual Business Survey (ONS)
- Annual Purchases Survey (ONS)
- Employer Skills Survey (Department for Education)

Limitations

Unlike for assets within the national accounts' asset boundary, there are no internationally agreed definitions or methods for compiling estimates of investment in uncapitalised intangible assets. As such, these estimates cannot be easily compared across countries.

Intangible assets are inherently difficult to measure and identify a value of, owing to their intangible nature, lack of agreed definitions, and complex economic properties. Much intangible investment is conducted in-house by businesses, and there is therefore no associated transaction to observe. As such, much intangible investment must be estimated through economic modelling, and so must rely on assumptions. It is therefore difficult to gauge the degree of accuracy of the estimates.

The timeliness of estimates presented in our Investment in intangible assets in the UK: 2021 bulletin and accompanying dataset is controlled by the availability of the necessary input data. An important data input, the supply and use tables, are published with a two-year lag, therefore the estimates of intangible investment are currently published with more than a two-year lag. As part of our future work plan, we will investigate the incorporation of consistent, timely estimates and statistical modelling to extend the data available in future publications.

Like many services and products affected by digital transformation, it is hard to measure the prices for intangible assets. As such, we lack high-quality price deflators to produce constant price estimates of intangible investment. In the Investment in intangible assets in the UK: 2021 bulletin we have continued to suspend the publication of constant price estimates, pending ongoing improvement of our deflator methods.

While awaiting a review of historical methods and data for own-account intangible investment, any estimates before 2011 in the Investment in intangible assets in the UK: 2021 bulletin have been produced by benchmarking previously published estimates to newly estimated 2011 data. This means that growth rates in most own-account data presented will match those for data published in previous bulletins.

Investment in intangibles assets in the UK bulletins are designated official statistics in development and there is currently no timeline for accreditation to an official statistic.

Recent improvements

In our Investment in intangible assets in the UK: 2021 bulletin, occupation codes used for own-account estimates moved from being on a Standard Occupational Classification (SOC) 2010 basis to being on a Standard Occupational Classification (SOC) 2020 basis, allowing our estimates to continue to use the latest Annual Survey of Hours and Earnings (ASHE) data available (See Section 6: Quality characteristics of the data).

Secondly, we began taking on revisions from our data providers. This affected data back to 1997.

In our Investment in intangible assets in the UK: 2021 bulletin, occupation codes used for own-account estimates moved from being on a Standard Occupational Classification (SOC) 2010 basis to being on a Standard Occupational Classification (SOC) 2020 basis, allowing our estimates to continue to use the latest Annual Survey of Hours and Earnings (ASHE) data available (See Section 6: Quality characteristics of the data).

We have also improved our outlier process for our own-account estimates by looking at the impact of certain individuals and whether they were skewing trends outside of the norm. After identifying extreme outliers, the weighting allocated is reduced for these individuals.

Further to this, we also improved our specialised design assets estimates, which make up part of our purchased design figures. We did this by improving how we used Annual Purchases Survey (APS) industry breakdown figures.

Finally, we updated our training estimates, by moving from the Employer Skills Survey (ESS) microdata to their published dataset to allow for timelier but consistent estimates.

If you would like more information about our previous methods, please contact us at nfa-development@ons.gov.uk .

5 . Quality characteristics of the data

Relevance

Measuring intangible assets continues to be an area of importance for us in our efforts to provide a more complete picture of the UK economy. Changes to the UK National Accounts, which capitalised spending on some intangible assets such as R&D, have contributed to addressing this change in the nature of production.

In this attempt, we have benefitted from a growing body of economic literature starting with Measuring Capital and Technology: An Expanded Framework by Carol Corrado, Charles Hulten and Daniel Sichel, published in 2005.

This began the development of a measurement framework to capture investment in a broader set of intangible assets, which are not capitalised in the UK National Accounts.

Our Investment in intangible assets in the UK: 2021 bulletin currently meets user needs regarding coverage and content, but we aim to improve our estimates in a number of ways.

