
How can the rolling stock supply chain create greater value for the UK?

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1 Foreword

The rail industry provides a vital public service across the UK. It drives economic growth and success, aids social mobility, and will play a pivotal role in the UK's decarbonisation agenda. Embedded within the industry is the UK rolling stock manufacturing and maintenance supply chain, a vital cog in the larger wheel that makes up the industry. To date, no one has attempted to quantify its contribution to the UK's economy.

Rail Forum Midlands (RFM) commissioned this analysis to understand the size, impact and potential of this important part of the rail ecosystem. The analysis has not been straightforward, as current industry classifications make it difficult to disaggregate information from wider manufacturing datasets. We are grateful for the significant help from a range of train manufacturers, asset owners and larger Tier 1 suppliers that have provided valuable insight and data to facilitate the production of this report.

Our analysis demonstrates that the UK rolling stock manufacturing and maintenance supply chain is an important sector in its own right. It supports tens of thousands of highly skilled, well-paid jobs, primarily across the North and Midlands. It is highly productive, with the potential to further increase UK economic activity, supporting the levelling-up and decarbonisation agendas, without requiring an increase in overall investment by clients and government.

An approach to procurement that increases UK content in manufacturing from the current low of 25% to 50% would create an additional £133m gross value added (GVA) p.a. and 2,000 new jobs. Additionally, this would provide far greater resilience in the supply chain and increase the scope for UK suppliers to expand their export potential.

In the digital era our manufacturers feel forgotten. The creation of Great British Rail (GBR) and the UK's exit from the EU provide a significant opportunity to address this situation. RFM is committed to work with the UK government and devolved administrations to ensure that our manufacturing and maintenance supply chain can make the best possible contribution not just to the success of the UK railway, but also to the wider economy.

Elaine Clark

CEO, Rail Forum Midlands

2 Executive summary

The rolling stock supply chain in the UK makes a substantial contribution to the UK economy; conservatively, we estimate that it supports 26,000–27,000 jobs and £1.7bn–£1.8bn of gross value added (GVA). That employment and economic activity is distributed around the UK, with a key cluster of activity in the Midlands.

Current rolling stock supply chain employment: 26,000–27,000 jobs

The rolling stock supply chain is a highly productive sector, with GVA per employee of £105,000,¹ compared with £65,000 for the UK manufacturing sector as a whole² (which in turn is higher than the UK average). An expansion of the sector would therefore be likely to support the UK government's 'levelling-up' agenda through the creation of high-skill, high-productivity jobs.

Rolling stock supply chain is 1.6 times more productive than UK manufacturing average

Looking under the surface, different parts of the supply chain perform very differently: the UK has (or will have) four rolling stock assembly plants, and much of the maintenance work is carried out by UK based suppliers. However, our analysis of a range of data sources shows that approximately 75% of the components used in assembly and maintenance are manufactured outside the UK. The reasons for this are varied, but include that the components may not be currently available from the UK supply chain, that non-UK suppliers may provide a lower price, and that component manufacture is part of internationally integrated supply chains.

75% of components used in assembly and maintenance are manufactured outside the UK

Nevertheless, industry participants interviewed for this study agreed that there are opportunities to increase the share of components manufactured in the UK (and therefore the value that the rolling stock supply chain can bring to the UK) if a number of levers are used by both the rail industry and the UK government. These levers include:

- a more focused use of government procurement strategy, building on the successes of previous procurements in driving the use of UK parts;
- more stable and predictable procurement of rolling stock (both new-build and maintenance) to give the supply chain confidence to invest in people and capital equipment;
- careful consideration by the rail industry and the UK government of whether there is capability that would provide value to the UK but is not currently located in the UK because of coordination failures that could be remedied through government coordination and support;
- a greater use of early supplier involvement in rolling stock procurement to drive innovation and cost reduction.

The current industry reform, with the publication of the Williams–Shapps review, gives an opportunity to pursue these reforms. Our assessment gives

¹ Oxera analysis of data for 2019.

² Data for 2018 from Office for National Statistics (2020), 'Firm-level labour productivity estimates from the Annual Business Survey (ABS): summary statistics', 1 June.

rise to five key questions to the industry and the government. We present these in Figure 2.1.

Figure 2.1 Key questions to the industry and the government



How will the rolling stock supply chain engage with the design of Great British Railways (GBR) such that the opportunities for both growth and smoother procurement cycles are embedded in the decision-making processes within GBR when it begins operating? For example, how will the rolling stock supply chain be represented in the national and regional workstreams that are being set up?



How will the GBR take the opportunity presented by the Williams–Shapps review to embed the supply chain closer to the centre of the industry than has historically been the case?



Who in the rolling stock supply chain could provide strategic insight to the Department for Transport (DfT) and GBR on the key issues that affect price, innovation and wider key purchasing criteria, and that would drive optimal value for money for the taxpayer?



What will the government (including Network Rail and GBR) do to reward the wider economic, social and environmental impacts of UK-based manufacturing in its procurement processes?



How will government (including Network Rail, GBR and the DfT) reform the industry programme to provide a transparent, stable and credible forward view of the industry's needs to enable the rolling stock supply chain to plan and invest in people and equipment?

Source: Oxera.

