OXFORD ECONOMICS

THE MANUFACTURING TECHNOLOGIES ASSOCIATION

MTA

The true impact of UK Manufacturing

April 2024

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APRIL 2024

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FOREWORD

Manufacturing has had a significant impact on the prosperity of the UK economy. Our manufacturers deliver the tools and solutions that make it possible for us to better protect our health, defend our nation and allow us to face into emerging threats such as climate change.

This report highlights the vital role that our manufacturers play in keeping our economy strong, in contributing 24% to GDP and fuelling the prosperity of communities right across the country. The sector also continues to innovate to meet global challenges. The drive to reduce carbon emissions will see new technologies and new industries being born in areas such as renewable energy which offer huge potential for our national prosperity.

We will see great opportunities in areas such as lightweighting and new, less carbon intensive materials and technologies. While the focus is on the highest profile new technologies, it is imperative though that cross-sectoral enabling technologies and companies operating in high technology niche areas are not forgotten. As technologies evolve, the scale of change can be daunting for SMEs so access to practical and financial support must continue to be a priority.

Firms show immense resilience in the face of continuing challenges. In the last five years manufacturers have had to navigate Britain's changing relations with the European Union, the pandemic, and the outbreak of war in Europe. Labour shortages continue to constrain capacity – a particularly acute problem for SMEs who aren't able to support multiple apprenticeships and face intense competition to keep those that they do have.

Manufacturers have been pushed to the limits of their ingenuity but have overcome every hurdle and emerged as a sector that will not only thrive but has the potential of putting the UK in a prime position in global market and thought leadership. Encouraging domestic production and supporting UK companies to export for the first time or increase existing exports in a changing global economy will create vital opportunities to generate wealth and improve the standard of living across the UK.

This report therefore is a reminder, should it be needed, that manufacturing matters. Creating an environment in which our manufacturers can thrive is important to our health and wealth and the future of our planet.

The Advanced Manufacturing Plan published recently by the government promises support worth £4.5 billion to dynamic and growing sectors, giving us confidence that the importance of manufacturing and the need for a long-term approach to supporting our manufacturers is recognised. Meeting that ambition requires a long-term well-integrated commitment from the nation. We must seize the opportunity by working together - policy makers, business leaders and the UK's world-leading researchers, to deliver an environment that allows manufacturing companies to succeed. Joining forces to identify the opportunities and risks that face us and develop a united plan will enable us to deliver sustainable economic growth.

James Selka

CEO, MTA

"As this report highlights, manufacturing is an integral part of the UK economy, through GDP contribution, job creation, and as a source of high wages. When you consider the sector's extended reach through its supply chains and beyond, you can really start to see the scale of its contribution.

Manufacturers have demonstrated agility and resilience in the past few years of uncertainty. We're continuing to invest in partnerships in the sector to ensure it has the skills, tools and support to compete on a global scale. I look forward to supporting SMEs with the challenges they face now and with the opportunities to be grasped."

Dave Atkinson

UK Head of Manufacturing SME & Mid Corporates, Lloyds Bank

"This report captures the value of manufacturing not merely in terms of its direct economic impact, but the bearing it can have on creating a more sustainable and prosperous society. Importantly, it recognises that the only way to achieve this is if government, academia and industry work side by side.

"The UK is already a top-flight manufacturing nation. With the right policies in place we can grow our rich capabilities to deliver a thriving industry ready to meet the most difficult challenges we face."

Katherine Bennet CBE

CEO, High Value Manufacturing Catapult

"Manufacturing has always been a strategically important sector for UK economy and, none more so than now, given the immense societal, political and economic challenges that we face. Just as the first industrial revolution provided a step change, the accelerating pace of technological change of the fourth industrial revolution gives us a generational opportunity to do the same now. This valuable report highlights to those in power now and in the future, how vital a sector manufacturing is to the fabric of the UK. The sector stands ready to work with all key stakeholders to ensure we grasp the opportunity facing us with both hands."

Stephen Phipson CBE

CEO, Make UK

"It's a good time to be in Manufacturing in the UK. Whilst the sector continues to face the challenges of skills shortages, demand fluctuation, export friction and supply chain difficulties that necessitate unprecedented resilience, we can point to improving conditions for investment with both our major political parties focusing policy instruments and promises on the sector.

With a £4.5bn Advanced Manufacturing Plan in play, full capital expensing for plant and machinery made permanent and £100m support for the Made Smarter Adoption programme to secure it until 2030 - businesses large and small can embrace innovation and industrial digital technology to help

improve their competitiveness, productivity and sustainability with the support and signposting of key organisations like MTA, our Catapult centres and the Made Smarter team too. Taking first steps in digitalisation and decarbonisation can be daunting which is why it's incredibly important to partner up and take the time to explore the art of the possible. I hope you find value in this report to inspire action of your own and hope to see you at Mach 2024…"

Brian Holliday

Managing Director for Siemens Digital Industries, Siemens plc & Co-Chair of Made Smarter

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EXECUTIVE SUMMARY

Manufacturing is an important part of the UK economic landscape. As conventionally measured in national accounts, the sector directly employs 2.6 million workers across the UK, who collectively generated an estimated £184 billion in GDP during 2022. This means manufacturing companies directly contributed 8% of GDP and 7% of employment in that year. As a high productivity sector, manufacturing is also an important source of high wages jobs across the country; the median manufacturing wage is 11% higher than the average UK equivalent.

However, the sector's impact on the UK economy extends far more widely than manufacturing companies themselves. In particular, manufacturers rely on a complex network of UK-based supply chains. Purchases from these suppliers generate "indirect" impacts which ripple out across all sectors of the economy. Once these indirect impacts are included within our calculations, we find that manufacturing supported £348 billion of GDP (15% of the UK economy) and 5 million jobs (14% of the UK total) in 2022.

There is also a third aspect to the contribution that manufacturing makes to the UK economy. This is the "induced" impact, which arises when those employed by manufacturers and their suppliers spend their wages in the wider economy. **Bringing together the direct, indirect, and induced impacts of manufacturing gives us a third way of estimating the impact of the sector.** On this basis, we estimate that the total impact of manufacturing on UK GDP was £518 billion in 2022. For every £1 million that the manufacturing sector contributes to UK GDP itself, a further £1.8 million is supported across the wider economy through indirect and induced multiplier effects. On the same basis, manufacturing supported a total of 7.3 million jobs in 2022. For each job in the manufacturing sector itself, a further 1.8 are supported in other sectors of the UK economy.

Over and above the GDP and employment it supports, the manufacturing sector makes an important contribution to the UK economy in other ways. Firstly, manufacturing accounts for a disproportionate share of R&D expenditure: in 2022, 47% of business R&D investment was made by manufacturers. R&D expenditure is important as it can generate wider benefits that extend beyond the individual business or sector. Further, manufacturing's heavy export orientation means it is a significant source of export revenues: in 2022, manufactured goods accounted for over a third (34.5%) of UK goods and services exports.

This report also assesses the economic impact of the engineering sub-sector, defined here to comprise the manufacture of metal products, electronics and electrical equipment, machinery and equipment, motor vehicles and other transport equipment (which includes aerospace, railway equipment, shipbuilding, etc.) See Appendix 1 for details.

In total, the engineering sub-sector contributed £193 billion to UK GDP and supported 3.1 million jobs in 2022. The GDP figure includes the £66 billion that engineering firms contributed directly, plus £128 billion in indirect and induced multiplier effects. The UK engineering sector employs 963,000 people, with a further 1.7 million jobs sustained in the supply chain and as a result of workers' spending.

1. INTRODUCTION

The size of the UK's manufacturing sector is closely monitored in official statistics which track the sector's direct contribution to the economy, for example in terms of GDP and employment. But such measures do not reflect **the full impact of manufacturing on the UK economy, which extends far beyond these headline estimates**.

In 2018, the Manufacturing Technologies Association (MTA), representing companies that design, manufacture, and supply the advanced machinery, software, and knowhow that manufacturers deploy to create their products, asked Oxford Economics to investigate this, and to estimate the true impact of UK manufacturing. This request followed in the footsteps of the government's 2016 Manufacturing Metrics Review, which highlighted the need for a more comprehensive approach to measuring manufacturing activity.[1] In order to get a more up to date picture of the UK manufacturing sector, this 2024 report updates the methodology used in the 2018 report whilst also incorporating additional analysis.

As in the 2018 report, this report uses an *economic impact assessment* to quantify the full contribution that the manufacturing sector makes to employment and GDP. Crucially, this includes the wider economic "footprint" supported by the industry's domestic supply chains, together with the wage-financed consumption of its workers and those in its supply chain.

The analysis of manufacturers' UK supply-chain purchases is particularly important in understanding the sector's true impact on the economy. Increased outsourcing of support functions means many activities that were traditionally carried out in-house by manufacturers are now classified as "services activity" in the national accounts.

Even when UK manufacturers import raw materials, components and equipment from overseas, they may still be supporting activity within the UK—for example, among UK-based distributors and logistics companies who facilitate these imports.[2] Our modelling accounts for these effects to the fullest possible extent using official statistics.

We start our analysis by assessing the manufacturing sector itself, before extending our focus to the supply chain impact, and then worker spending effects.

In Section 6, we take a closer look at the engineering sub-sector, to ascertain its impact on the UK economy, both directly and through supply chain and worker spending multiplier effects. Technical details of our approach and data sources are provided in the appendices.

[1] Manufacturing Metrics Expert Group. 2016. "Manufacturing metrics review report".
[2] The extent to which such activity is captured within our estimates will depend on the structure of contracts and the categorisation of firms. This is discussed further in the appendix.

INTRODUCTION TO OUR ECONOMIC IMPACT ANALYSIS

The impact of manufacturing is assessed using a standard means of analysis called an economic impact assessment. This involves quantifying the sector's impact across three "core" channels:

- ***Direct impact,*** which relates to the manufacturing sector's own activities. It encompasses the economic activity and employment supported directly by firms in the manufacturing sector.
- ***Indirect impact,*** which encapsulates the economic activity and employment supported in the supply chain of the manufacturing sector, as a result of its procurement of goods and services from firms in other sectors. Our analysis estimates the impact of manufacturers' capital investments, as well as that of their day-to-day purchases.
- ***Induced impact,*** which comprises the wider economic benefits that arise when employees within the manufacturing sector, and its supply chain (including that for capital purchases), spend their earnings—for example, in local retail and leisure establishments.

The sum of these channels makes up the manufacturing sector's total economic impact. Two main metrics are used to present a picture of the sector's economic contribution:

- ***GDP,*** or more specifically, the *gross value added (GVA)* contribution to GDP.[3]
- ***Employment,*** measured on a headcount basis.

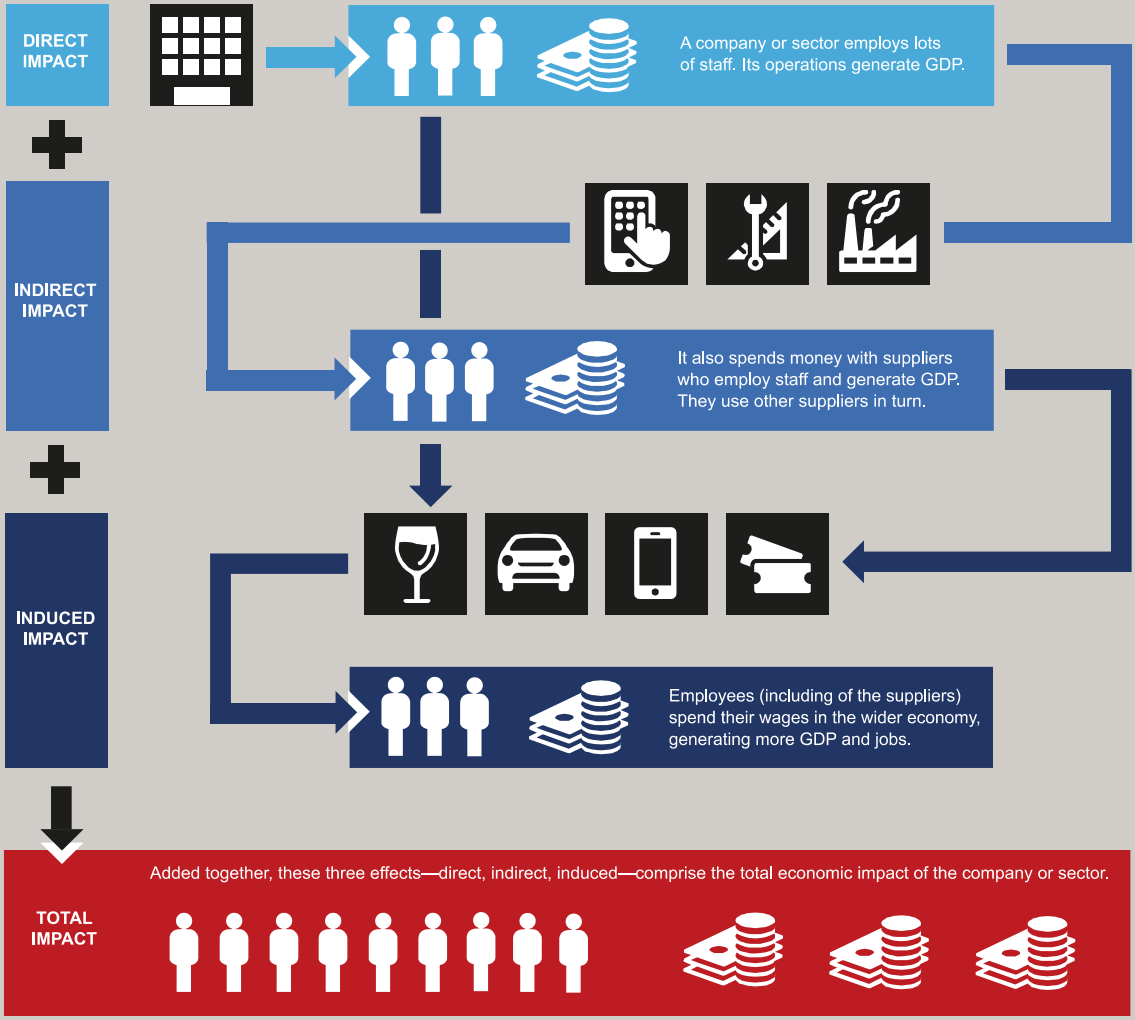
The modelling is conducted using an Input-Output (I-O) based model of the UK economy. This model was constructed by Oxford Economics, using data published by the ONS.

Note 1: A standard I-O based assessment of the manufacturing industry's supply chain would count its purchases of fuels, consumable parts, tools, utilities, professional services, etc, but would miss out capital spending on machinery, vehicles, or the construction of facilities that are crucial for its activities. Our approach also incorporates information on capital purchases that are made as part of each industry's gross fixed capital formation (GFCF). By including the average amount of capital spending that is required to sustain a given level of output, we have a more accurate measure of what inputs are required for economic activity to take place.

Further detail about the economic impact methodology is included in Appendix 3.

[3] GVA measures the contribution to the economy of each individual producer, industry or sector. When aggregated across all industries, GVA (plus product taxes minus product subsidies) sums to GDP. The latter represents the total value of all goods and services produced in an economy and is the main measure of a country's total economic activity. See Appendix 3 for further details.