Firstly, we are working with the Regional Capital team (regionalcapital@ons.gov.uk) as they work on official statistics in development: regional breakdowns of gross fixed capital formation (GFCF), which will allow us to produce regional breakdowns of our capitalised estimates.

Secondly, we are looking to reintroduce investment by industry as a share of Gross Value Added (GVA) and investment per worker to allow a more detailed picture of investment in intangible assets.

We continue to develop the scope and methods used in line with international best practice. The introduction of data as an intangible asset is one of the most important additions to the System of National Accounts 2025 update . Following a period of reviewing the impact of its introduction, we are aiming to introduce data into our estimates in a forthcoming release of Investment in intangible assets in the UK.

Two potential changes for the future are introducing a timelier release of quarterly intangibles investment estimates using suitable quarterly indicators, and reintroducing estimates of investment in real terms (i.e. adjusted for inflation) similar to our release in 2021.

All development discussions are in their early stages so any feedback on this would be appreciated, please contact us at nfa-development@ons.gov.uk.

Accuracy and reliability

The results from previous attempts to measure investment in intangible assets with a survey (Investment in Intangible Assets (IIA) Survey results (PDF, 419KB) were deemed difficult to interpret and the survey was discontinued after two iterations. However, a survey to measure intangibles is still considered an effective way to measure the investment so this may be revisited in the future.

International discussions have consistently agreed that the sum-of-costs approach is a suitable way to measure investment in own-account intangible investments, in lieu of appropriate survey or administrative data being available. Whereas there are appropriate surveys available for capitalised and purchased intangibles.

Our data are subject to revisions in line with our data providers.

Intangibles investment estimates are subject to the sampling errors of the source providers. This includes the sampling errors discussed in the Annual Survey of Hours and Earnings, Low pay and Annual Survey of Hours and Earnings pension results Quality and Methodology Information (QMI) report.

Coherence and comparability

There are no directly comparable data sources, although we can compare our bulletin with other national statistical institutes (NSIs). We are leading internationally on the topic and collaborate with other countries to further develop the measurement of intangibles and aim to ensure we adhere to international guidance on measurements and definitions.

One international group who is looking into the measurement of intangibles in the UK is Luiss Lab of European Economics at Luiss University in Rome, Italy. They are measuring investment into intangibles in multiple countries using their integrated EUKLEMS and INTANProd database. While these data are comparable in concept, they use different data sources and provide different estimates of intangible investment for the UK. We are in early discussions with Luiss University statisticians to establish reasons for these discrepancies.

The Investment in intangibles in the UK: 2021 bulletin incorporates assets that are both capitalised (within the asset boundary of current UK National Accounts guidelines) and uncapitalised (outside the asset boundary). Capitalised assets (research and development (R&D), mineral exploration, artistic originals, and software and database) are wholly consistent with estimates of intellectual property products within our Business investment in the UK bulletins.

In addition, the Business Enterprise Research and Development Survey (the largest component of total UK expenditure on research and development) in the Business investment in the UK releases, provides users with expenditure on research and development performed by UK businesses.

Accessibility and clarity

Our Investment in intangible assets in the UK bulletins are published for free on the ONS website in line with the Code of Practice for Statistics. Our recommended format for accessible content is a combination of HTML web pages for narrative, charts and graphs, with data provided in usable formats such as CSV and Excel file types. We also offer users the option to download the narrative in PDF format. In some instances, other software may be used or may be available on request.

For information regarding conditions of access to data, please refer to the following:

- Office for National Statistics (ONS) website terms and conditions
- ONS Freedom of Information (FOI) requests
- The ONS's accessibility statement

One issue regarding the clarity of the Investment in intangible assets in the UK: 2021 bulletin is the complexity of the definitions used. It is also difficult to convey some of the messaging because of the lack of formal definitions and challenges of measuring this topic.

Timeliness and punctuality

Annual intangible investment estimates follow the publication of supply and use tables (SUT) and detailed gross fixed capital formation (GFCF) breakdowns, typically published around two years after the reference year. This timeframe occurs because intangibles are based on input data that are not available until late in the year following the reference year.