3 Introduction

Firms involved in the assembly, manufacture and maintenance of rolling stock and its components are a critical part of the rail industry in the UK.³ In addition to enabling passenger and freight services, the supply chain is economically important in its own right, providing employment and creating value to the UK economy.

It is particularly economically important in the North and Midlands as part of the wider UK manufacturing base (as many firms supplying the rail industry also supply the automotive, maritime, nuclear, and defence sectors).

The COVID-19 pandemic has also highlighted the importance of the UK rolling stock supply chain in enabling passenger and freight rail operations to continue throughout severe disruption to international supply chains.

While the economic contribution of the UK rail industry has been well documented⁴ and the economic importance of the UK's manufacturing sector is widely recognised, the role of the rolling stock supply chain (which we define as firms involved in the assembly, manufacture and maintenance of rolling stock and its components) is less well understood. This report aims to bridge this gap by explaining the size of the sector in the UK, how that activity is distributed across the country, and the potential benefits that could be realised by growing this supply chain.

We have taken a 'snapshot' of the value of the rolling stock supply chain in 2019/20, bringing together a range of data sources in an unprecedented way. Of course, there are other perspectives and additional angles that could be added (for example, how this value has changed over time, or expanding the coverage to Very Light Rail): this report is the start of a discussion, rather than the end.

As with any manufacturing sector, the UK rolling stock supply chain is integrated with international supply chains. One of the key aspects that this study looks at is the extent to which the components used in the supply chain are sourced from the UK; to what extent they are sourced from non-UK manufacturers; and why.

This assessment aims to support the industry in understanding the factors at play and how different approaches may affect the outcomes in this market. It is important to be clear that there are good reasons why many components are sourced from suppliers outside the UK, and consumers will often benefit from this. However, when a component is sourced, it is necessary to be clear about why that purchasing decision is being taken, and its implications for the consumer of the component, the organisation purchasing that component, the supply chain, and for the UK as a whole.

The industry reorganisation under the Williams–Shapps Plan for Rail,⁵ the rail sector deal⁶ and the UK government's '10 point plan for a green industrial

³ In this report, we use statistics from official statistical agencies (the Office for National Statistics and Eurostat, which cover the whole of the UK; and data from industry sources which cover Great Britain. For ease of reference, we refer to the UK but this will slightly understate the size of the total supply chain as the industry data does not include rolling stock maintenance in Northern Ireland.

⁴ See, for example, Oxera (2015), 'What is the contribution of rail to the UK economy?', available at <https://www.oxera.com/wp-content/uploads/2018/07/RDG-booklet-Final-Sept-15.pdf>, accessed 25 May 2021.

⁵ Department for Transport (2021), 'Great British Railways: the Williams-Shapps Plan for Rail', May.

⁶ HM Government (2018), 'Industrial strategy: rail sector deal'.

revolution⁷ mean that now is a good time to ask what role the rolling stock supply chain could be playing in delivering value for the UK, and what are the levers that industry and government can use to maximise that value.

This study has benefitted greatly from the contribution of a wide range of organisations (including those below), and Oxera is grateful for their time and commitment. These organisations do not necessarily share or endorse the analysis and perspectives provided in this report, and they are not responsible for its content in any way.



⁷ HM Government (2020), 'The ten point plan for a green industrial revolution', November.

4 How does the rolling stock supply chain bring value to the UK?

When thinking about the economic value of the rolling stock supply chain, a useful starting point is the level of employment and GVA that it creates. However, the overall level of employment and GVA do not tell the full story for a number of reasons shown in Figure 4.1 below.

Figure 4.1 How the UK rolling stock supply chain contributes to the UK economy and society

Contribution to levelling up: the distribution of employment across the UK associated with this part of the rail supply chain is important to the UK government's 'levelling-up' agenda. It supports significant skilled employment opportunities outside London and the South East.

The rolling stock supply chain is a part of the wider UK manufacturing capability, with many companies working or having potential to work across sectors, which in turn drives innovation and efficiencies.

Employment and GVA metrics do not account for differences in productivity from different sources of employment. In the long term, living standards and levels of economic activity are determined by how productively an economy uses the resources (e.g. people, land, capital) available to it; more productive use of these resources provides greater economic output and therefore a higher standard of living.* The rolling stock supply chain is a highly productive sector of the economy.

The UK rolling stock supply chain also provides a key contribution to the security of supply of the UK's rail passenger and freight operations, as well as to the UK's exports (in a small way at present).

Note: * More formally, economists refer to a 'net economic impact' of an industry which accounts for how much more productive employees and other resources are when employed in one part of the economy rather than another.

Source: Oxera.

4.1 GVA and employment

In 2019, suppliers in the UK produced £1.3bn of locomotives, rolling stock and parts thereof.^{8,9} By using statistics on the trade of rolling stock between the UK and the rest of the world,¹⁰ we found that the total domestic consumption of rolling stock and railway locomotives was almost £2.3bn in 2019. Therefore, 58%¹¹ of this demand for assembled rolling stock and locomotives was covered by UK suppliers, with imports meeting the remaining demand.

However, when intermediate products such as bogies, axles, wheels, brakes and other products used in the assembly and maintenance of rolling stock are considered, it seems that these are mainly sourced from other geographies. According to ONS and Eurostat data,¹² the UK demand for locomotives or rolling stock parts¹³ was £0.7bn in 2019. The majority of this demand was covered by imported parts, with the share covered by **UK companies being approximately 25%**.