Fig. 1. How we measure the UK manufacturing industry's total impact



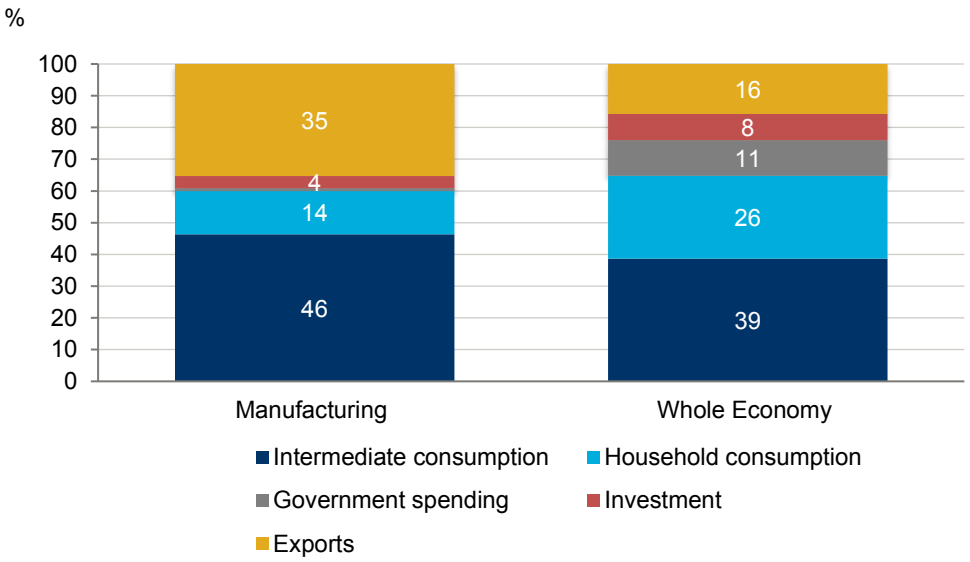
2. THE DIRECT IMPACT OF THE MANUFACTURING SECTOR

2.1 SIZE AND IMPORTANCE OF MANUFACTURING

2.1.1 Sales: how much, and who to?

The manufacturing sector continues to play an important role in the UK economy, selling products worth £608 billion at home and abroad in 2019. The sources of demand for UK manufacturing outputs are shown in Fig. 2.[4]

Fig. 2. Sources of demand: manufacturing versus whole economy, 2019



Source: ONS Input-Output tables, Oxford Economics

The largest source of demand for the UK manufacturing sector's output is intermediate consumption—that is domestic businesses purchasing goods for use in their production processes. This accounted for 46% of the total—a considerably higher share than the overall economy where 39% of purchases were defined as intermediate consumption.[5] Exports are also a much more important source of demand for the manufacturing sector than the overall economy. Overseas sales represented 35% of demand for UK manufacturing output; this proportion is more than double that of the whole economy (16%).

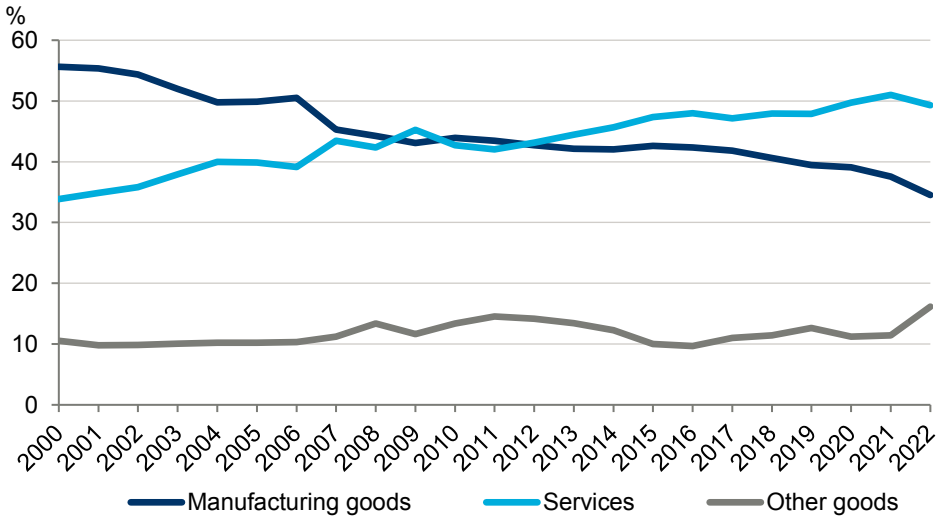
The importance of export sales for the UK manufacturing sector also means that it accounts for a disproportionate share of overall UK export sales: in 2022, manufacturing exports accounted for 34.5%

[4] ONS. 2023. UK input-output analytical tables.

[5] Household consumption only includes direct sales to households. Therefore, if a manufacturer sells a product to a distributor, who then sells to households, the sale would be recorded as intermediate consumption.

of all UK goods and services exports. However, the manufacturing sector's share of total exports has declined over the years; in 2000 manufacturing exports accounted for 55.6% of all goods and service exports. Over this time period, services exports have grown faster than manufacturing exports with service exports making up 50.7% of all exports in 2022, compared to 33.9% in 2000.[6]

Fig. 3. Manufacturing goods share of UK goods and services exports, 2000-2022

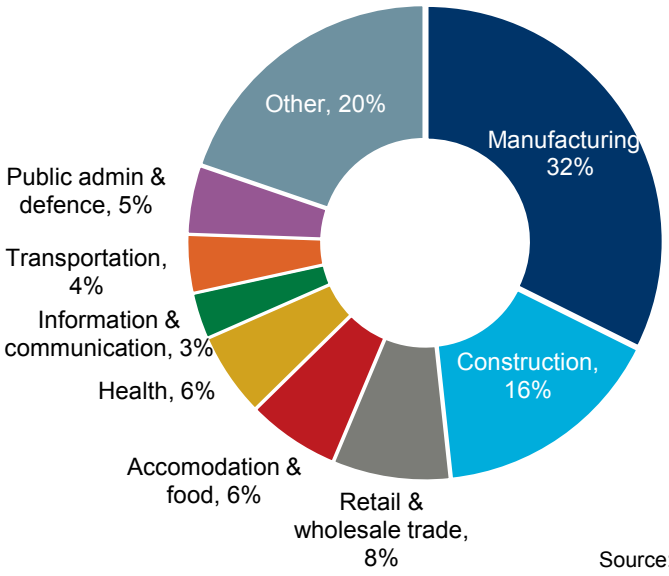


Source: ONS, Oxford Economics

Fig.2 suggested that the largest source of demand for the UK manufacturing sector's outputs was other businesses purchasing goods for use in their production processes (so-called "intermediate consumption"). Using detailed data from 2019 ONS Input-Output tables, we can examine the destination of goods sold to other businesses as intermediate consumption (see Fig. 4).[7] Of the £233 billion of manufacturing products sold for this purpose, 32% were sales to other manufacturing companies for use in their production process. Sales to the construction sector ranked second at 16% and the retail and wholesale trade bought the third largest share at 8%.

[6] The "Other goods" category contains non-monetary gold which historically has been very volatile.
[7] The 2019 Input-Output tables were the most recent available at the time of writing.

Fig. 4. Sectoral mix of sales of manufactured products for intermediate consumption within the UK, 2019

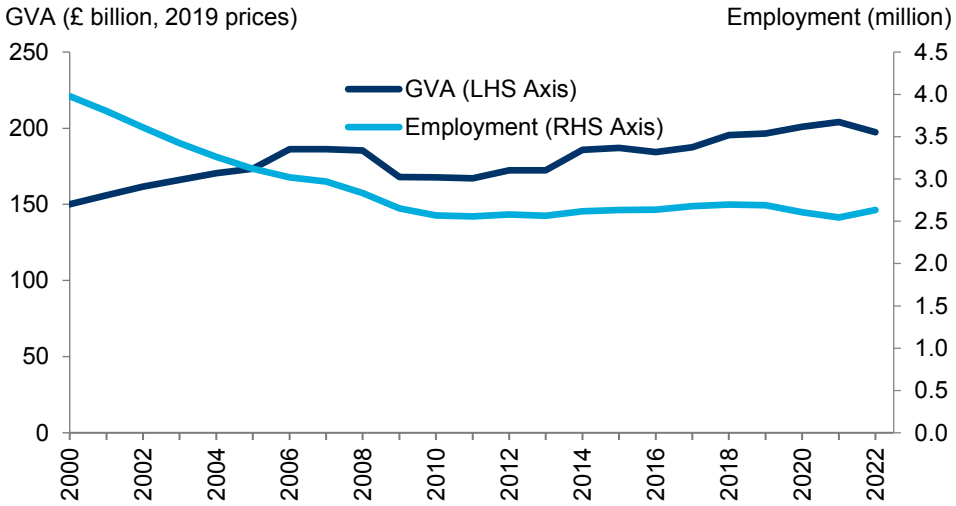


Source: ONS Input-Output Tables

2.1.2 Contribution to GDP and employment

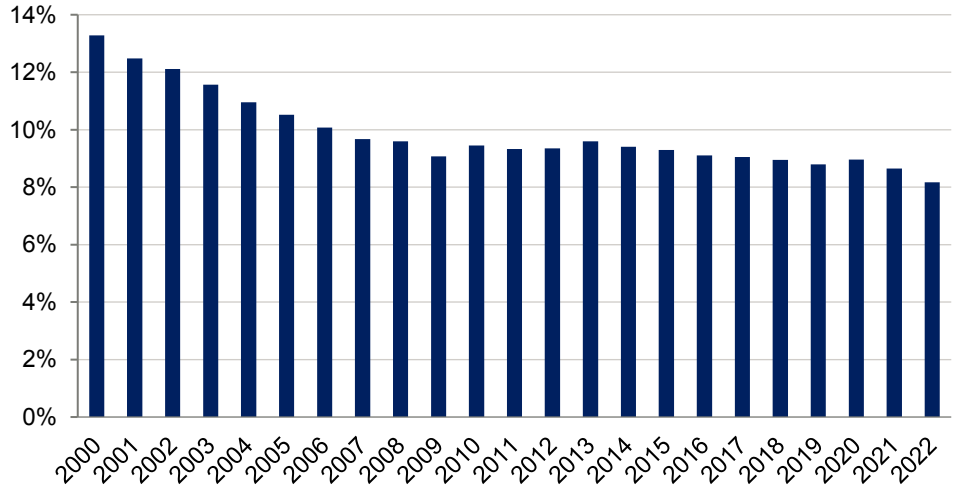
Manufacturing gross value added (in real terms) has continued to grow over time (Fig. 5). In 2022, the manufacturing sector directly contributed to 8.2% of UK GDP (Fig. 6). Direct employment in manufacturing has been stable at around 2.6 million since 2010. In 2022, manufacturing employment made up 7.3% of the UK's total employment.

Fig. 5. Manufacturing sector GVA and employment, 2000-2022



Source: ONS, Oxford Economics

Fig. 6. Manufacturing's direct contribution to GDP, 2000-2022, %

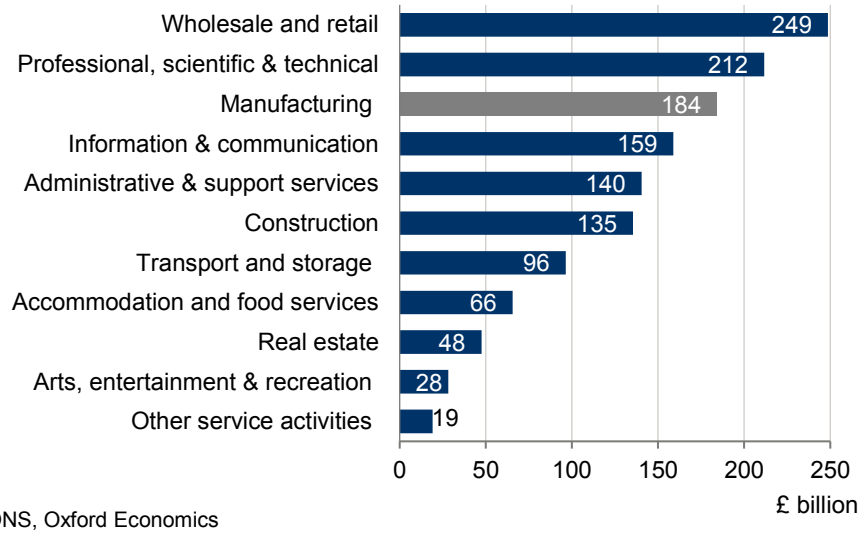


Source: ONS Blue Book, Oxford Economics

We use figures from ONS Annual Business Survey and Quarterly National Accounts to assess how the manufacturing sector compares to other broad sectors in the economy (Fig. 7).[8,9] In 2022, the manufacturing sector directly contributed £184 billion in gross value added to the UK economy. This is larger than sectors such as information and communication, transport and storage, and construction.

[8] ONS. 2023: Annual Business Survey 2021: Non-financial business economy, UK: Sections A to S.
[9] ONS. 2023. Quarterly national accounts.

Fig. 7. GVA by sector, 2022



Source: ONS, Oxford Economics

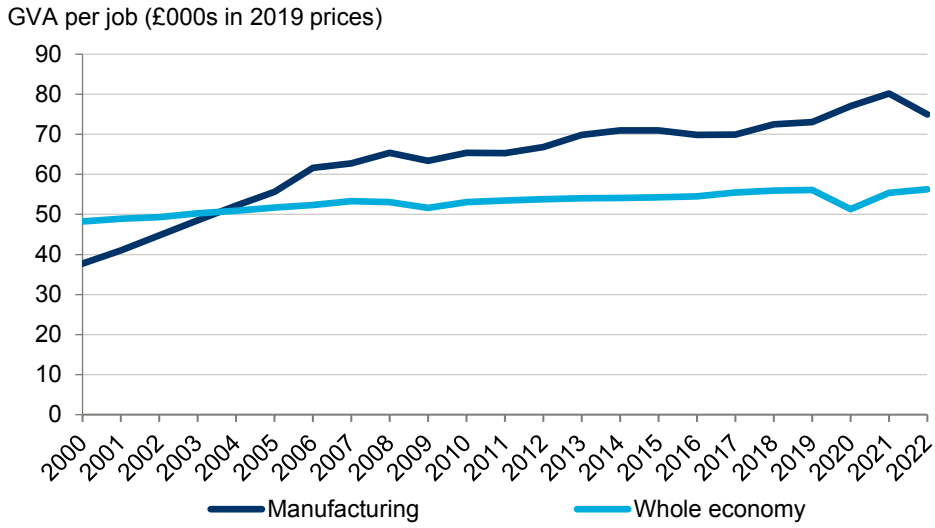
2.2 PRODUCTIVITY OF THE MANUFACTURING SECTOR

By combining GVA estimates from the Annual Business Survey and ONS estimates of workforce jobs by industry we can construct a time series of "GVA per job", a measure of labour productivity for the sector.[10]

In 2022, the average manufacturing GVA per job was £75,000. This is 33% higher than the average GVA per job for the whole economy (£56,000). Manufacturing productivity surpassed that of the whole economy in 2004 and productivity has continued to grow at a faster rate than that of the whole economy. Between 2016 (the datapoint used when this study was last commissioned) and 2022, UK manufacturing GVA per job increased by 1.2% per year whilst UK GVA per job for the whole economy increased by 0.5% a year.

[10] Unlike the rest of the report where the Business Register and Employment Survey (BRES) is used to derive employment figures, this time series chart uses ONS data on workforce jobs by industry. This is because the BRES does not have annual data which go as far back as 2000.