The time between the availability of data and the bulletin is needed for the production and quality assurance of the projections, with the Intangible Assets and Investment team typically requiring approximately six weeks to publish their estimates after the publication of the annual UK National Accounts, The Blue Book

For more details on related releases, the release calendar provides 12 months' advance notice of release dates. In the unlikely event of a change to the pre-announced release schedule, public attention will be drawn to the change and the reasons for the change explained at the same time, as set out in the Code of Practice for Statistics .

Concepts and definitions

We use the System of National Accounts, 2008 (SNA2008) (PDF, 9.08 MB) for the following definitions: entertainment, literary and artistic originals; mineral exploration and evaluation; research and development; computer software and databases. Branding (own-account and purchased) is referenced in SNA2008 but a full definition is not included. The other definitions given in this section are not included in SNA2008.

Entertainment, literary and artistic originals

"Entertainment, literary and artistic originals consist of the original films, sound recordings, manuscripts, tapes, models, etc, on which drama performances, radio and television programming, musical performances, sporting events, literary and artistic output, etc, are recorded or embodied. Such works are frequently developed on own account. Subsequently they may be sold outright or by means of licences." This definition is from Chapter 10.115, System of National Accounts, 2008.

Mineral exploration and evaluation

"Mineral exploration and evaluation consists of the value of expenditures on exploration for petroleum and natural gas and for non-petroleum deposits and subsequent evaluation of the discoveries made." This definition is from Chapter 10.106, System of National Accounts, 2008.

Research and development

"Research and development is creative work undertaken on a systematic basis to increase the stock of knowledge, and use this stock of knowledge for the purpose of discovering or developing new products, including improved versions or qualities of existing products, or discovering or developing new or more efficient processes of production." This definition is from Chapter 6.207, System of National Accounts, 2008.

Computer software

"Computer software consists of computer programs, program descriptions and supporting materials for both systems and applications software." This definition is from Chapter 10.110, System of National Accounts, 2008.

Databases

"Databases consist of files of data organised in such a way as to permit resource-effective access and use of the data. Databases may be developed exclusively for own use or for sale as an entity or for sale by means of a licence to access the information contained." This definition is from Chapter 10.112, System of National Accounts, 2008.

Branding (own-account and purchased)

Chapter 10.198 of the System of National Accounts, 2008, lists several examples of marketing assets, including "brand names, mastheads, trademarks, logos and domain names". It also provides guidance on the intangible nature of a "brand", stating that it goes beyond a simple "corporate name or logo" but includes the "overall impression a customer or potential customer gains from their experience with the company and its products".

Design (own-account and purchased)

Design work can include a much wider variety of activities, from aesthetic activities such as fashion design and interior design, through to service design. From April 2021, our estimates have also included the turnover of the specialised design industry as an additional data source, as a further step towards including a broader range of activities.

Financial product innovation

Financial product innovation (FPI) was proposed in Measuring Capital and Technology: An Expanded Framework by Carol Corrado, Charles Hulten and Daniel Sichel in 2005. It is described as research and development in finance, a form of non-scientific research and development, broadly defined as an estimate of the spending for new product development by financial services and insurance firms.

Firm-specific training

Relates to the know-how that is not transferable between companies; for example, the knowledge needed to use bespoke software. The act of providing training can be viewed as investment in the acquisition of knowledge and skills. In our experimental measures, a sum-of-costs approach covering the cost of training staff (direct training costs and the cost of employees' time spent on training) is used to estimate the value of knowledge and skills acquired.

Organisational capital (own-account and purchased)

Investment in organisational capital is generally considered to be investment into the structures and management practices of organisations intended to increase productivity and efficiency.

Why you can trust our data

The Office for National Statistics (ONS) is the UK's largest independent producer of statistics and its national statistical institute. We treat the data that we hold with respect, keeping it secure and confidential, and we use statistical methods that are professional, ethical, and transparent. We also adhere to the Code of Practice for Statistics, which holds us to a high standard and "gives you confidence that published government statistics have public value, are high quality, and are produced by people and organisations that are trustworthy."