Therefore, it is evident that although the UK rail sector sources just over half of rolling stock from suppliers with assembly plants based in the UK, the components used in new-build rolling stock are usually sourced from other geographies. Figure 4.2 below illustrates that this trend has been prevalent across time and has been increasing since 2015.

⁸ This includes value of exports. Office for National Statistics (2020), 'UK Manufacturers' sales by Product (PRODCOM)'. This refers to the UK SIC 2007 Group '3020: Manufacture of railway locomotives and rolling stock' and excludes the SIC subcategories 30204030 – Parts of locomotives or rolling stock and 30204050 and 30204060 that refer to manufacture of signalling and traffic control equipment for railways, roads, etc.

⁹ In this study we used the most recent data available wherever that was possible. The latest PRODCOM publication by the ONS includes information up to 2019. Office for National Statistics (2020), 'UK Manufacturers' sales by Product (PRODCOM)'.

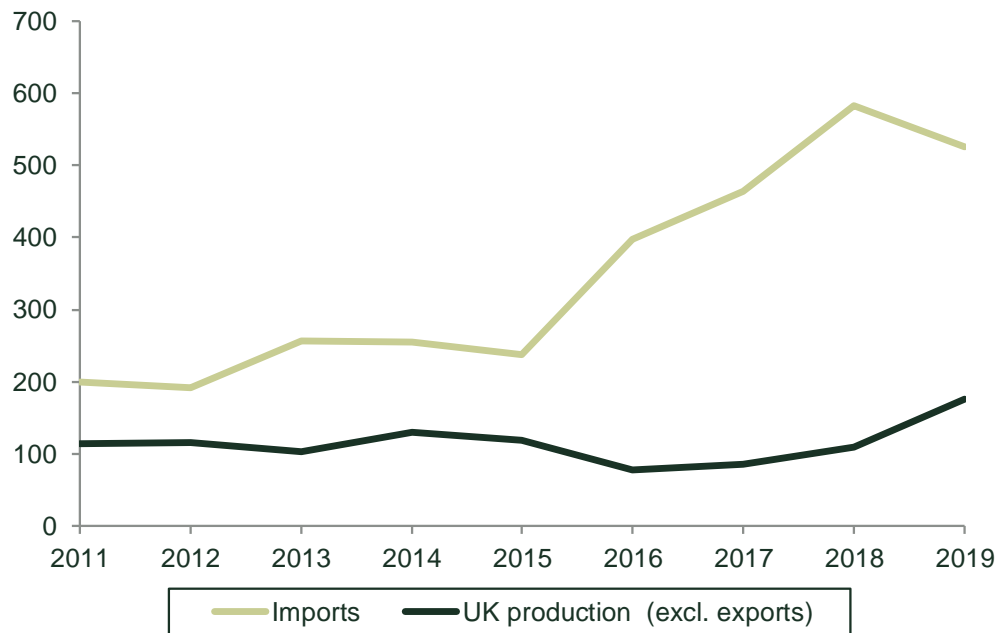
¹⁰ Eurostat (2021), 'EU trade since 1988 by CN8'. In particular, we used trade data for the products classified under the SIC code '3020: Manufacture of railway locomotives and rolling stock', excluding manufactured products related to signalling and traffic control equipment for railways, roads, etc. For further information on the methodology, see Appendix A1.

¹¹ The percentage may not match a calculation using the reported numbers of total sales and domestic consumption due to rounding.

¹² Office for National Statistics (2021), op. cit.; Eurostat (2021), op. cit.

¹³ This refers to the PRODCOM product 'Parts of locomotives or rolling stock' with code 30204030. According to the SIC explanatory notes, this category includes: bogies, axles and wheels, brakes and parts of brakes; hooks and coupling devices, buffers and buffer parts; shock absorbers; wagon and locomotive frames; bodies; corridor connections, etc. Office for National Statistics (2009), 'UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007) – Structure and explanatory notes', p. 131.

Figure 4.2 UK production excluding exports and imports of 'Parts of railway locomotives or rolling stock' 2011–19, £m

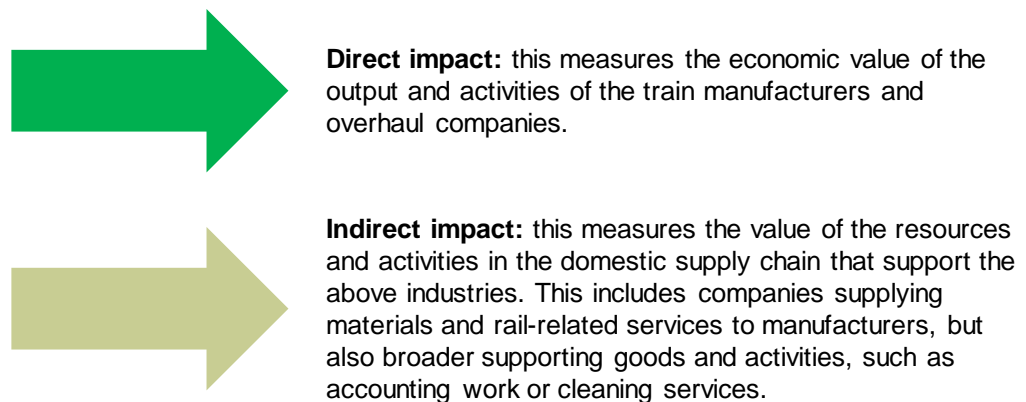


Source: Oxera analysis of data from ONS (2020) and Eurostat (2020).