Fig. 8. Labour productivity, 2000-2022[11]



Source: ONS, Oxford Economics

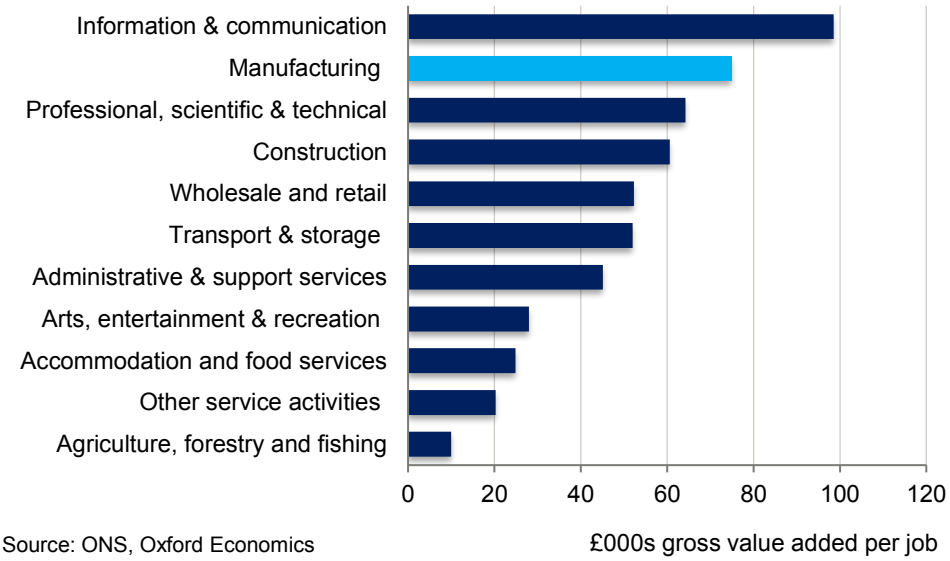
Manufacturing productivity remains above that of sectors such as professional services, retail & wholesale, and transportation (see Fig. 9). This above-average productivity partly reflects that manufacturing is more capital-intensive than many service activities, which have a greater reliance on labour to produce their outputs. Other factors which contribute to the manufacturing sector having above-average productivity are discussed further in Section 2.2.1.

Productivity is important because productivity growth in an economy is necessary for improving living standards. Higher productivity at a firm level can benefit both employees and customers by allowing for increases in wages and increased competitiveness through reductions in prices per item sold. Government and society also stand to gain from gains in productivity, as taxes typically increase disproportionately in response to higher pay per head. Concerningly, the UK has experienced slow productivity growth since the global financial crisis (GFC) and its productivity lags behind many of its peers in the G7.[12] Given that manufacturing has above average productivity levels and has experienced above average productivity growth in recent years, its expansion has the potential to help raise productivity levels in the UK.

[11] Output per hour in manufacturing also fell in 2022 by 6.2%. ONS four letter identifier DJK6. ONS. 2024. Labour productivity time series.

[12] ONS. 2023. International comparisons of UK productivity (ICP), final estimates: 2021.

Fig. 9. UK labour productivity by sector, 2022[13]



Source: ONS, Oxford Economics

2.2.1 Drivers of productivity

Business investment

The manufacturing sector possesses certain characteristics which contribute to it having above-average productivity levels. Manufacturing is more capital intensive than many service activities. As employing capital enables labour to be more effective, labour productivity in capital intensive industries tends to be higher than labour-intensive industries.[14]

By definition, capital intensive industries such as manufacturing engage in significant business investment activities. Business investment is capable of boosting the productive capacity of the UK economy—in other words improving the ingredients that are needed to support future output, incomes, and prosperity.

In 2022, businesses investment made by the manufacturing sector amounted to 15% of total business investment.[15] Given that manufacturing accounts for a significantly smaller share of the economy (8.2%), this means that the manufacturing sector is considerably more investment intensive than average.

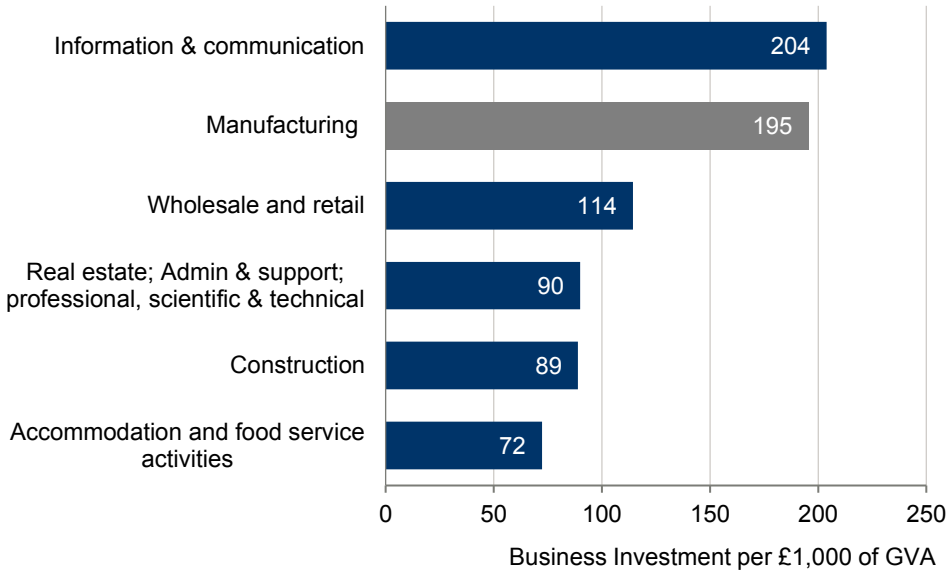
As Fig.10 illustrates, the manufacturing sector engages in considerably more business investment activities per £ of gross value added generated than most other sections of the economy.

[13] Mining & quarrying excludes activity in the UK offshore oil sector. The extra-regio component of GVA is, however, included in the UK average.

[14] ONS. 2017. Labour productivity measures from the Annual Business Survey: 2006 to 2015.

[15] ONS. 2023. Business investment by industry and asset.

Fig. 10. Business investment by sector, per £1,000 of GVA, 2022



Source: ONS, ABS, Oxford Economics

Export-orientation

As discussed in Section 2.1.1, the manufacturing sector is significantly more export orientated than the rest of the economy, with overseas sales representing 35% of demand for UK manufacturing output versus 16% for the whole economy. This is largely a result of the high degree of tradability of many manufacturing goods. This helps contribute to the manufacturing sector having above average productivity; as manufacturing firms typically face competition from abroad, they must remain globally competitive to remain in business.

Moreover, evidence suggests that firms can improve their productivity by exporting through learning about more efficient methods and processes that their clients or competitors use.[16] Evidence to support this claim includes a UK study which found that exporters were 25% more productive two years after entering the export market.[17] The ability for manufacturing firms to learn from others as a result of exporting is likely to lead to positive spillover effects in the wider economy.

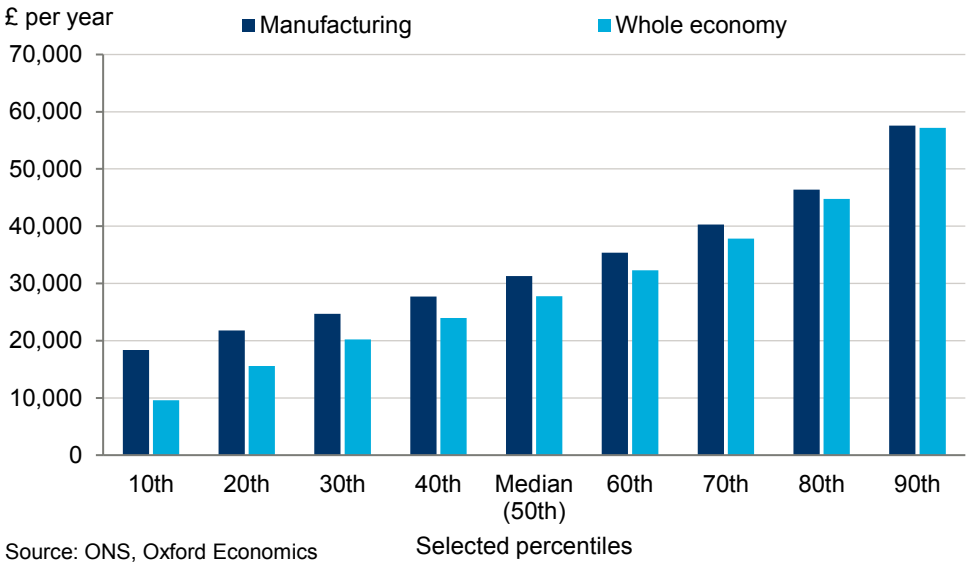
Consistent with its above-average productivity levels, manufacturing sector wages are also above the UK average. In 2022, the median wage in manufacturing was £31,300, 11% higher than the UK's overall median wage.[18] As shown in Fig. 11 this premium varies across the earnings distribution with people at the low-to-middle part of the earnings distribution earning substantially more in manufacturing. Manufacturing wages were more than double that of the whole economy at the 10th percentile.

[16] Department for Business & Trade. 2023."The relationship between trade and productivity: a feasibility study".

[17] Canadian Journal of Economics. 2008. "Productivity, exporting, and the learning-by-exporting hypothesis: direct evidence from UK firms".

[18] ONS. 2023. Earnings and hours worked, industry by two-digit SIC: ASHE Table 4.

Fig. 11. Annual wages paid to employees across the earnings distribution, 2022



Source: ONS, Oxford Economics

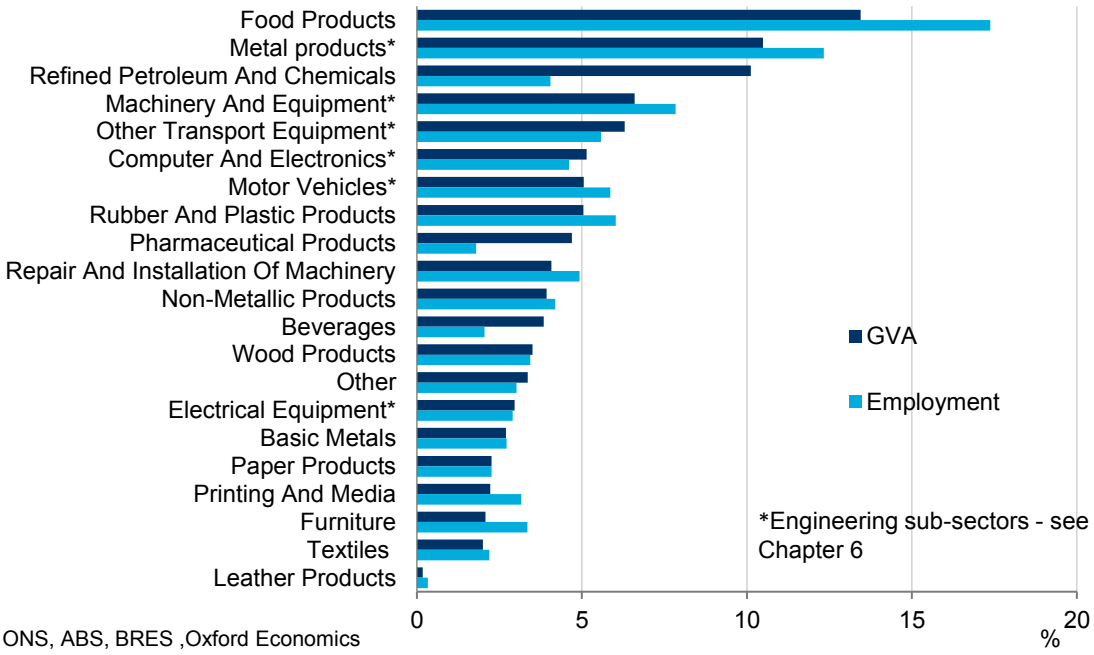
2.3 DIVERSITY OF THE MANUFACTURING SECTOR

We have so far referred to the UK's manufacturing sector as a single entity. The reality, of course, is that it boasts a huge degree of diversity—not least in the range of goods that are produced.

In terms of both GVA and employment, the largest manufacturing sub-sector is the production of food products, which contributes 13% of manufacturing GVA and 17% of manufacturing employment (Fig. 12). Food products are often perishable and specific to local tastes which has meant that the sector has been relatively immune to the outsourcing of manufacturing production to overseas locations.

At the other end of the spectrum, a relatively small share of UK manufacturing GVA is contributed by the production of lower-value goods such as textiles and leather products, which may be more efficiently produced in low-cost locations overseas.

Fig. 12. Share of manufacturing GVA and employment by sub-sector, 2022



Source: ONS, ABS, BRES ,Oxford Economics

Productivity levels vary considerably between these sub-sectors. Comparing the GVA and employment shares in Fig. 12 illustrates that petrol and chemical refining, for example, accounts for a much higher share of manufacturing GVA than employment, reflecting its status as a very capital intensive sub-sector with very high levels of GVA per person (£190,000 per year).

A similar pattern is visible for pharmaceuticals, where GVA per person is approximately £200,000 per year. This high value is likely a result of a high proportion of highly skilled workers in the sector. High sales margins, necessitated by significant sums that the sector spends on lengthy and uncertain research and development projects are also likely a factor.[19]

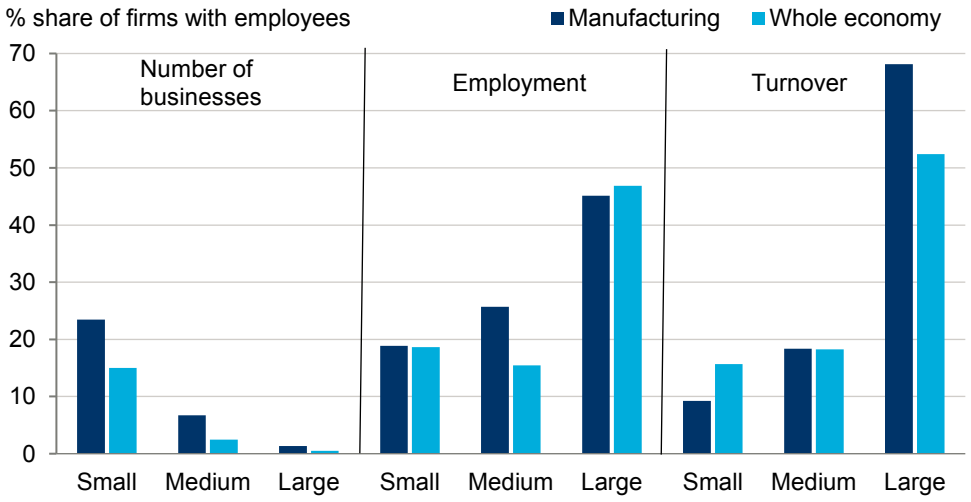
Sectors which have a high share of employment relative to GVA include manufacture of leather products (GVA per person: £42,000) and furniture (GVA per person: £48,000). These activities are typically labour-intensive.

Over and above the diversity within the types of products the UK manufacturing sector produces, there is also diversity in the types of business operating in this sector. At the beginning of 2022, there were approximately 21,100 small businesses (10 to 49 employees), 6,100 medium-sized businesses (50 to 249 employees), and 1,200 large businesses (over 250 employees) across the manufacturing sector in the UK (Fig. 13).[20] While small manufacturing firms are more numerous in number, large firms employ more people and generate greater turnover.

[19] National Library of Medicine. 2020. "Profitability of large pharmaceutical companies compared with other large public companies".

[20] Department for Business, Energy & Industrial Strategy. 2022. "Business population estimates 2022".

Fig. 13. Share of firm numbers, employment, and turnover provided by manufacturing and all private sector firms with employees by business size, 2022

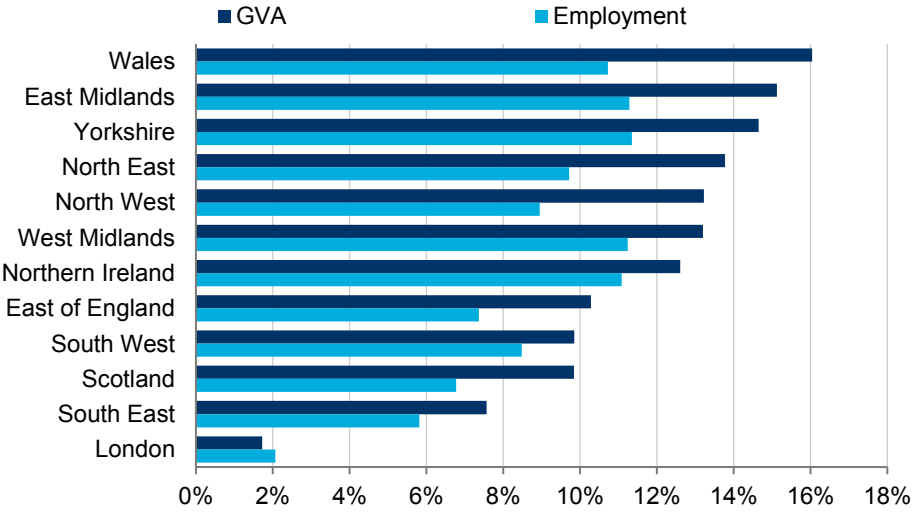


Source: BEIS, Oxford Economics

2.4 THE GEOGRAPHIC SPREAD OF UK MANUFACTURING

Manufacturing directly contributes around 8.2% of the UK's GDP and 7.3% of its employment. However, the sector's importance varies considerably across the regions and countries of the UK. As a proportion of the total economy, manufacturing has the greatest importance in Wales where it accounts for 16% of GVA. In contrast, manufacturing supported just 2% of GVA in London in 2022.