6 . Methods used to produce the data

Defining the market sector

To create our market sector estimates, we exclude data relevant to industries 68 (real estate activities), 84 (public administration and defence; compulsory social security), 85 (education), 86 (human health activities), 87 (residential care activities), and 88 (social work activities without accommodation). This is to omit the real estate industry and the public sector.

The real estate industry is excluded, as it is where all dwellings are classified. Therefore, a comparison of intangible and tangible assets including this industry would include all dwellings as tangibles and skew our analysis. The public sector is omitted to remove the "non-market sector", which creates a proxy for the "market sector" from the remaining industries.

Our use of "market sector" in this release is different to the standard definition of "market sector" used by the Office for National Statistics (ONS), which states that any unit selling at an economically significant price is operating in the market. Not all of sections 84 to 88 are non-market, and there are non-market parts of other industries.

Capitalised intangibles

Research and development, artistic and literary originals, mineral exploration

We obtain data that are consistent with our Business investment in the UK bulletin. More detail on the methods used for this bulletin are available in our Business investment QMI.

Purchased and own-account software

These data are consistent with our Business investment in the UK bulletin. We take estimates of purchased software and estimates of total software for each industry to find the proportion of total software investment that comes from purchased software.

We multiply the total software investment figure by the proportion of total software that is purchased (or own-account) for the corresponding industry.

Uncapitalised intangibles

Purchased design

We create these data using a combination of intermediate consumption and gross fixed capital formation (GFCF) data from our Input-output supply and use tables (SUT) dataset. Specifically, we refer to Table 2: Demand of products - The "Combined Use matrix" - Final demand, and Table 4: Gross fixed capital formation by industry.

We use the data from classification of products by activity (CPA) Product 71 (architectural and engineering services; technical testing and analysis services). We focus solely on the "architectural and engineering services" aspect of CPA 71 and exclude "technical testing and analysis services". To understand the split of the two categories, we use data from Sector M of the Annual Business Survey (ABS) data, which relates to professional, scientific, and technical activities.

The group is further divided into 71.1 "architectural and engineering services and related technical consultancy" and 71.2 "technical testing and analysis services". For every year of data, we calculate the proportion that 71.1 "architectural and engineering services" (what we call "design") contributes to the overall category 71, using total turnover figures.

$$\text{Proportion} = \frac{\text{Figure for 71.1 Architectural and engineering services}}{\text{Figure for 71 Architectural and engineering services; technical testing and analysis services}}$$

We apply several factors to each figure. First, we multiply figures by 0.84, an adjustment to exclude production that does not produce design assets. This percentage excludes certain subsectors within "architectural and engineering services" that are not design-related activities, such as geology. This estimate is based on 2004 employment data from the business structure database and a calculation made in Fernando Galindo-Rueda, Jonathan Haskel and Annarosa Pesole's 2010 article How much does the UK employ, spend and invest in design?

We also multiply all figures by 0.5, as we assume that half of all design activity is short-lived. This calculation is from Haskel and Pesole's 2011 article Design Services, Design Rights and Design Life Lengths in the UK. The article uses design expenditure on new products as a proxy for long-lived design. This assumption is based on a 2005 report from the Construction Industry Scheme (CIS) and Design Council Survey (DCS). DCS found that 86% of firms that developed a new product used design at least to a limited extent. They also found that the level of design spending on new products reported in the CIS accounts for 9% of the authors' estimates of purchased design. With a lower bound of 9% and upper bound of 86%, the authors use a rough mean of 50%.

These factors are legacy assumptions that were incorporated into previous iterations of our Investment in intangible assets in the UK bulletin.

Finally, we convert data into billions for publication.

Data on specialised design (a component of purchased design) are obtained from the Annual Purchase Survey (APS). We use data from CPA Product 74 (other professional, scientific, and technical services). For data from 2016 onwards, we calculate the proportion each industry contributes to the total. For years where we do not have data provided by APS (1997 to 2015), we use the average of years with data available (2016 onwards).