It is this level of demand that the rolling stock supply chain is meeting: the next step in our analysis is therefore to turn that demand into an understanding of the employment and GVA produced in meeting that demand (referred to as the 'economic footprint').

The economic footprint of the UK rolling stock supply chain can be divided into two parts: a direct impact and an indirect impact. These are described in Figure 4.3.

Figure 4.3 Types of economic impact

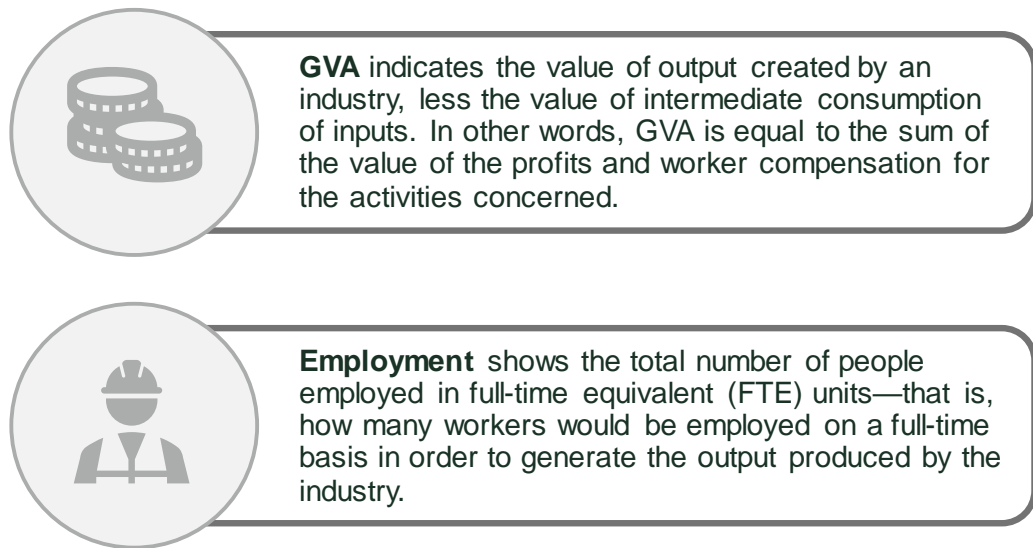


Source: Oxera.

We provide two indicators of economic footprint:

- the gross value added (GVA);
- the employment generated from the domestic production and maintenance of rolling stock.

Figure 4.4 Economic indicators



Source: Oxera.

We used ONS and Eurostat data, together with information from rolling stock leasing companies and original equipment manufacturers ('OEMs'). It is important to note that these do not capture the supply chain in its entirety due to the way that businesses are classified in the national statistics.¹⁴ This means that our analysis is more likely to provide a conservative estimate of the value of the rolling stock supply chain. For a detailed description of our methodology, see Appendix A1.

The key messages from this analysis are as follows.

- **Direct impact:** in 2019, UK-based assembly of rolling stock and locomotives (including light rail and freight), as well as manufacture of subcomponents, contributed £0.6bn of GVA to the UK economy and supported up to 7,000 jobs.¹⁵ The direct impact arising from the maintenance of rolling stock is estimated at £0.5bn–£0.6bn in terms of GVA, which translates to 7,000–8,000 full-time employees ('FTEs').¹⁶
- **Indirect impact:** we estimated that the supply chain supporting the assembly of rolling stocks and locomotives and the manufacture of related subcomponents in the UK generated £0.6bn of GVA in 2019 and supported more than 10,000 jobs. This excludes any activities supporting exports of rolling stock (examined in section 4.6). Similarly, we estimated that the supporting supply chain activity of maintenance of UK rolling stock contributes approximately £0.2bn to the UK economy, supporting 3,000–4,000 UK jobs.¹⁷

¹⁴ For example, although a rolling stock consultancy company would clearly be part of the rolling stock supply chain, it would be registered as an 'engineering activities consultancy' alongside other consultancies that provide services to other industries. This makes the information on the rolling stock-related activity impossible to isolate.