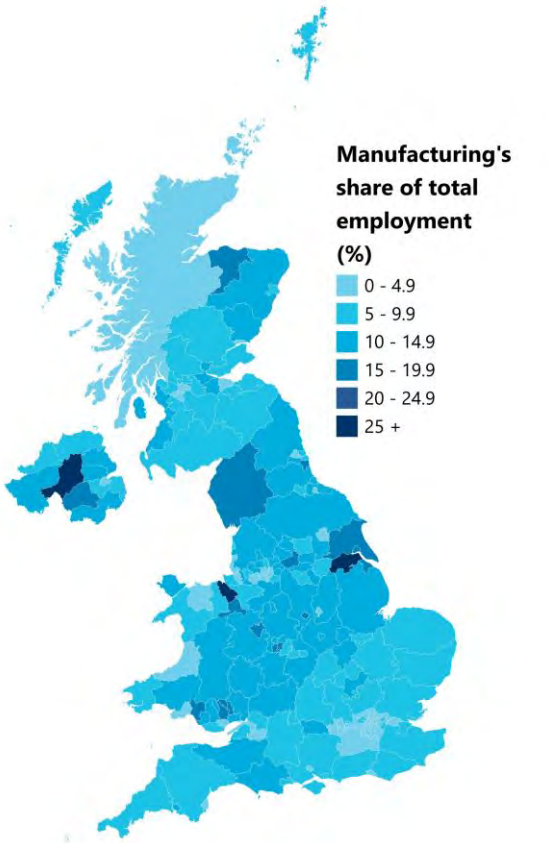
Fig. 14. Contribution of manufacturing to GVA and employment, 2022



Source: BRES, ONS, Oxford Economics

In certain local areas, the direct economic contribution of manufacturing is greater still (see Fig. 15). In some areas, manufacturing can account for 20% or more of total employment—for example, certain districts in the North West and Wales employ many people in the aerospace and defence sector whilst areas in the East Midlands and Northern Ireland rely particularly on the manufacture of food products.

Fig. 15. Manufacturing share of employment in UK local authority districts, 2022



Source: BRES, Oxford Economics

In this chapter we have focused on the manufacturing sector itself, highlighting its direct contribution to the economy, the diversity encompassed within it, and its contribution to UK productivity. However, the sector's impact on the UK economy extends far beyond what it produces itself. We explore this further in the next sections, starting with the activity supported within the supply chain.

3. THE SUPPLY CHAIN IMPACT OF UK MANUFACTURING

The manufacturing sector's contribution to the economy is wider than just the gross value added and tax receipts it generates, and the people it employs. It stimulates economic activity around the rest of the economy through its procurement of goods and services. This chapter investigates the size of the impact it has on its UK supply chain.

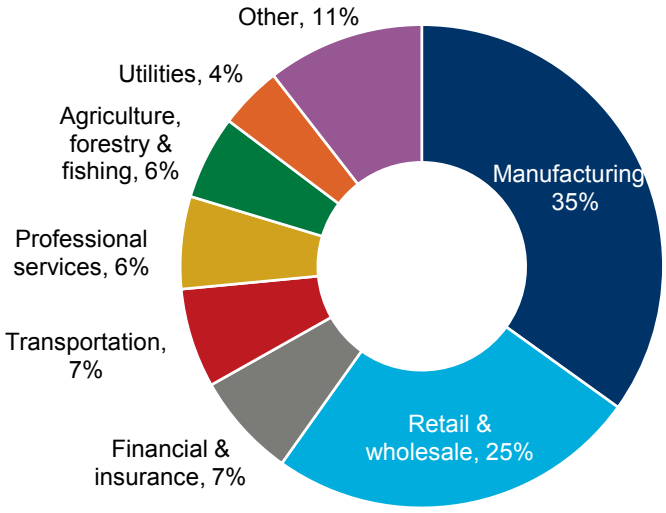
3.1 MANUFACTURERS' PURCHASES OF GOODS AND SERVICES

3.1.1 Intermediate consumption

Our analysis suggests that UK manufacturing companies spent £376 billion on inputs of goods and services to produce the goods they made in 2022. Of this, 63% (or £237 billion) was sourced from UK suppliers, with the remaining 37% imported from abroad.

Over a third (35%) of purchases came from within the manufacturing sector itself, reflecting that manufacturing incorporates companies operating at many different stages in the production process (Fig. 16). Wholesalers and retailers received the second largest spend, for those manufacturers which did not place orders directly with the ultimate supplier.

Fig. 16. UK manufacturers' purchases of goods and services from domestic suppliers for use in the production process, 2019 (intermediate consumption)

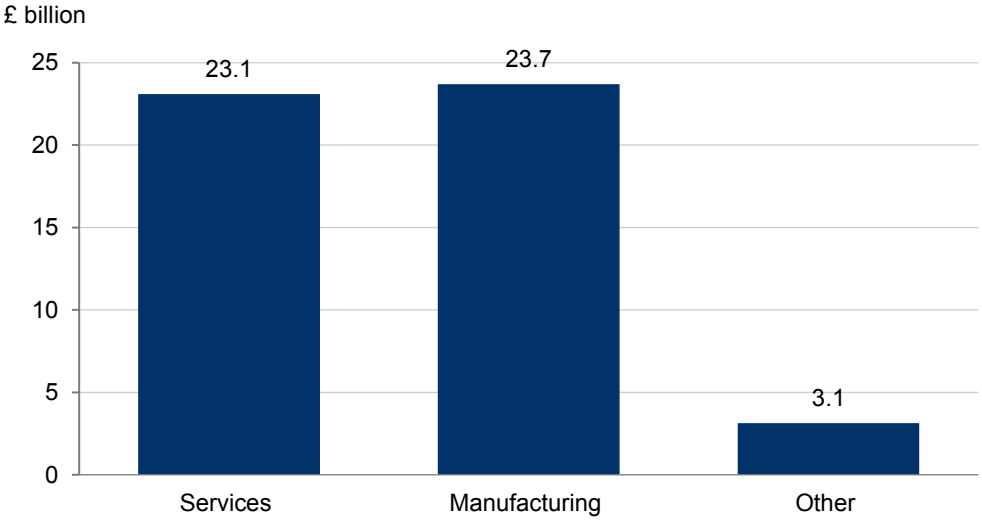


Source: ONS Input-Output Tables, Oxford Economics

3.1.2 Capital purchases

In addition to intermediate consumption, businesses also make capital expenditures. ONS gross fixed capital formation data provide estimates on net capital expenditures.[21] The data show that manufacturers' total capital expenditures were £33.3 billion in 2021 and £33.5 billion in 2022.[22] Research and Development (R&D) is an important component of capital expenditures with manufacturers punching above their weight in terms of their share of total UK business R&D expenditure. Manufacturing businesses spent £23.7 billion on R&D in 2022 which accounted for 47% all R&D expenditure associated with UK businesses (Fig. 17).

Fig. 17. Expenditure on R&D performed in UK businesses, 2022.[23]



Source: ONS, Oxford Economics

R&D spend is a key driver of productivity in an economy. Firstly, innovation that comes about as a result of R&D expenditure will push up a firm's productivity, fuel its growth, and help to ensure the firm remains internationally competitive. Secondly, the technological advances and breakthroughs that emerge from its investment in R&D will affect other parts of the economy and society, in a so-called "spillover" effect. Spillover benefits include benefits to users (for example, to the firms purchasing and using the new technology) and benefits to imitators (firms operating in the sector where the innovation has occurred).[24] Benefits may also arise as new ideas foster additional innovations in the future.

[21] Office for National Statistics, "Annual gross fixed capital formation by industry and asset". 2023.
[22] Not comparable with ABS values. Since the previous 2018 report the ABS has changed its definition of capital expenditures to exclude not yet in production (NYIP) acquisitions from its published estimates.
[23] ONS. "Business enterprise research and development (R&D), 2022.". 2024.
[24] National Bureau of Economic Research, 2020. "A calculation of the social returns to innovation".

Previous research by Oxford Economics suggests that such spillover effects are very large, with R&D investment by the manufacturing sector generating a social return of around 50%—every £100 million invested in R&D leads to a reoccurring increase in GDP of £50 million a year in the long run.[25]

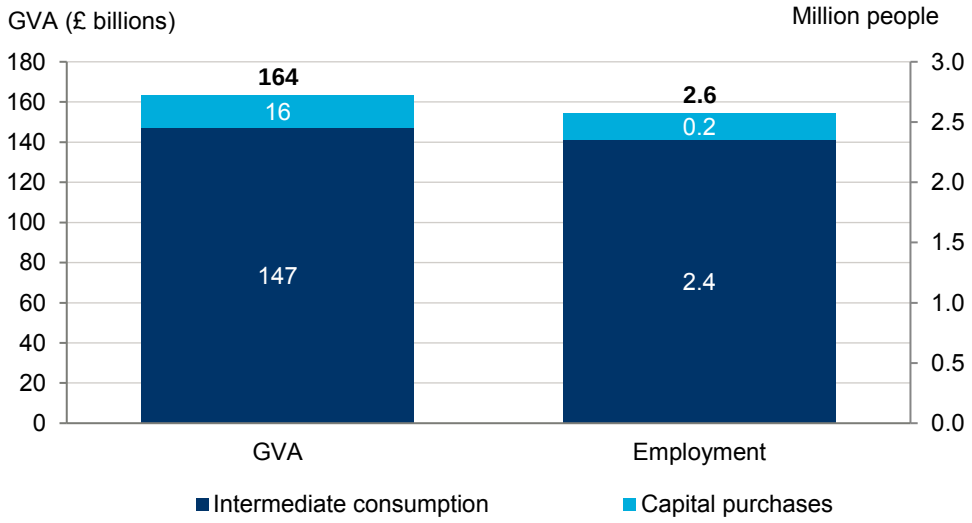
3.2 ACTIVITY SUPPORTED BY MANUFACTURERS' SUPPLY CHAIN PURCHASES

We can now use Input-Output tables to estimate the value of the gross value-added contribution to UK GDP supported by manufacturers' purchases from domestic suppliers, as identified in the previous section. This constitutes the manufacturing sector's "indirect contribution" to GDP.[26]

On this basis, we estimate the UK manufacturing industry supported an indirect GVA contribution to UK GDP of £164 billion in 2022 through its intermediate consumption and capital purchases (Fig. 18).

Having calculated this figure for GVA, we can use UK productivity data in each sector to estimate the number of jobs supported in the manufacturing supply chain. This suggests that manufacturing indirectly supported 2.6 million jobs in 2022.

Fig. 18. Indirect contribution of UK manufacturing, 2022



Source: Oxford Economics

Using this analysis, we can also identify which sectors benefit from the indirect GVA contribution supported by the manufacturing industry (Fig. 19). We find that the indirect impact of manufacturing is broad based, supporting activity in a range of sectors across the UK economy.

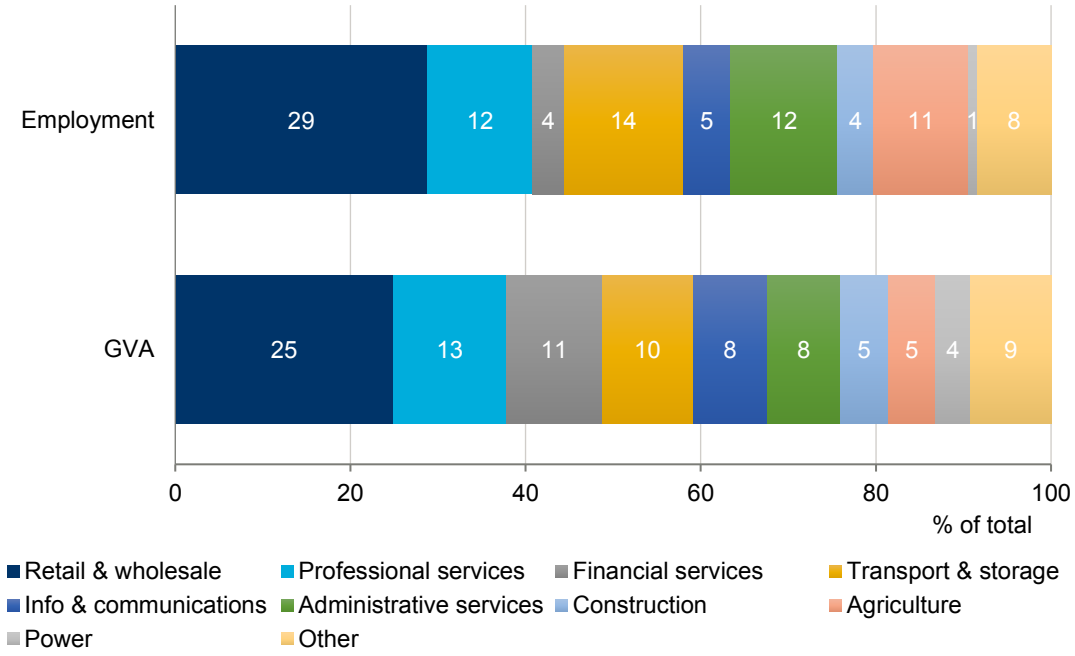
[25] Oxford Economics, 2008. Study of the impact of the Intermediate Research and Technology Sector on the UK economy.

[26] In making this calculation, we must exclude purchases from other UK manufacturing companies, because this activity has already been counted in our estimate of the sector's direct impact. (For example, a manufacturer's purchases of machinery or machine repairs are excluded from the supply chain calculations because they are already included in our estimate of the seller's direct contribution to GDP and employment).

The largest indirect gross value-added contribution accrues within retail and wholesale (25%). The next is professional services (13%), which partly reflects that this sector is a substantial recipient of manufacturers' capital purchases, particularly those relating to intellectual property products.

In employment terms, we find that 64% of the indirect impact of manufacturing falls within four sectors: professional services, retail and wholesale, administrative services, and agriculture. The relatively large share of employment in administrative services partly reflects that this sector includes employment services firms, which are an important source of agency staff for UK manufacturers. We estimate that more than 60% of indirect jobs within administrative services fall within the "employment services" category.