Once we have calculated the proportion each relevant industry's turnover contributes to total specialised design activity turnover, we multiply the industry turnover proportion by the total specialised design turnover figure to get a specialised design estimate by industry.

We then combine the specialised design figure with the ABS data and sum this with our core purchased design figures to get the final, publishable series.

Purchased branding

We create these data using a combination of intermediate consumption and GFCF data from our Input-output supply and use tables (SUT) dataset. Specifically, we refer to Table 2: Demand of products - The "Combined Use matrix" - Final demand, and Table 4: Gross fixed capital formation by industry. We use Classification of Products by activity (CPA) Product 73 "advertising and market research services".

The SUT data "advertising and market research services" are split into two categories, "advertising" and "market research services", using data from the ABS, specifically Sector M of the Standard Industrial Classification (professional, scientific, and technical activities).

Taking the two products 73.1 (advertising) and 73.2 (market research (MR) and public opinion polling), we calculate the proportion that each product contributes to the total turnover figures. This gives us two series: the percentage that is advertising and the percentage that is MR. For every year, these percentages should sum to 100.

$$\text{Proportion that is Ad} = \frac{\text{Turnover of Ad}}{\text{Turnover of Ad} + \text{turnover of MR}}$$

$$\text{Proportion that is MR} = \frac{\text{Turnover of MR}}{\text{Turnover of Ad} + \text{turnover of MR}}$$

We then multiply the percentage that is advertising by the combined estimates of intermediate consumption and GFCF for advertising and MR. Finally, we multiply all figures in the table by 0.6. The resulting figure represents "national" advertising, which we assume to be long-lived when compared with local advertising, which we assume to be short-lived. This in turn informs our estimate that 40% of advertising is short-lived, which we define as having an asset life of less than one year. Our figures now represent investment in advertising.

We then multiply the percentage that is MR by the combined estimates of intermediate consumption and GFCF for advertising and MR. Finally, we multiply all figures in the table by 0.6, based on our assumption that 40% of MR is short-lived. This assumption originated from the Corrado, Hulten and Sichel (CHS) paper published in 2005 and was explored in Josh Martin's 2019 paper for the National Institute Economic Review, Measuring the other half: new measures of intangible investment from the ONS.

We then aggregate the data into the 12 industry groups (SIC12) and convert the data into billions, for publishing.

Finally, we sum the totals of advertising and MR to create the total for purchased branding.

Purchased organisational capital

We create these data using a combination of intermediate consumption and GFCF data from our Input-output supply and use tables (SUT) dataset. Specifically, we refer to Table 2: Demand of products - The "Combined Use matrix" - Final demand, and Table 4: Gross fixed capital formation by industry. We use CPA Product 70"services of head offices; management consulting services". To these data, we apply a factor of 0.8, with the assumption that 20% of purchased organisational capital is short-lived. This gives us our final data.

Own-account branding, design, organisational capital, and financial product innovation (FPI)

The calculation of investment in these own-account uncapitalised intangible assets uses a sum-of-costs approach. This approach states that the value of output is equal to the sum of the following items: intermediate consumption, compensation of employees and other taxes on production less other subsidies on production.

To create our own-account estimates we start with data from the Annual Survey of Hours and Earnings (ASHE). We create our assets by selecting only relevant occupations, which differ for each asset. These can be found in Table 1: Intangible Standard Occupation Classification (SOC) codes by asset, 2020 (XLSX, 18KB).

We then apply further factors to the data. This is to account for the amount of time staff spend doing productive activities in these areas (time factors) and the relevance of the occupation to the asset (relevance factors). These time factors are shown in Table 1.