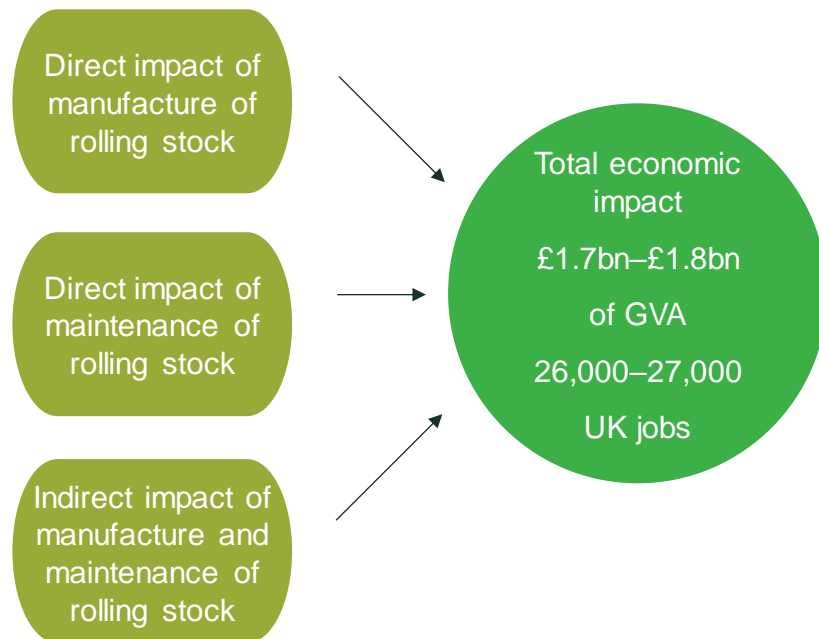
¹⁵ These refer to activity covering UK demand for rolling stock and excludes any impact generated from activities facilitating UK exports.

¹⁶ The economic impacts of maintenance activity vary depending on the share of the UK-based goods and services in the total inputs used in maintenance of rolling stock, which is assumed to range from 25% to 50% based on market intelligence and the analysis of national statistics.

¹⁷ The economic impacts of maintenance activity vary depending on the share of the UK-based goods and services in the total inputs used in maintenance of rolling stock, which is assumed to range from 25% to 50% based on market intelligence and analysis of national statistics.

- **Total impact:** after removing any overlap between the maintenance and manufacturing activities, we estimate that the assembly, manufacture and maintenance of rolling stock and the supply chain supporting these activities **generate £1.7bn–£1.8bn of GVA for the UK economy and support employment of 26,000–27,000 jobs.**¹⁸

Figure 4.5 Total economic impact of manufacture and maintenance of rolling stock in the UK



Source: Oxera analysis.

These results are a conservative estimate of the size of the UK rolling stock supply chain because they do not capture impacts generated by the following:

- maintenance of light and freight railway vehicles;¹⁹
- design and consultancy services related to rolling stock;
- activities related to exports of rolling stock or components thereof.

A complete picture of the size of the supply chain is very difficult to gather given the available data. However, to illustrate what a more complete definition of the rolling stock supply chain may look like it, is useful to consider that in 2017, according to a list of suppliers from the Rail Forum,²⁰ there were more than 550 businesses providing goods and services to rolling stock manufacturers located in the Midlands. This compares to approximately 300

¹⁸ The total impact is not equal to the sum of the direct and indirect impact: we deduced a part of the impact to avoid any double counting. See Appendix A1.6 for more information.

¹⁹ The total impact includes the impact related to the assembly of freight railway vehicles, as well as the manufacture of subcomponents used in this, but not any impact generated by the maintenance of freight railway vehicles.

²⁰ The list was produced from Rail Forum Midlands in 2017 and does not present an exhaustive picture of the total supply chain of the rolling stock manufacture and maintenance industry in the UK. However, the list does provide an indicative estimate of how extensive the supply chain of rolling stock manufacture and maintenance can be when a more inclusive definition is used, rather than one that focuses only on train assemblers and manufacturers.

firms belonging in the SIC codes related to train assembly, manufacture and maintenance.²¹

Similarly, the Rail Forum found that the supply chain located in the East of England doubles in size when a more extensive definition is used than just train assemblers and manufacturers. The list includes businesses such as consultancy firms, manufacturers of rolling stock interiors, electric subsystems providers, and others.

In summary, this section demonstrates that the rolling stock supply chain's contribution to the UK economy is up to £1.8bn of GVA and supports up to 28,000 employees. This is achieved through the impact of the direct supply chain and also through the value created from the purchases of goods and services that support this activity. Although a significant portion of activity related to assembly is established in the UK, there is room for growth in the generated value from subcomponents of rolling stock, as the vast majority of these are usually imported from other geographies.

The overall number of employees and GVA are clearly only part of the story. The rest of this section examines other ways in which the supply chain brings value to the UK.