Fig. 19. Sectoral share of the indirect contribution of the UK manufacturing industry, 2022[27]



Source: Oxford Economics

3.2.1 Trends in manufacturers' supply chain purchases over time

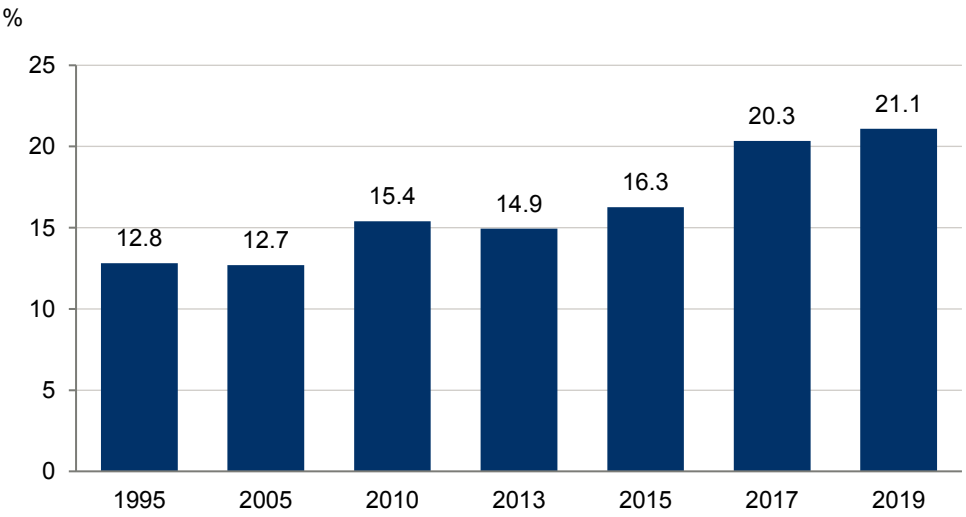
Between 2016 (the datapoint used when this study was last commissioned in 2018) and 2022, the number of direct jobs supported by the manufacturing sector decreased by 13,000 whilst the number of indirect jobs increased by 143,000. This phenomenon can be partly explained by the manufacturing sector increasingly outsourcing non-core activities to the domestic service sector, evidence of which is

[27] Professional services include legal services, accounting services, tax consulting services, services of head offices, management consulting services, architectural and engineering services, technical testing and analysis services, scientific research and development services, advertising and market research services, other professional, scientific and technical services, and veterinary services. Administrative services include: rental and leasing services, employment services, travel agency, tour operator and other reservation services and related services, security and investigation services, services to buildings and landscape and office administrative, office support, and other business support services.

confirmed in the academic literature.[28] Outsourcing can help reduce a firm's costs (for example, through the economies of scale specialised providers of services possess) thus increasing a business's profitability.[29] Examples of outsourcing activities include book-keeping and accountancy activities as well as cleaning and catering services.

By examining UK input-output tables over time we can see evidence of outsourcing activity. In 2019 manufacturing firms procured services from domestic firms worth 21.1% of their total output (Fig. 20). This is 8.3 percentage points higher than in 1995 when manufacturing firms purchased domestic services worth 12.8% of their total output. Service sectors where purchases from manufacturing sectors have increased the most include transport and food service sectors as manufacturing firms have increasingly outsourced their logistics and catering.

Fig. 20. Manufacturing spend on services as a percentage of total manufacturing output



Source: ONS Input-Output Tables, Oxford Economics

That a growing proportion of manufacturing activities are outsourced exemplifies the importance of considering indirect impacts when examining the significance of the UK's manufacturing sector. The indirect impact of the manufacturing sector is growing as increasing parts of the economy serve manufacturing businesses. This economic activity should be included as these businesses would not exist if manufacturing activity vanished.

[28] Centre for Economic Performance. 2014 "Outsourcing and the rise in services".

[29] Katharine Abraham and Susan Taylor. 1996. "Firms' use of outside contractors: Theory and evidence." Journal of Labour Economics.

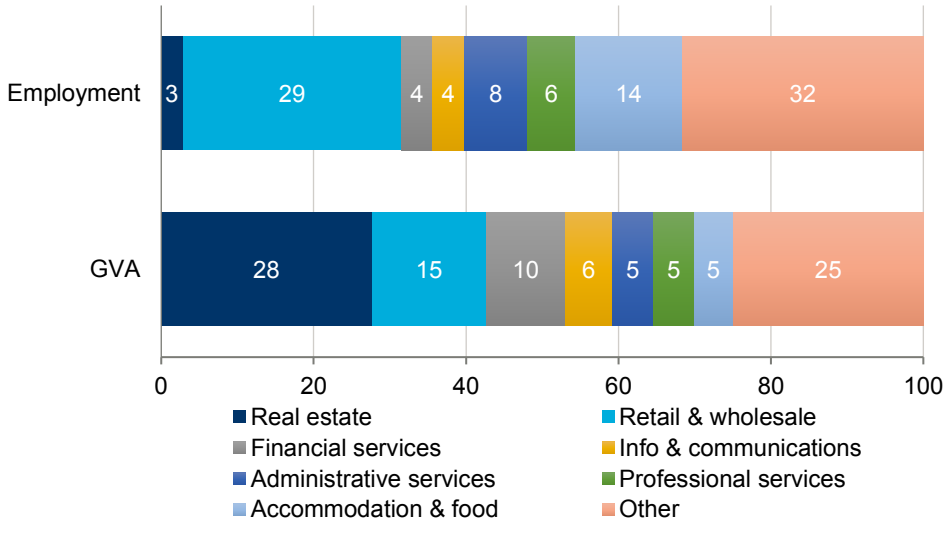
4. WORKER SPENDING IMPACTS

A second type of wider activity supported by manufacturing occurs as workers employed in the manufacturing industry and its UK supply chain spend their wages. This wage-financed consumer spending stimulates economic activity and employment at sectors serving households such as shops, restaurants, and hotels. This effect is known as the "induced impact".

In Section 2.2.1, we highlighted that wage levels in manufacturing were greater than the UK average. To assess the impact of these wage payments, along with those to workers in the supply chain, we estimated the total value of wages payable to workers in manufacturing (£103 billion) and its supply chain (£86 billion) using the Input-Output model. We then estimated the value of consumer spending supported by those wages, and finally the induced contribution to GDP associated with this expenditure.[30]

On this basis, we estimate that manufacturing supported a £169 billion gross value-added contribution to UK GDP through workers' spending. Perhaps unsurprisingly, our analysis suggests the largest beneficiaries of the worker spending impact are the real estate (in terms of gross value added) and retail sectors as people rent or purchase housing and buy everyday items like food (Fig. 21).

Fig. 21. Sectoral share of the induced contribution of the UK manufacturing industry, 2022



Source: Oxford Economics

*Figures may not sum due to rounding

By combining the induced gross value added impact in each sector with productivity estimates, we also estimate that manufacturing supported 2.1 million jobs through worker spending multiplier effects in 2022. Although real estate was a key contributor to the manufacturing industry's induced GDP contribution, it does not play a substantive role in employment terms (28% of gross value added

[30] In making these calculations we assume that the pattern of workers' spending is in line with the UK average.

versus 3% of the employment).[31] In contrast, the induced impact of retail (29% versus 15%), and accommodation and food services (14% versus 5%), is much greater when measured in terms of employment than in terms of GDP. This reflects the differences in labour productivity in each sector.

[31] Real estate refers to the value to households of owning their residence, imputed as an equivalent rental value. Within the modelling framework, this imputed spending flows to an "industry"—one that provides a service (housing) and purchases some, comparatively limited inputs to provide this (e.g. maintenance and upkeep, fees on mortgages). The difference between the output (equivalent to the imputed rent) and inputs means that value-added is generated. However, no employment is associated with this. As such, induced activity in the real estate sector can appear to give rise to lots of GVA and relatively few jobs.

5. TOTAL IMPACT OF THE UK MANUFACTURING SECTOR

In this chapter, we bring together the findings of the previous sections to present three estimates of how the manufacturing sector impacts on the UK economy.

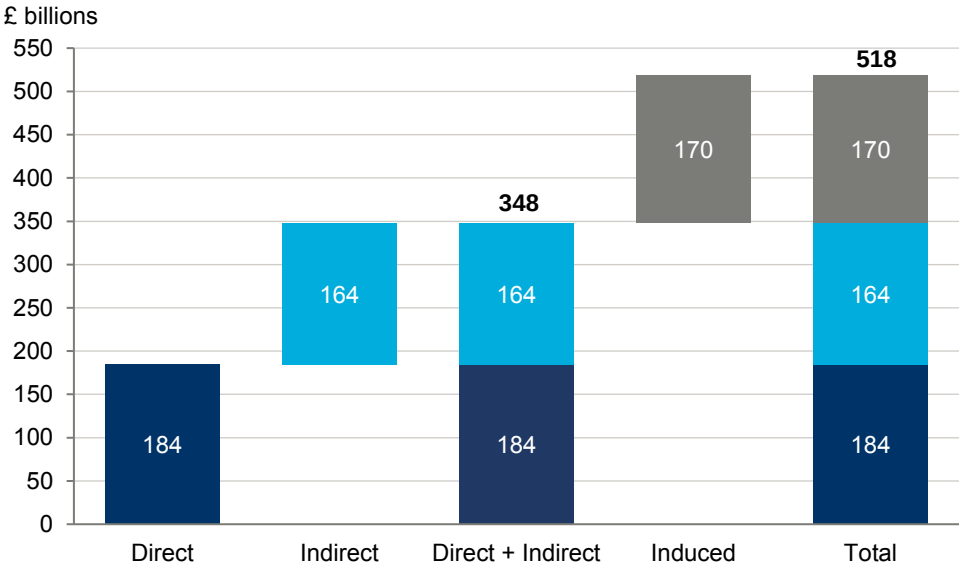
The first estimate, which we explored in Chapter 2, reflects the size of the manufacturing sector, as conventionally measured in national accounts. On this basis, the direct contribution of manufacturing to UK GDP was estimated to be £184 billion in 2022, or 8.2% of the UK economy (Fig. 22).

The second estimate adds the supply chain (or indirect) impact of manufacturing to the direct impact. When this is done, the impact of the manufacturing sector increases to £348 billion in 2022, or 15.5% of GDP. By comparing the combined size of the direct and indirect impacts with the direct impact, we can calculate the "Type I GDP multiplier". This is found to be 1.9, suggesting that for every £1 million in gross value added that the manufacturing sector generates itself, its procurement stimulates a further £0.9 million contribution to UK GDP along its domestic supply chain. At 1.9, this Type I multiplier is higher than the 1.7 value estimated in 2016—the datapoint used when this study was last commissioned in 2018. Part of the explanation for the increase is the manufacturing sector has increasingly outsourced functions to domestic services firms (as discussed in Chapter 3) as it focuses on its core competencies. This shifts the GDP and jobs from the direct to the indirect impact.

Our third estimate includes not only the direct and indirect impact of manufacturing, but also the induced, worker spending impact. On this basis, we estimate that in 2022, **the UK manufacturing sector supported a total GDP contribution of £518 billion**—equivalent to 23.1% of the UK's total economy. This means that for every £1 million in gross value added the manufacturing sector contributes to GDP itself, it creates another £1.8 million elsewhere in the UK economy—giving manufacturing a "Type II GDP multiplier" of 2.8.[32]

[32] The Type II multiplier is calculated as: (Direct GDP + Indirect GDP + Induced GDP) / Direct GDP.

Fig. 22. Total GVA contribution to UK GDP by the manufacturing sector, 2022



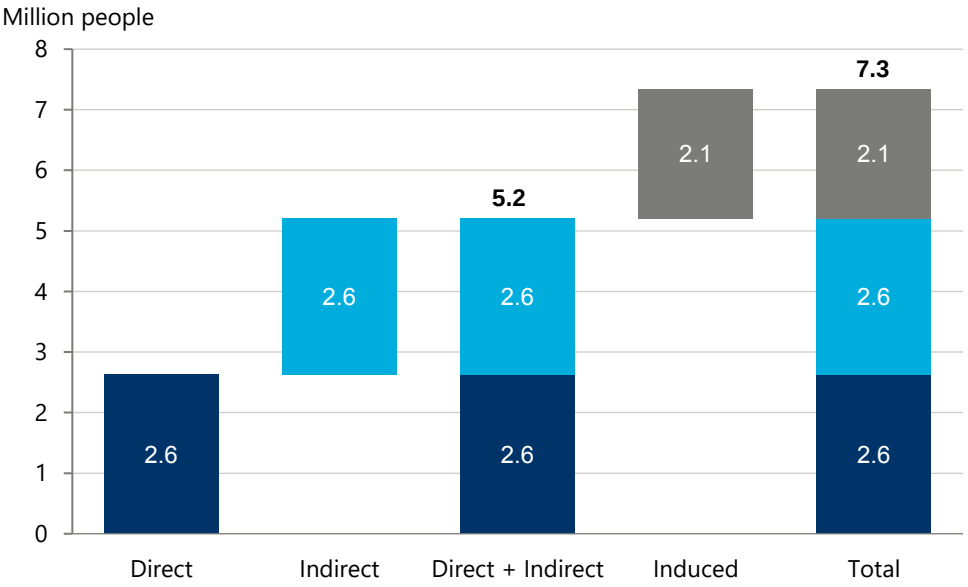
Source: Oxford Economics

*Figures may not sum due to rounding

We follow a similar process to assess the extent to which manufacturing supports employment in the economy. In 2022 the sector directly supported 2.6 million jobs and indirectly supported the same number (Fig. 23). As such, manufacturing and its supply chain together supported 5.2 million jobs, a 3% increase from 2016 (the datapoint used when this study was last commissioned in 2018).

Further extending the employment estimate to also include the induced results suggests that UK manufacturing sector supported a total of 7.3 million jobs in 2022, equivalent to 22.4% of the UK total. This means for every direct job within the sector, another 1.8 are supported elsewhere in the UK economy—giving manufacturing a "Type II employment multiplier" of 2.8.

Fig. 23. Total employment contribution of the UK manufacturing sector, 2022



Source: Oxford Economics

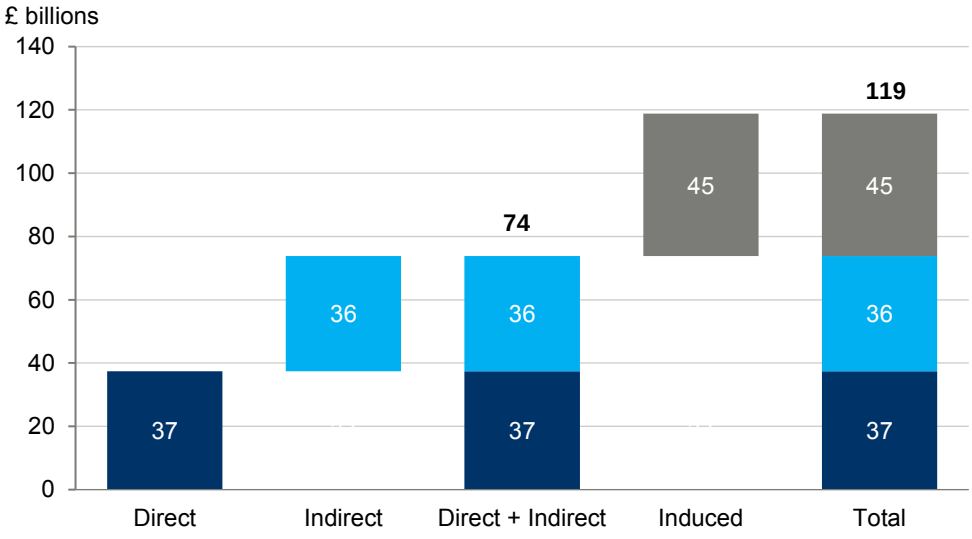
Finally, we examine the extent to which manufacturing contributes to the UK Exchequer in the form of tax receipts. In 2022, manufacturing businesses and their employees paid £37 billion in taxes (Fig. 24).[33] This is equivalent to 4.7% of all HMRC tax and National Insurance Contributions (NICs) receipts in 2022/23.[34] Moreover, the activity supported as a result of the manufacturing sectors supply chain purchases also contributes to tax revenues for the UK government. Businesses in the manufacturing sectors supply chain pay corporation tax and other taxes on production and products. Equally, the people employed in these businesses pay income tax and NICs. Considering all of these taxes, we estimate that the manufacturing sectors supply chain activities (indirect impact) raised £36 billion for the Exchequer in 2022. As such, the manufacturing sector's direct and indirect contribution to the UK Exchequer amounted to £74 billion in 2022. This is 28% more than the total budget for English schools in 2023/2024.[35]

Lastly, wage-financed spending of those employed in the manufacturing sector and its supply chain supports a further tax contribution to the UK Exchequer. This includes the duties and VAT households

[33] Includes income taxes and National Insurance.
[34] HMRC. 2023. HMRC tax receipts and National Insurance contributions for the UK (annual bulletin). Accessed February 2024.
[35] www.gov.uk. 2024. 1.8.1 Total schools budget (before academy recoupment). Accessed February 2024.

pay on their consumption. In 2022, these tax revenues were an estimated £45 billion, making the total contribution of the manufacturing sector to UK tax receipts £119 billion.