Having applied these factors to the labour costs data, we then apply cost uplift factors to account for non-labour costs in the production of these assets. To achieve this, we create a cost uplift factor using compensation of employees for relevant industries associated with each uncapitalised intangible as a numerator, and the total gross output (compensation of employees, intermediate consumption, consumption of fixed capital and operating surplus) for the relevant industries associated with the relevant uncapitalised intangibles as the denominator. The resulting factor is applied to the labour costs to calculate a total value of the asset, which reflects both labour and other costs incurred.

We also remove the amount of investment expected to have a lifespan of less than one year, as this should not be treated as capital formation (capitalisation factor).

Once all relevant factors have been applied, we calculate the relevant investment and hours we use in our Investment in intangible assets in the UK Statistical bulletin. Throughout this process we are aiming to understand the amount of investment into these assets. To do this, we aggregate the data to the publishable industry groups.

Before publishing the estimates, we also account for disclosive values. This is done by looking at the unweighted observations of the data and identifying any instances where the unweighted observations are below three, following our policy on statistical disclosure control.

Our Investment in intangible assets in the UK: 2021 dataset is the first to use the SOC20 codes detailed in Table 1 for the latest year. Before July 2024, all calculations were performed on previous SOC iterations. Table 2 includes a mapping table of the move between SOC10 and SOC20 codes. Table 2: Intangible SOC codes from Standard Occupation Classification 2010 to 2020 (XLSX, 20.7KB).

Workplace-specific training

To produce "training" data, we use the Employer Skills Survey (ESS) dataset from the Department for Education (DfE) website. We specifically use the UK geography and totals. These datasets include data from 2011 onwards on a biannual basis, although there is a larger gap between 2019 and 2022.

Data are only available for England, Wales and Northern Ireland in 2019, so we must scale up to UK level by applying a Scotland uplift factor. The year 2019 is the only one affected by this issue. As we are only working with data on market sector industries, we remove the "health and social work," "public admin" and "education" sectors by deleting them from the total in the ESS dataset.

To account for real estate, which is included within the business services sector, we multiply each business services training estimate by 0.9, based on a historical estimate of the relative size of the real estate industry. We then match the categories used by the ESS dataset for each industry.

- 65.0% of business services goes to professional, scientific and technical activities.
- 25.0% of business services goes to administrative and support service activities.
- 55.7% of primary sector and utilities goes to agriculture, mining and quarrying, with the remainder going to gas and utilities.
- 48.7% of transport and storage, and communications in 2011, 2013 and 2015 goes to transport, with the remainder going to information and communications.

All other industries used are a direct mapping from the ESS data to the SIC industries used in our Investment in intangible assets in the UK bulletin.

We now have data for market sector training investment for 2011, 2013, 2015, 2017, 2019 and 2022. For the missing years between 2011 to 2019, we interpolate based on the average of the surrounding years. For example, for 2012, we estimate training investment as the average of the 2011 and 2013 training figures.

For the missing years between 2019 and 2022, we interpolate based on compensation of employees (CoE) data from the supply and use tables. As ESS annual growth is not available between 2019 and 2022, we have used the annual growth rate of CoE between 2019 and 2022, and constrain this to the three-year (2019 to 2022) growth provided by the ESS data.

For the years where ESS is not available, to get an industry allocation within the newly created annual growths (constrained to ESS), we take the five-year average industry contributions to the overall training total investment (given in millions and British pounds) for years where we have ESS data. For the Investment in intangible assets in the UK: 2021 bulletin, this took the averages of 2016 to 2019, and 2022. For years before 2011, CoE data from the SUT are used to back-cast training estimates from 2011 ESS estimates.

Total tangible estimates

Total tangible estimates are provided by the Gross Fixed Capital Formation (GFCF) team and comprise building and transfer costs, transport equipment, other machinery equipment, information and communication technology, and cultivated assets. We exclude dwellings in line with the removal of industry 68 for real estate. Within total tangible estimates we also remove the market sector. These figures are consistent with those presented in our Business investment in the UK bulletin.

Total uncapitalised intangibles

Total uncapitalised intangibles are created by summing the totals of branding, design, financial product innovation, training and organisational capital.