4.2 A widely spread industry, creating employment across the UK

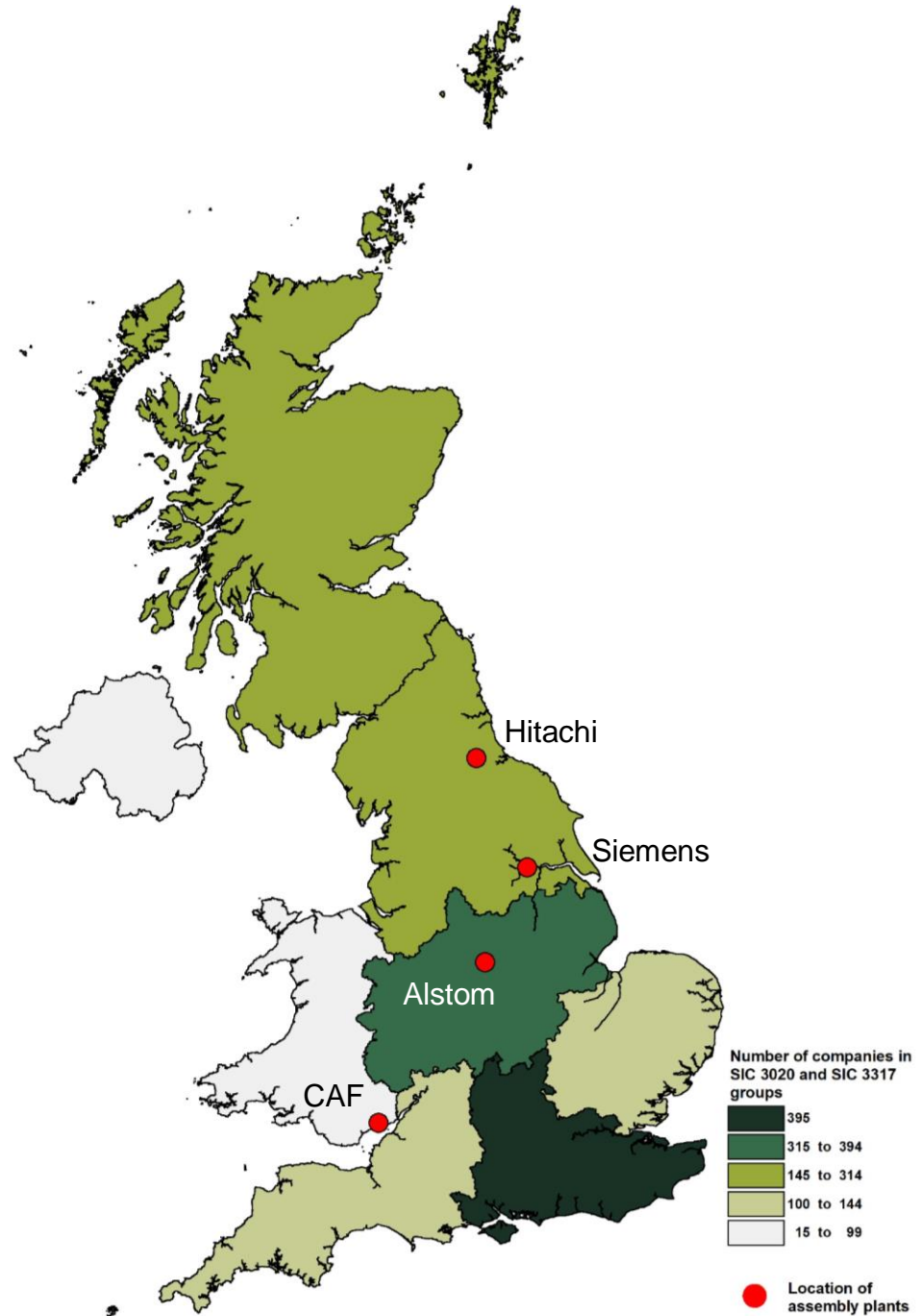
The rolling stock assembly, manufacture and maintenance industry supports employment across all regions of the UK. According to ONS statistics,²² approximately 53% of enterprises directly involved in the assembly, manufacture and maintenance of rolling stock and locomotives and parts thereof are located in Northern England, the Midlands, and Scotland. In comparison, the South East (including London) accounts for 27% of the total businesses in this industry.²³ This is illustrated in Figure 4.6.

²¹ Oxera analysis of ONS statistics based on a snapshot of the Inter Departmental Business Register (IDBR) taken in March 2020. Office for National Statistics (2021), 'Analysis of enterprises in regions of the United Kingdom for specified UK SIC 2007 group & UK SIC2007 class (transport related) 2019 and 2020', 2 March.

²² Office for National Statistics (2021), 'Analysis of enterprises in regions of the United Kingdom for specified UK SIC 2007 group & UK SIC2007 class (transport related) 2019 and 2020', 2 March.

²³ It should be noted that when an enterprise has multiple sites, the ONS identifies the main operating site or the head offices as the location of the enterprise. This means that if a company has its head offices registered in London, it is more likely that this would be its location in the ONS data.

Figure 4.6 Distribution of enterprises in assembly and manufacturing of railway locomotives and rolling stock in the UK (2020) and location of main assembly plants



Note: Number of enterprises in SIC07 groups '3020: Manufacture of railway locomotives and rolling stock' and '3317: Repair and maintenance of other transport equipment' as in March 2020. Siemens' assembly plant in Goole, East Yorkshire, is under construction (in August 2021).

Source: Oxera analysis of data from Office for National Statistics (2021). Locations of assembly plants were sourced from publicly available sources, as follows. Hitachi: *Global Railway Review* (2021), '[New facilities opened at Hitachi Rail's County Durham factory in UK](#)', 5 March. Siemens: Siemens (2021), '[Proudly manufacturing new trains for the UK](#)', accessed 23 August 2021.

Alstom: Alstom (2021), '[UK International Trade Secretary Liz Truss visits Alstom Derby to mark major milestone in Cairo Monorail project](#)', press release, 25 June. CAF: CAF (2021), '[Facilities and offices](#)', accessed 23 August 2021.

Another perspective on the geographic distribution of the rolling stock supply chain is that according to ONS, the majority of the employment is located in the northern part of the country, with the Midlands acting as a hub: the region facilitates almost 43% of the total employment of the sector.²⁴

This is only a partial view of the supply chain: there are many other businesses that participate in the making and maintenance of rolling stock and locomotives but cannot be identified through the use of the ONS data. However, there is no reason to believe that the national statistics data presents a distorted view of the distribution of economic activity.