Fig. 24. Total contribution of manufacturing sector to UK tax receipts, 2022



Source: Oxford Economics

Figures may not sum due to rounding

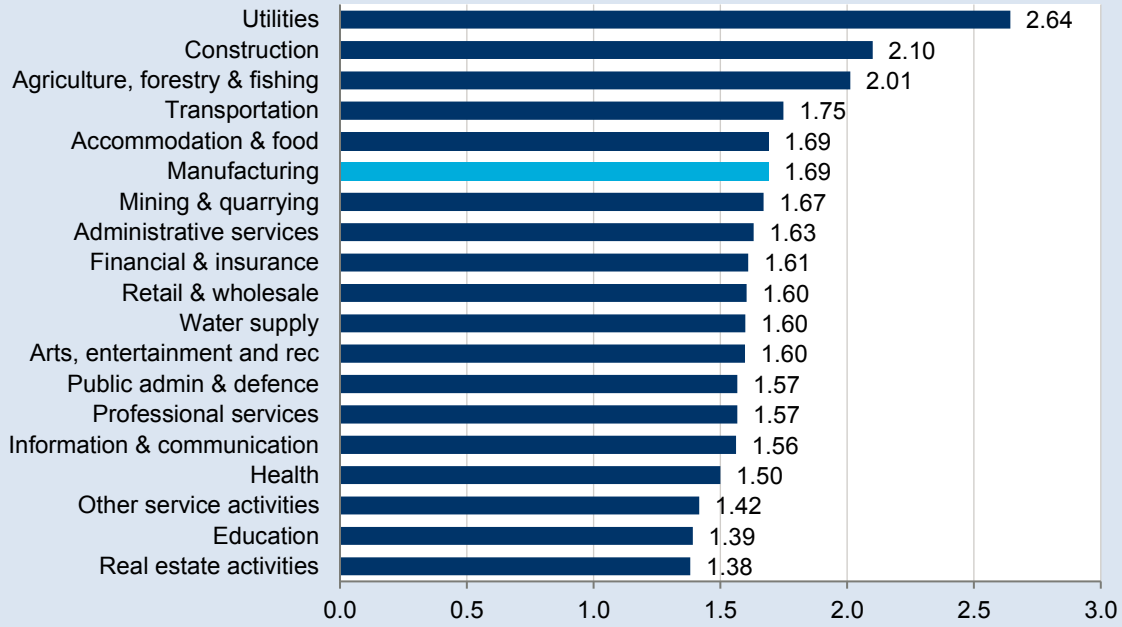
HOW DO THE MANUFACTURING SECTOR'S MULTIPLIERS COMPARE TO OTHER SECTORS?

In this section we have presented a series of multipliers which identify the extent to which activity in the manufacturing sector supports wider activity through additional supplier purchases and wage income. A natural extension to this analysis would be to compare the manufacturing sector's multipliers to those for other sectors, to assess whether indirect and induced impacts are proportionately larger for manufacturing than for other parts of the economy. While producing equivalent multipliers for other sectors is beyond the scope of the current study, it is possible to gain insights from published information.

The ONS Input-Output tables, which form the basis for much of our analysis, include estimates of Type I multipliers for output, GVA, and employment which are presented for 105 product types.[36] By weighting these individual product types by their total output we present Type I GVA multipliers by broad sector.

[36] ONS. 2023. UK input-output analytical tables.

Fig. 25. Type I GVA multipliers



Source: ONS, Oxford Economics

Similar to the Type I multipliers mentioned in this report, the ONS multipliers measure the ratio between the direct impact and the direct plus indirect (supply chain) impact of each sector. While these results are not directly comparable with our own results, they do provide an indication of how the manufacturing sector's multiplier compares to other sectors. Of the 19 broad sectors, the ONS finds that manufacturing has the sixth largest Type I GVA multiplier, coming in above sectors including financial & insurance and information & communication.

The largest difference in methodology between the ONS figures and our own findings is that the former do not remove the supply chain impacts which occur within the same sector. The ONS calculations capture the extent to which activity across the whole economy (including manufacturing) increases in response to a one unit increase in direct manufacturing activity. In contrast, the Oxford Economics calculations measure the impact of the manufacturing sector as a whole, capturing all of the sector's output, GVA, and employment. The Oxford Economics estimates of supply chain impacts therefore exclude those which arise within manufacturing, since they have already been counted within the direct impact. A second source of difference is that, unlike our results, the ONS multipliers exclude capital expenditure procurement impacts (although estimates of our multipliers excluding capital impacts are presented in Appendix 2).

6. THE IMPACT OF THE ENGINEERING SECTOR

As well as assessing the economic impact of UK manufacturing as a whole, the MTA is also interested in exploring the impact of a sub-set of manufacturing sectors which together constitute "engineering". In this chapter, we use the same techniques to estimate the full economic impact of those elements of manufacturing which the MTA classes as engineering.

DEFINITION OF THE ENGINEERING SUB-SECTOR

The MTA defines "engineering" to include the following types of manufacturing activity:

- Fabricated metal products, except machinery and equipment (SIC division 25)
- Computer, electronic, and optical products (26)
- Electrical equipment (27)
- Machinery and equipment not elsewhere classified (28)
- Motor vehicles, trailers, and semi-trailers (29)
- Other transport equipment (30)

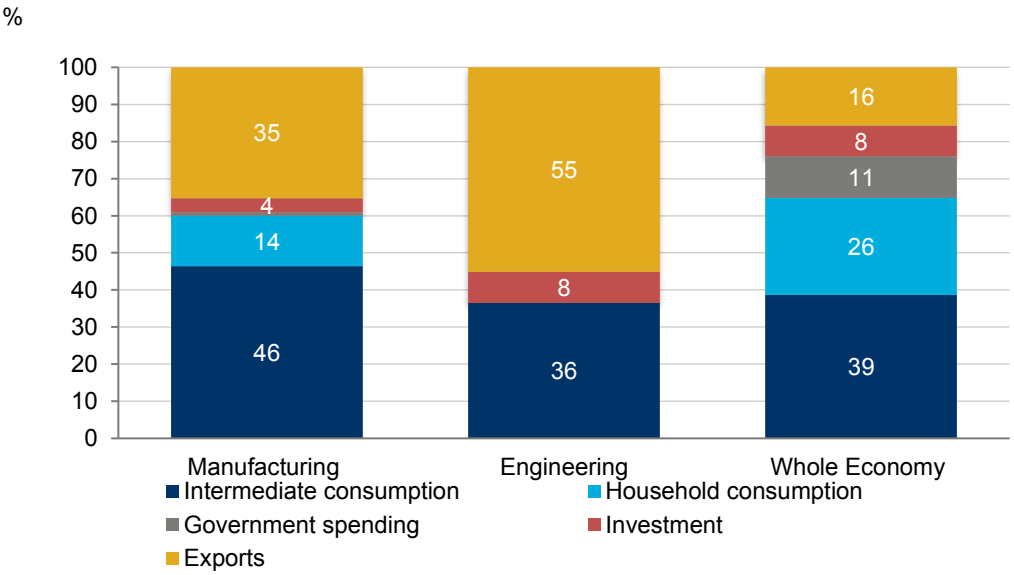
The MTA has noted that some UK companies engaged in the engineering sector may earn a large share of their revenues from the provision of engineering services. However, there is no separate SIC category for engineering services and hence there is no systematic way of identifying such firms within official statistics. To the extent that engineering services firms are assigned to the SIC codes identified above, they will be included in our analysis.

6.1 DIRECT IMPACT OF THE ENGINEERING SUB-SECTOR

Analysis of the latest Input-Output tables shows the UK engineering sub-sector sold products worth £179 billion, or 36% of total manufacturing sales in 2019.[37] This dataset suggests that engineering sales are even more export-orientated than for the manufacturing sector as a whole: some 55% of demand comes from customers overseas (Fig. 26).

[37] ONS. 2023. UK input-output analytical tables.

Fig. 26. Sources of demand: engineering, manufacturing, and whole economy, 2019

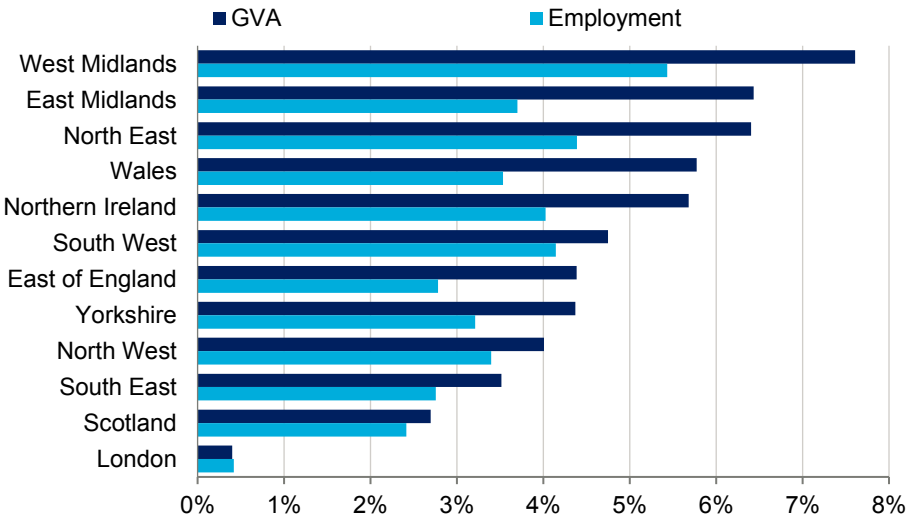


Source: ONS Input-Output Tables, Oxford Economics *Figures may not sum due to rounding

Based on these sales, our estimates suggest that UK engineering firms generated a direct GDP contribution of £66 billion and employed 964,000 people in 2022.

As with the manufacturing sector overall, the importance of engineering to regional economies varies considerably across the UK. The concentration of engineering activity is particularly high in the West Midlands, where the sector accounts for 8% of regional gross value added and 5% of the region's employment. The largest contributors to manufacturing employment in the West Midlands are the manufacture of fabricated metals (17%) and motor vehicles (15%).

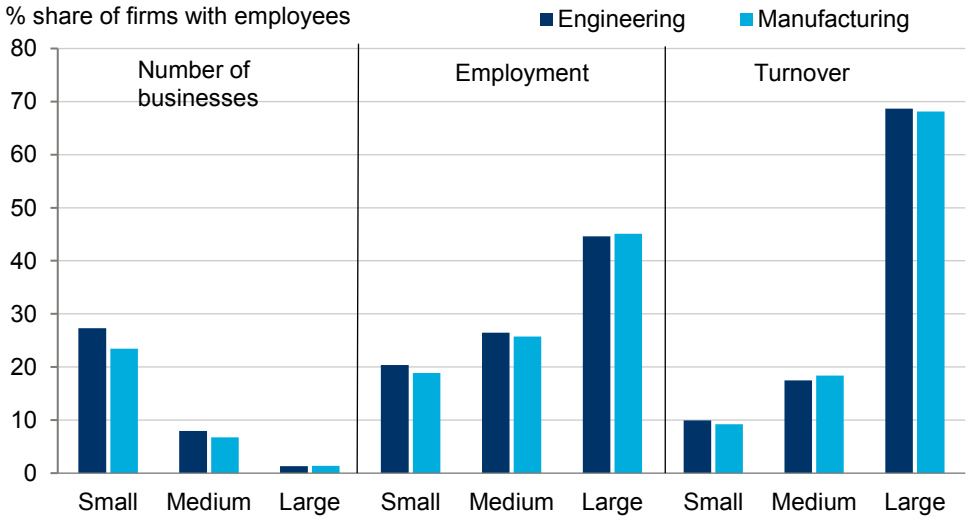
Fig. 27. Direct contribution of the engineering industry in 2022 by region



Source: BRES, ONS, Oxford Economics

At the start of 2022, there were 31,320 firms operating in the engineering sector with employees.[38] Of these, 27% were small (10-49 employees), 8% were medium-sized firms (10-249 employees), and 1% were large (250 employees and over). The large firms provide a larger share of employment and receive a larger share of turnover.

Fig. 28. Share of firm numbers, employment, and turnover provided by engineering and manufacturing firms with employees by business size, 2022



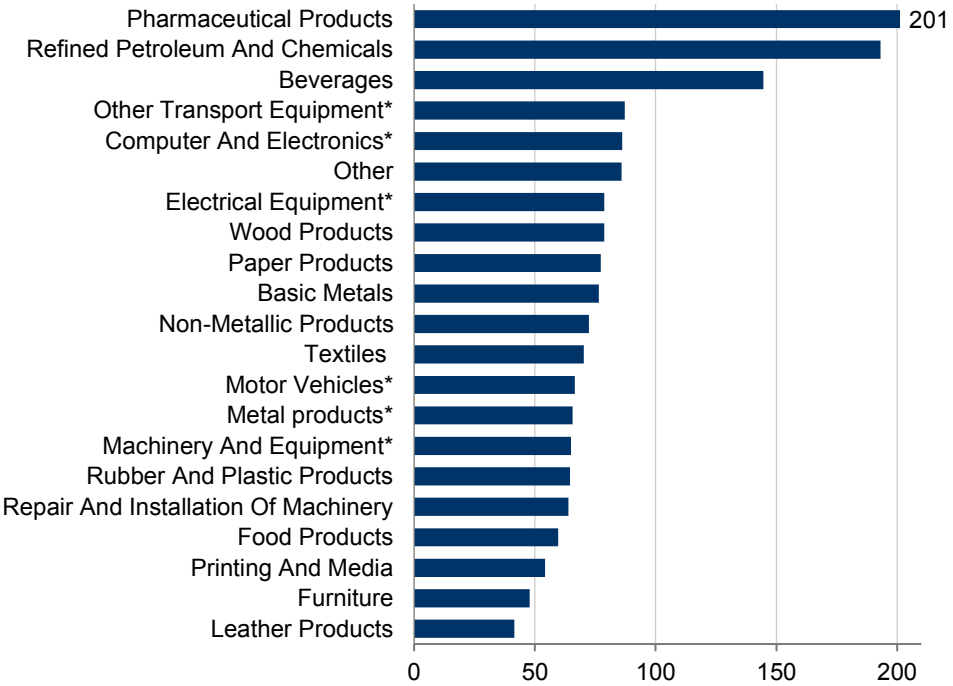
Source: BEIS, Oxford Economics

By dividing the estimate of direct gross value added by employment, we estimate that average labour productivity is £70,000 in the engineering sub-sector. This is marginally lower than in the manufacturing sector overall, but still 32% higher than the UK average.

The finding that labour productivity in engineering is slightly less than in the broader manufacturing sector may appear counter-intuitive, since engineering incorporates many of the more advanced manufacturing sub-sectors, such as computers and electronics and other transport equipment. However, engineering does not include certain manufacturing sub-sectors which have exceptionally high levels of labour productivity: pharmaceuticals, petrol refining, and beverage manufacturing.

[38] Department for Business, Energy & Industrial Strategy. 2022. "Business population estimates 2022".