Total capitalised intangibles

Total capitalised intangibles are provided to us by the GFCF team. They are created by summing the market sector totals of artistic originals, software and databases, mineral exploration and research and development.

Total intangibles

Total intangibles are created by summing the totals of uncapitalised and capitalised intangibles.

Our data tables

Our Investment in intangible assets in the UK dataset presents data in various categorisations and includes three headline tables.

- Table 1 covers total intangible and tangible investment.
- Table 2 covers investment in intangibles by asset (details of these assets are included in Section 5: Quality characteristics of the data).
- Table 3 covers intangible investment by asset and industry, presented as a Standard Industrial Classification (SIC) 12 section breakdown.

We aggregate these data into 12 industry sector groups, which are defined by Standard Industrial Classification (SIC) codes 2007:

1. Agriculture, mining, and utilities, SIC codes 1 to 9, A (agriculture, forestry, and fishing, B (mining and quarrying)
2. Manufacturing, SIC codes 10 to 33, C (manufacturing)
3. Gas and electricity, SIC codes 35 to 39, D (electricity, gas, steam, and air conditioning supply), E (water supply, sewerage, waste management and remediation activities)
4. Construction, SIC codes 41 to 43, F (construction)
5. Wholesale and retail trade, SIC codes 45 to 47, G (wholesale and retail trade; repair of motor vehicles and motorcycles)
6. Transport, SIC codes 49 to 53, H (transportation and storage)
7. Accommodation and food services, SIC codes 55 to 56, I (accommodation and food service activities)
8. Information and communication, SIC codes 58 to 63, J (information and communication)
9. Financial Services, SIC codes 64 to 66, K (financial and insurance activities)
10. Professional scientific and technical activities, SIC codes 69 to 75, M (professional, scientific and technical activities)
11. Administrative and support service activities, SIC codes 77 to 82, N (administrative and support services activities)
12. Arts, recreation and other services, SIC codes 90 to 98, R (arts, entertainment and recreation), S (other service activities) and T (activities of households as employers; undifferentiated goods and services producing activities of households for own use)

Following our headline tables in our Investment in intangible assets in the UK dataset, we have included further asset breakdowns by industry. The number of industries included vary between these breakdowns because we use different industry groupings.

Research and development, computer software and databases, organisational capital, design, and branding all include 64 of the 99 industries. This is consistent with the data in our Business investment in the UK bulletin.

The artistic originals category covers industries 58 to 60 and 90 to 92. Mineral exploration covers industries 5 to 9. Financial product innovation covers industries 64 to 66.

All data tables have excluded industries 68 (real estate activities), 84 (public administration and defense; compulsory social security), 85 (education), 86 (human health activities), 87 (residential care activities) and 88 (social work activities without accommodation). This is to omit the real estate industry and the public sector.

For more information on what these divisions include, please see UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007) (PDF, 1.2MB).

Main data sources

The main data sources for our Investment in intangible assets publications include:

- our Annual Survey of Hours and Earnings (ASHE)
- our Business investment in the UK bulletin
- our Annual Business Survey (ABS)
- our Annual Purchases Survey (APS)
- the Employer Skills Survey (ESS)
- our Input-output supply and use tables (SUT) dataset

How we analyse and interpret the data

We produce time series analysis to show how investment in intangible assets changes over time. We also provide industry breakdowns for each of the assets.

To ensure we are using the data provided to us correctly we have a curiosity meeting with our data providers to explain how we are interpreting their data and highlighting any important messages.

Within our bulletin, we also try to provide economic context for any data changes, to allow for better understanding.

How we quality assure and validate the data

Rigorous quality assurance is carried out at all stages of production. Specific procedures include:

- scrutinising input data to investigate the accuracy of any abnormal values
- scrutinising trends in the totals, assets, and industry breakdowns
- comparing current estimates with previous estimates to see where substantial changes are taking place and to understand the reasons for those changes
- completing revisions analysis on our input data using PowerBI
- having the dataset checked by other teams at the Office for National Statistics (ONS) and external data providers
- checking output tables to identify and address any errors or inaccuracies before publication

How we disseminate the data

These data are disseminated primarily through statistical bulletins and ad-hoc releases on the ONS website. Our publication schedule is available in Section 5: Quality characteristics of the data. The Intangible Assets and Infrastructure team publishes regular statistical bulletins. Our releases are also discussed through the ONS social media accounts.