4.3 An industry that is part of the UK's wider manufacturing capability

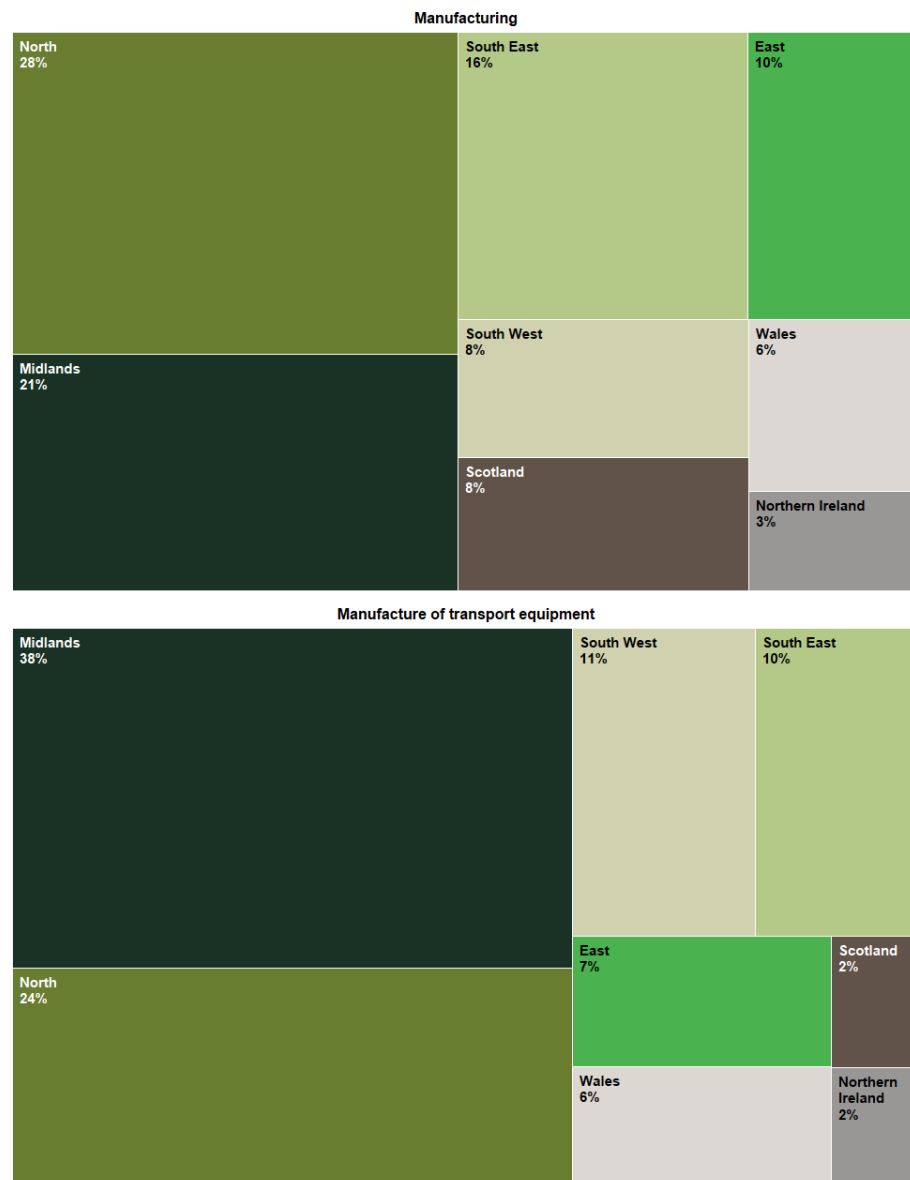
The rolling stock supply chain is deeply integrated with the UK's wider manufacturing sector because many parts of the rolling stock supply chain also supply other equipment (for example, automotive, aerospace, maritime, and defence). This overlap of the supply chain means that activity in the rolling stock supply chain has a broader impact: it contributes to building and strengthening manufacturing capability and capacity across several parts of the UK manufacturing sector. Therefore, a stronger UK rolling stock supply chain would benefit the UK's wider manufacturing capability.

Figure 4.7 shows the relative importance of manufacturing activity in the different regions of the UK.²⁵ It shows that overall manufacturing activity is clustered in the North and the Midlands, which generate 49% of the total GVA from manufacture, and that transport-related activity is more focused in the Midlands (with 38% of the GVA from the UK manufacture of transport equipment being generated there), although there are sizeable levels of activity in other regions.

²⁴ Employment refers to total employment of the SIC07 groups '3020: Manufacture of railway locomotives and rolling stock' and '3317: Repair and maintenance of other transport equipment' as in March 2020. The SIC07 3020 group includes manufacture of signalling equipment for railways, roads, etc. In the absence of detailed information on the businesses and employees occupied in the latter activity, it is not possible to disaggregate the total employment.

²⁵ Office for National Statistics (2019), 'Regional gross value added (balanced) by industry: all NUTS level regions', 19 December. NUTS stands for Nomenclature of Territorial Units for Statistics.