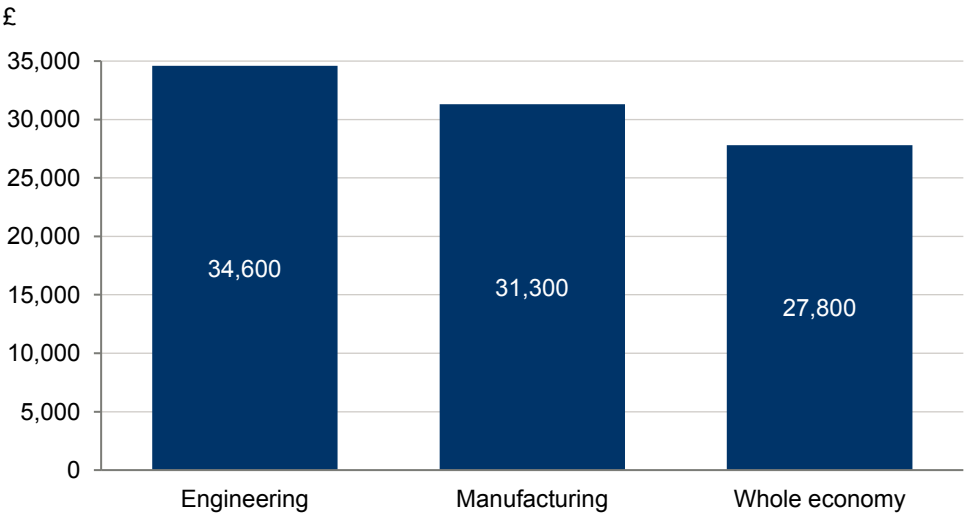
Fig. 29. Labour productivity by manufacturing sub-sector, 2022



Source: ONS, Oxford Economics

While productivity is lower in engineering than in the manufacturing sector as a whole, the opposite is true of wages. The median wage in engineering was £34,600 in 2022, some £6,800 higher than in the economy as a whole (Fig. 30).

Fig. 30. Median annual gross pay by sector, 2022[39]



Source:ONS ASHE, Oxford Economics

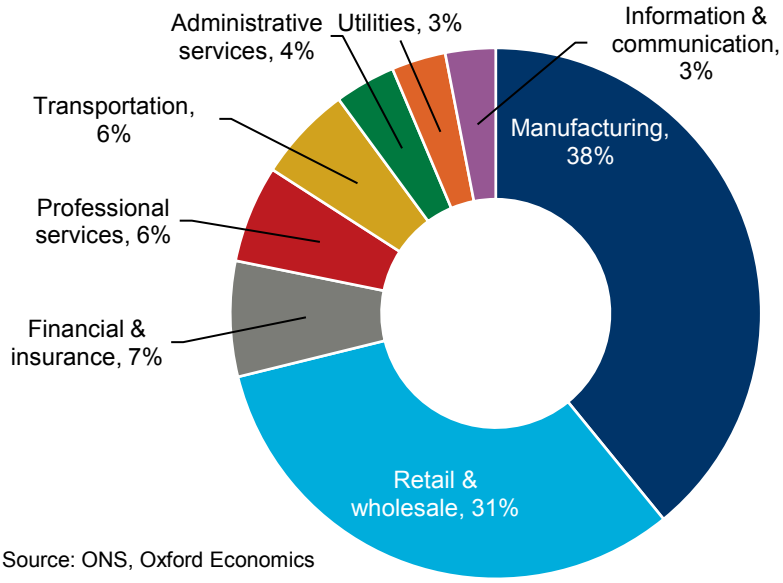
[39] ONS. 2023. Earnings and hours worked, industry by two-digit SIC: ASHE Table 4.

6.2 SUPPLY CHAIN IMPACTS

Our analysis suggests that UK engineering companies purchased £80 billion of goods and services from UK suppliers in 2022.[40] The largest sources of intermediate consumption were the manufacturing sector (38%) and the retail and wholesale sector (31%) (Fig. 31).

Our analysis of 2019 Input-Output tables suggests that the majority (61%) of the UK engineering sectors intermediate consumption was from UK-resident suppliers with the rest (39%) being imported from abroad.

Fig. 31. Domestic intermediate consumption of UK engineering by sector, 2019



Source: ONS, Oxford Economics

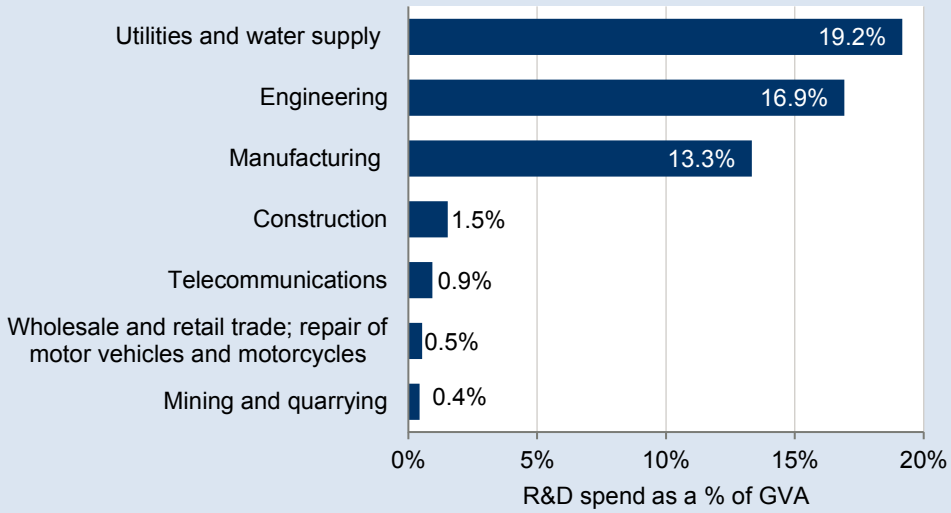
R&D SPENDING IN MANUFACTURING AND ENGINEERING SECTORS

By delivering improved products and processes to businesses, government, and consumers, R&D spending is a key driver of productivity in an economy. Manufacturing businesses punch well above their weight in R&D spending, accounting for 47% of all R&D expenditure by UK businesses in 2022.[41] This is further illustrated in Fig. 32; the manufacturing sector is several times more R&D intensive than other sectors of the economy. The engineering sub-sector is even more R&D intensive than manufacturing as a whole; at 16.9%, engineering R&D spend as a share of GVA is 3.6 percentage points higher than the manufacturing sector as a whole. This can be explained by engineering containing many advanced high-technology sub-sectors such as automotive and aerospace which typically invest significantly in R&D activities. In 2022, engineering businesses spent

[40] Consistent with the underlying datasets, imported goods purchased from a UK distributor are counted as domestic purchases.
[41] ONS. 2024. "Business enterprise research and development, UK", Accessed March 2024.

£11.1 billion on R&D which accounted for 22% of all R&D expenditure within the manufacturing sector.

Fig. 32. R&D spend as a percentage of gross value added in selected industries, 2022



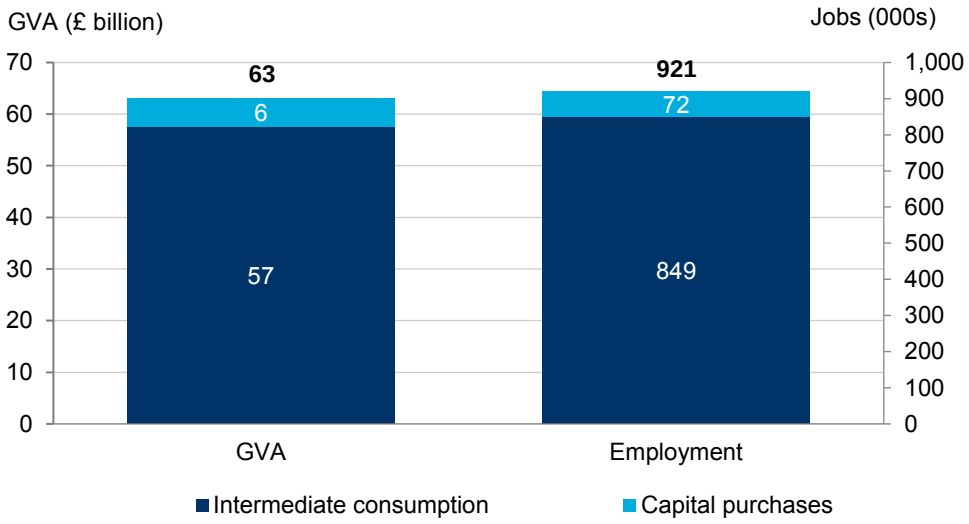
Source: ONS, Oxford Economics

6.2.1 Activity supported by engineering companies' supply chain purchases

Based on the purchases identified above and ONS Input-Output tables, we can calculate the impact of supply chain spending with UK suppliers. We estimate that in 2022, the engineering sector's procurement stimulated a £63 billion gross value added contribution to GDP along its UK supply chain. Of this total, £57 billion resulted from intermediate consumption purchases, and £6 billion from investment purchases (Fig. 33).

Once the indirect impacts have been estimated in GDP terms, data on productivity in each sector can be used to estimate the number of jobs supported in the supply chain. On this basis, we estimate that UK engineering supported 921,000 jobs in 2022 through its intermediate consumption and capital purchases.

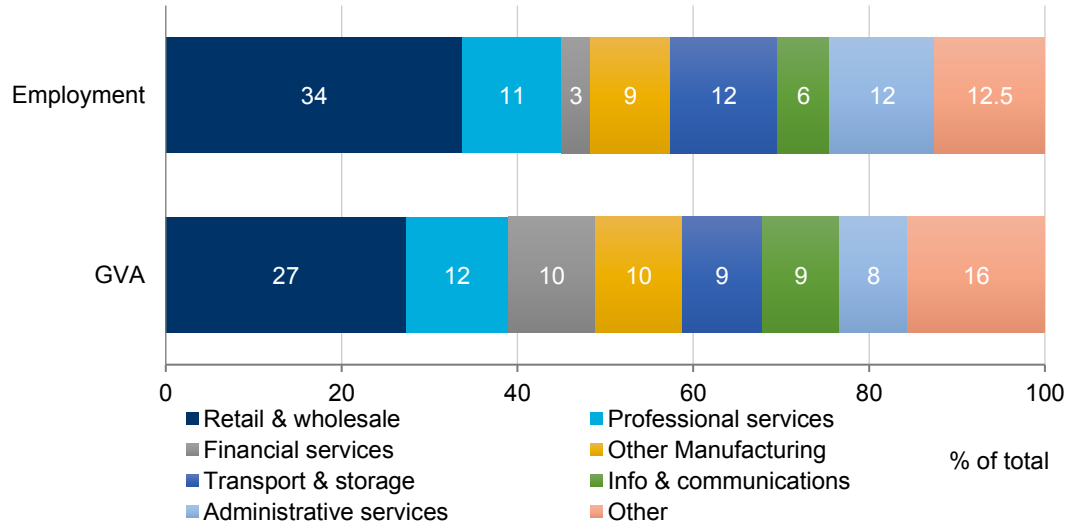
Fig. 33. Indirect contribution of UK engineering, 2022



Source: Oxford Economics

Through its supply chain purchases, UK engineering supports activity across a wide range of other sectors of the economy. In GDP terms, just under half (49%) of this impact accrues in three sectors: retail and wholesale, other manufacturing, and professional services (Fig. 34). When assessed in terms of the jobs supported, a similar pattern emerges but with administrative services accounting for a much larger share of supply chain activity.

Fig. 34. Industrial composition of the indirect impact of the UK engineering sector, 2022



Source: Oxford Economics

6.3 WORKER SPENDING IMPACTS

As workers employed in the engineering sector and its supply chain spend their wages in the wider UK economy, further GDP and employment are supported through the induced channel. As with manufacturing, we can use an Input-Output model to estimate the value of GDP and employment

supported in this way. Our analysis suggests that in 2022, through workers' spending UK engineering supported £65 billion gross value added contribution to GDP and 809,000 jobs.

6.4 TOTAL IMPACT OF THE ENGINEERING SECTOR

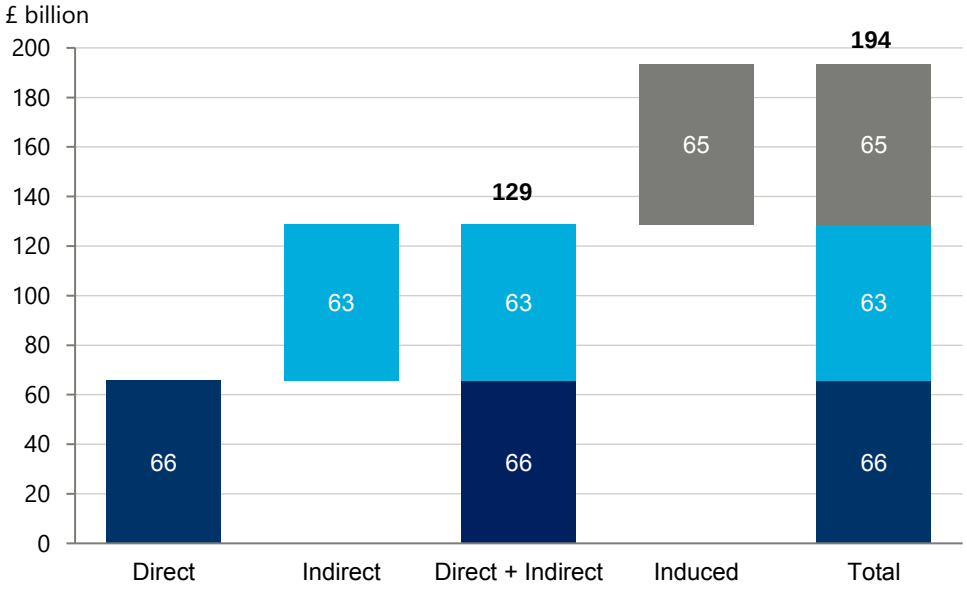
As with the manufacturing sector as a whole, the analysis in the preceding sections provides three ways of considering the economic contribution of the engineering sub-sector.

Firstly, engineering directly contributed £66 billion to UK GDP in 2022 (Fig. 35). This is equivalent to 3.0% of the UK economy and approximate to the size of the UK's accommodation and food service industry.

Secondly, if we broaden the sector's contribution to also include activity in its supply chain, we find that engineering supported a £129 billion GVA contribution to UK GDP in 2022, or 5.9% of the UK total. Based on these figures, the Type I GDP multiplier for engineering is 2.0.[42]

Finally, if we also incorporate the induced, worker spending impacts, we find that engineering supported a total GVA contribution of £194 billion in 2022, equivalent to 8.8% of the UK economy. For every £1 million the engineering sector contributes to GDP itself, it creates another £1.9 million elsewhere in the UK economy. This means that UK engineering's Type II GDP multiplier is 2.9.[43]

Fig. 35. Total GVA contribution to UK GDP by the engineering sector, 2022



Source: Oxford Economics

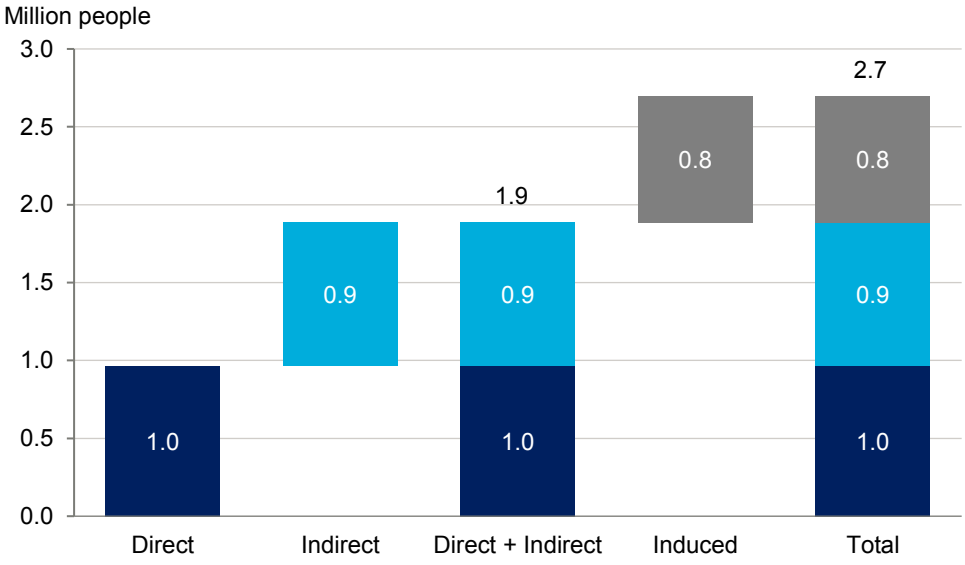
UK engineering companies directly provided just under 1 million jobs in 2022 (Fig. 36). This doubles to just under 2 million once supply chain impacts are included, equivalent to 5.8% of the UK total.