Internal stakeholders and data suppliers receive data ahead of release as part of the quality assurance process.

We employ consistent disclosure control procedures ahead of publication.

The Code of Practice for Statistics sets out practices for how we protect data from being disclosed. In our processing of own-account intangibles, we ensure assets and industries with fewer than three observations are removed to eliminate any opportunity for disclosing individuals. More information can be found on the ONS disclosure control page.

How we review and maintain the data processes

As our data are official statistics in development, we regularly review our definitions and methods. We also engage with international discussions on the topic through our involvement with task teams, specifically regarding candidates for capitalisation within the national accounts data and marketing (branding) assets. We also keep up to date with the latest developments in academia on the measurement of intangible assets.

7 . Other information

Delivering Tangible Estimates of non-SNA Intangible Assets (PDF, 464KB)
Academic paper | Released 16 November 2022
Using Corrado, Hulten and Sichel (CHS) framework, this paper summarises the methods used by the Office for National Statistics (ONS) to produce estimates of the full set of CHS "uncapitalised" assets, and provide a universal picture of these assets and their economic importance.

The 'F Words': Why Surveying Businesses About Intangibles is so Hard (PDF, 640KB)
Discussion paper | Released August 2022
Explores the challenges of measuring the role of intangible assets in creating value in the modern economy.

Can intangible investment explain the UK productivity puzzle?
Discussion paper | Released May 2013
Investigates whether intangible investment might explain the UK productivity puzzle.

Estimating UK investment in intangible assets and Intellectual Property Rights (PDF, 4.2MB)
Report | Released 30 September 2014
Updated estimates of the level of UK market sector investment in knowledge assets and the proportions of those investments protected by Intellectual Property Rights (IPRs).

UK Intangible Investment and Growth: New measures of UK investment in knowledge assets and intellectual property rights (PDF, 1.1MB)
Report | Released September 2016
Update on UK intangible investment and growth for the period 1990 to 2014.

Public Support for Innovation, Intangible Investment and Productivity Growth in the UK Market Sector (PDF, 132KB)
Discussion paper | Released February 2010
Uses data on market sector productivity, research and development (R&D) and non-R&D intangible assets, and public sector R&D spending to look for evidence of market sector spillovers from intangible investment and from public R&D.

Measuring the Other Half: New Measures of Intangible Investment from the ONS
Methodological review | Released August 2019
A paper from the National Institute Economic Review about ongoing work at the ONS to develop measures of investment in intangible assets. The paper reviews developments in three areas: in-house branding investments, employer-funded training investments, and in-house investments in organisational capital.

We invite users to contact us at nfa-development@ons.gov.uk with questions or comments on our development work, estimates or future plans.

8 . Related links

Investment in intangible assets in the UK: 2021
Bulletin | Released 23 April 2024
Estimates of investment, both purchased and own account production, of intangible assets, and developmental estimates of investment in intangible assets by industry. These are official statistics in development.

Investment in intangible assets in the UK: 2020
Article | Released 15 December 2022
Developmental estimates of investment in intangible assets in the UK from 1997 to 2020, presented by asset category and industrial sector.

Investment in intangible assets in the UK by industry: 2019
Bulletin | Released 1 December 2021
Developmental estimates of investment in intangible assets by industry at the Standard Industrial Classification 2007 (SIC) division level.

Developing experimental estimates of investment in intangible assets in the UK: 2016
Article | 6 February 2019
Update on development work to measure intangible assets (knowledge assets) beyond those in the national accounts, and updated estimates of investment to 2016.

9 . Cite this methodology

Office for National Statistics (ONS) released 8 October 2024, ONS website, quality and methodology information report, Investment in intangible assets in the UK QMI.