[42] The Type I multiplier is calculated as (Direct GDP + Indirect GDP) / Direct GDP.
[43] The Type II multiplier is calculated as: (Direct GDP + Indirect GDP + Induced GDP) / Direct GDP.

Further widening the employment contribution of engineering to also include jobs supported through the induced channel increases the sub-sector's impact to 2.7 million. This is equivalent to 8.2% of UK jobs in 2022. For every direct job within the industry, another 1.8 are supported elsewhere in the UK economy, giving a Type II employment multiplier of 2.8.

For both GDP and employment, the Type II multiplier values for engineering are similar in scale to manufacturing as a whole (the estimated Type II multipliers for manufacturing were 2.8 for GDP and jobs).

Fig. 36. Total employment contribution of UK engineering, 2022



Source: Oxford Economics

Figures may not sum due to rounding

7. APPENDIX 1: DEFINITION OF THE MANUFACTURING AND ENGINEERING SECTORS

DEFINITION OF THE MANUFACTURING SECTOR

For this study we have defined the manufacturing sector in accordance with standard UK Standard Industrial Classifications. As such, our study incorporates the entirety of SIC Section C, and includes the following divisions:

Manufacture of food products (SIC division 10)

Manufacture of beverages (11)

Manufacture of tobacco products (12)

Manufacture of textiles (13)

Manufacture of wearing apparel (14)

Manufacture of leather and related products (15)

Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (16)

Manufacture of paper and paper products (17)

Printing and reproduction of recorded media (18)

Manufacture of coke and refined petroleum products (19)

Manufacture of chemicals and chemical products (20)

Manufacture of basic pharmaceutical products and pharmaceutical preparations (21)

Manufacture of rubber and plastic products (22)

Manufacture of other non-metallic mineral products (23)

Manufacture of basic metals (24)

Manufacture of fabricated metal products, except machinery and equipment (25)

Manufacture of computer, electronic, and optical products (26)

Manufacture of electrical equipment (27)

Manufacture of machinery and equipment not elsewhere classified (28)

Manufacture of motor vehicles, trailers, and semi-trailers (29)

Manufacture of other transport equipment (30)

Manufacture of furniture (31)

Other manufacturing (32)

Repair and installation of machinery and equipment (33)

DEFINITION OF THE ENGINEERING SECTOR

The engineering sector is defined to include the following divisions:

Manufacture of fabricated metal products, except machinery and equipment (25)

Manufacture of computer, electronic, and optical products (26)

Manufacture of electrical equipment (27)

Manufacture of machinery and equipment n.e.c (28)

Manufacture of motor vehicles, trailers, and semi-trailers (29)

Manufacture of other transport equipment (30)

8. APPENDIX 2: DETAILED RESULTS

Fig. 37. The economic impact of the manufacturing sector, 2022

Metric	Gross value added (£ millions)	Employment	Turnover (£ millions)
Direct			
Total	184,329	2,632,000	636,790
Indirect			
Intermediate Consumption	163,581	223,000	418,231
Capital goods	16,42	2,353,000	42,314
Total	163,581	2,576,000	460,545
Induced			
Intermediate Consumption	147,966	1,852,000	286,286
Capital goods	147,966	1,852,000	49,547
Total	170,017	2,136,000	335,833
Total			
Including capital goods	517,927	7,344,000	1,433,168
Excluding capital goods	479,458	6,837,000	1,341,306
Type I multiplier[44]			
Including capital goods	1.9	2.0	1.7
Excluding capital goods	1.8	1.9	1.7
Type II multiplier[45]			
Including capital goods	2.8	2.8	2.3
Excluding capital goods	2.6	2.6	2.1

Fig. 38. The economic impact of the engineering sector, 2022

Metric	Gross value added (£ millions)	Employment	Turnover (£ millions)
Direct			
Total	65,684	1,000,000	225,783
Indirect			
Intermediate Consumption	57,478	13,000	134,957
Capital goods	5,589	72,000	12,929
Total	63,066	921,000	147,885
Induced			
Intermediate Consumption	56,616	704,000	104,662
Capital goods	8,223	105,000	17,323
Total	64,839	809,000	121,986
Total			
Including capital goods	193,590	2,694,000	495,654

[44] The Type I multiplier is calculated as (Direct + Indirect) / Direct.
[45] The Type II multiplier is calculated as (Direct + Indirect + Induced) / Direct.

Excluding capital goods	179,778	2,517,000	465,401
Type I multiplier[46]			
Including capital goods	2.0	2.0	1.7
Excluding capital goods	1.9	1.9	1.6
Type II multiplier[47]			
Including capital goods	2.9	2.8	2.2
Excluding capital goods	2.7	2.6	2.1

[46] The Type I multiplier is calculated as (Direct + Indirect) / Direct.
[47] The Type II multiplier is calculated as (Direct + Indirect + Induced) / Direct.

9. APPENDIX 3: METHODOLOGY AND DATA SOURCES

MAIN DATA SOURCES

1. Office for National Statistics, "Non-financial business economy, UK: Sections A to S" *Annual Business Survey – 2021"*,18 May 2023<https://www.ons.gov.uk/businessindustryandtrade/business/businessservices/datasets/uknonfinancialbusinesseconomyannualbusinesssurveysectionsas > [accessed February 2024] *Hereafter referred to as the 'ABS'*.

2. Office for National Statistics, "United Kingdom Input-Output Analytical Tables, 2019," *UK Input-Output Analytical Tables*, 2023 < https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltablesindustrybyindustry > [accessed February 2024]. Hereafter referred to as the 'Input-Output tables'.

3. Office for National Statistics, " Supply and Use Tables, 1997 - 2021,"*Input-Output Supply and Use Tables*,2021 <https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/inputoutputsupplyandusetables> [accessed February 2024]. *Hereafter referred to as the 'Supply and Use tables'*.

4. Office for National Statistics, "Annual gross fixed capital formation by industry and asset" *Business Investment Statistical Release*, 2023 <https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/annualgrossfixedcapitalformationbyindustryandasset> [accessed February 2024]. *Hereafter referred to as the 'ONS business investment release'*

5. Office for National Statistics, "Regional gross value added (balanced) by industry: all ITL regions" *Regional Accounts, 2023* <https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalandrealregionalgrossvalueaddedbalancedbyindustry> [accessed February 2024]. *Hereafter referred to as the 'balanced regional GVA dataset'*.

6. Office for National Statistics, "Business Register and Employment Survey" *All data related to Employees in the UK: provisional results 2022.* <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/businessregisterandemploymentsurveybresprovisionalresults/provisionalresults2022revisedresults2021/relateddata>[accessed February 2024].

7. Oxford Economics, "2 Digit SIC Total Employment and GVA forecasts," Regional Model, 2022. Hereafter referred to as the 'Oxford Economics' regional forecasts.

8. Oxford Economics, "2 Digit SIC Total GVA forecasts," Industry Model, 2022. Hereafter referred to as the 'Oxford Economics' industry forecasts.

HOW WE CALCULATED THE DIRECT IMPACT

Sources of demand

- Intermediate consumption includes demand from market organisations, non-market organisations and non-profit institutions serving households. Market organisations comprise all private sector activity including demand from retailers and wholesalers. Non-market organisations refer to publicly funded activities delivered by public services e.g., the National Health Service. Non-profit institutions serving households (NPISH) are institutions that provide goods and services, either free or below the market prices, mainly derive their income from grants and donations, and are not controlled by government. Examples include charities, trade unions, and the majority of universities.[48]
- Government includes demand from central government and local authorities.
- Household consumption includes demand from households.
- Investment includes the following sub-categories: gross fixed capital formation, acquisitions less disposals of valuables, and changes in inventories.
- Exports includes all goods and services that are exported from the UK.

Gross value added

The gross value added (GVA) estimate for the manufacturing sector was taken from the Annual Business Survey published by the ONS on 18 May 2023. This provides GVA estimates at 2-digit SIC level for the UK. The dataset provides GVA estimates for 2021. To provide 2022 estimates we use scaled figures using the growth between 2021 and 2022 using the ONS Quarterly National Accounts series for gross value added in current prices.[49]

The measure of direct GVA forms the cornerstone of the analysis. All other variables (with the exception of capital expenditure and employment) have been scaled to it. We chose this approach because we consider the GVA estimate to be the most robust data point we use in this analysis.

[48] ONS. 2022. Households and non-profit institutions serving households. Accessed February 2024.
[49] For example, for manufacturing we scaled the 2021 value from the Annual Business Survey by the percentage growth in manufacturing gross value added in current prices between 2021 and 2022 (using the ONS four letter identifier series KKE3).

Employment

Employee jobs taken from the UK's Business Register and Employment Survey (BRES) Note: As BRES only provides employment data for Great Britain, we have also used the BRES employment survey data from Northern Ireland Statistics and Research Agency (NISRA).

HOW WE CALCULATED THE INDIRECT IMPACT

We define the indirect impact to include the economic activity supported within the UK as a result of the UK's manufacturing industry's purchases of goods and services from UK suppliers.

To calculate the indirect impact of the manufacturing industry, it is necessary to identify the value of intermediate consumption and capital expenditure of the companies within the industry, and determine how these purchases stimulate further economic activity through the UK supply chain.

Even when UK manufacturers import raw materials, components and equipment from overseas, they may still support activity within the UK—for example, among UK-based distributors and logistics companies who facilitate these imports. However, the extent to which these effects are captured within our results will depend on the structure of contracts. For example, where a UK manufacturer has a contract with a UK distribution company, the activity supported in the distribution sector is likely to be captured in our supply chain analysis. If, on the other hand, the UK manufacturer is purchasing from an overseas supplier and the overseas supplier commissions the UK leg of distribution activity, the activity with the UK distributor may not be captured in the supply chain.

A second example concerns the repair and maintenance of imported equipment by a UK-based company. In this case, the associated activity would be expected to fall within the direct impact of the manufacturing sector, although whether this is the case will depend on the SIC code assigned to the company undertaking the work.

Intermediate consumption

To calculate total intermediate consumption purchases, we developed an intermediate consumption to GVA ratio from the ABS and applied to it our estimate for GVA.[50] The sectors where the manufacturing industry made its purchases and the value these purchases created in the economy were estimated using ONS 2019 domestic Input-Output tables.

Capital purchases

A standard I-O based assessment of the supply chain of the manufacturing industry would count its purchases of fuels, consumable parts and tools, utilities, professional services, etc. But it would miss out capital spending on machinery, vehicles, or the construction of facilities that are crucial for its activities and represent a significant part of its interaction with the wider economy.

[50] The metric name for intermediate consumption within the ABS is 'total purchases of goods, materials and services'

Our approach also incorporates information on capital purchases, that are made as part of each industry's gross fixed capital formation (GFCF). By including the amount of capital spending that is required to sustain a given level of output, we have a more accurate measure of what inputs are in fact required for economic activity to take place. The total value of capital purchases was taken directly from the ABS "Total net capital expenditure" metric.[51]

The sectors where the manufacturing industry made their capital purchases and the value these purchases created in the economy were estimated using the gross fixed capital formation by industry matrix from ONS Supply and Use tables.[52]

Input-Output modelling

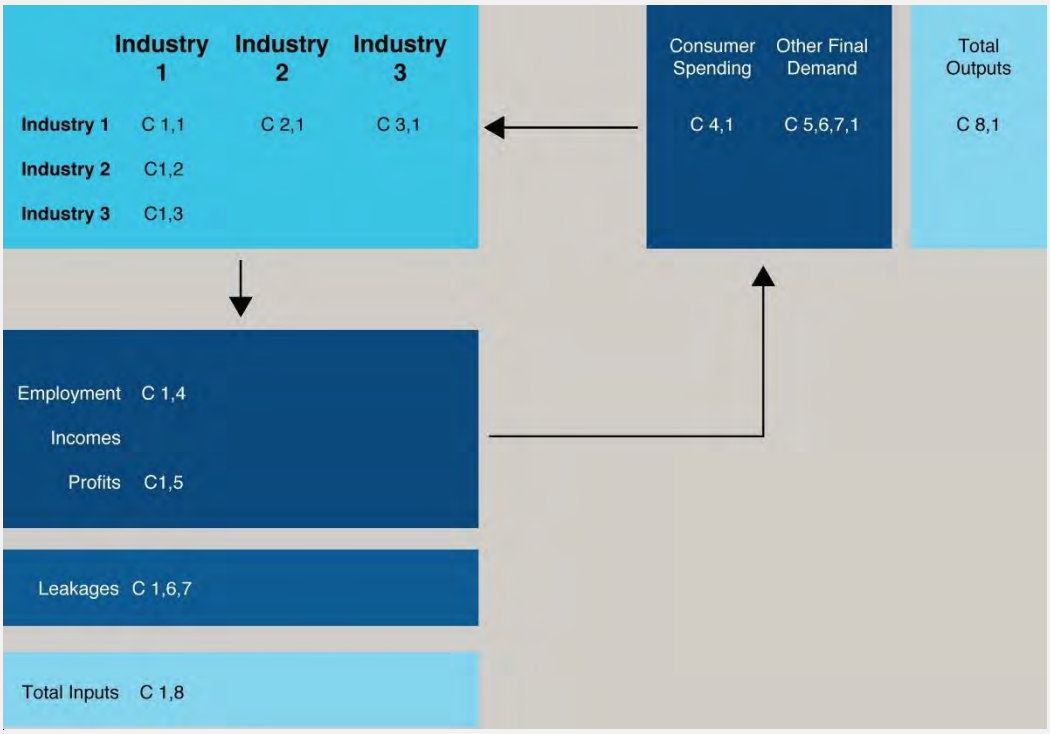
The modelling for this study was based on UK Input-Output tables published by the ONS (see above). These set out the goods and services that UK industries purchase from one another in order to produce their output (as well as their purchases from abroad). These tables also provide detail on the spending patterns of UK households, and indicate whether this demand is met by UK production or imported products. In essence, the tables show who buys what from whom. Using details of these linkages from the Input-Output tables, Oxford Economics constructed a bespoke UK impact model, which traces the intermediate consumption and capital good consumption impacts attributable to the manufacturing industry (this is known as the Leontief manipulation).

Oxford Economics' impact model quantifies all rounds of subsequent purchases along the supply chain. These transactions are translated into GDP contributions, using UK-specific ratios of GVA to gross output, sourced from the UK input-output table.

Once we have obtained results for output and GVA, we estimate employment using productivity estimates.

[51] Total net capital expenditure by businesses excludes expenditure on dwellings and the costs associated with the transfer of ownership of non-produced assets, and capital expenditure by local and central government.
[52] Both the supply and use tables and the ONS business investment release are consistent with the UK National Accounts Blue Book 2022 & UK Balance of Payments Pink Book 2022.

Fig. 39. A stylised Input-Output table structure



HOW WE CALCULATED THE INDUCED IMPACT

The induced impact is modelled using a similar method to the indirect impact. Using employment and wage data calculated as part of the direct impact, Oxford Economics used household spending data to model the typical consumption patterns of UK households, making an allowance for "leakages" in the form of imports and savings.

For workers within the manufacturing industry's supply chain, we used industry-specific ratios of employee compensation per unit of output to estimate the value of household wages supported among the suppliers' workers.

Both of these spending streams were then fed into our Input-Output model, to calculate the total impact of this spending on GDP. As with the indirect impact, employment impacts were derived using productivity estimates for each sector of the economy.

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