Figure 4.7 Proportion of total GVA and GVA of manufacturing industries across regions, % in 2018



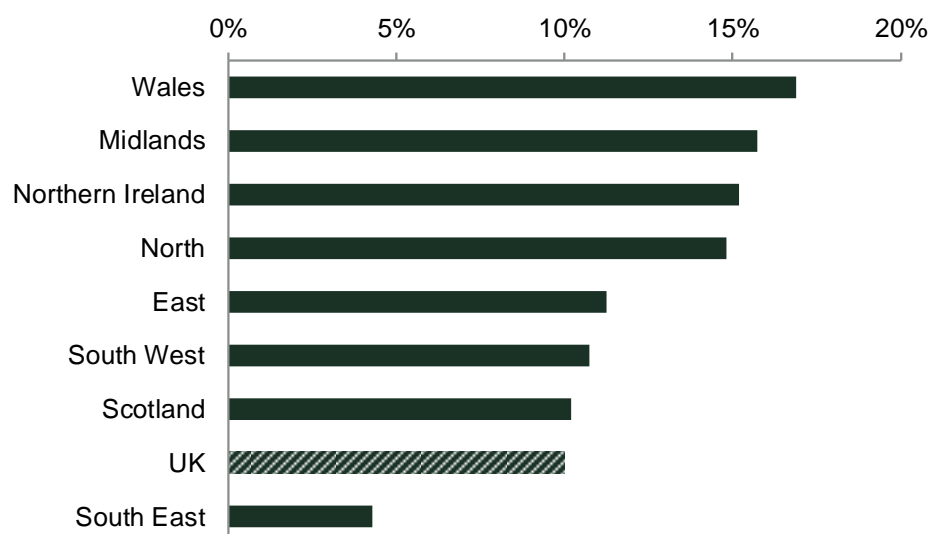
Note: 'North' includes the North East, the North West, and Yorkshire and the Humber. 'South East' includes London. 'Manufacture of transport equipment' includes the manufacture of motor vehicles (SIC division 29) and the manufacture of other transport equipment (SIC division 30).

Source: Oxera analysis of data from Office for National Statistics (2019), 'Regional gross value added (balanced) by industry: all NUTS level regions', 19 December.

Another way of looking at this question is by determining how important the manufacturing sector is as a source of economic activity in each region. As Figure 4.8 below shows, the manufacturing sector generates proportionally more GVA in regions such as the Midlands (16%) and Wales (17%) than in the South East (4%).²⁶ This illustrates the importance of the sector for the government's levelling-up agenda, given the greater share of manufacturing GVA outside the south east of England.

²⁶ Including London.

Figure 4.8 GVA generated by the manufacturing sector as a share of total GVA across different regions in the UK, %



Source: Oxera analysis of data from Office for National Statistics (2019), 'Regional gross value added (balanced) by industry: all NUTS level regions', 19 December.

The manufacturing sector, including the rolling stock supply chain, is primarily located outside London and the South East; therefore, the expansion of the rolling stock supply chain would contribute to the government's levelling-up agenda, both directly and as part of the UK's wider manufacturing base.

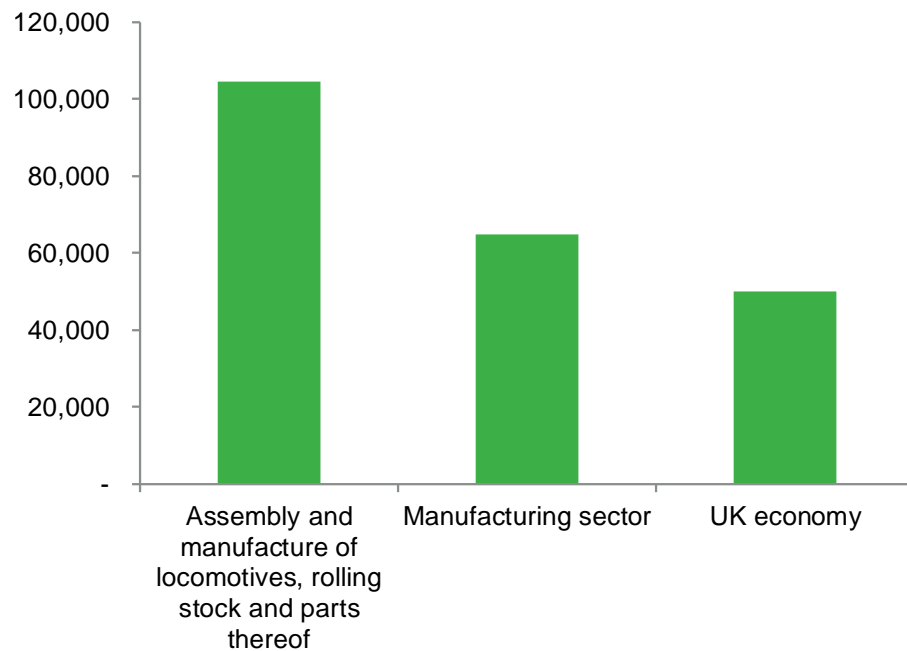
4.4 The rolling stock supply chain is a high-productivity sector

The rolling stock supply chain represents a very productive sector in the UK economy: according to our analysis, an average employee generated almost £105,000 of GVA in 2019.²⁷ This compares to an average of £65,000 of GVA per worker in the manufacturing sector in 2018, and it is more than double than the UK average for the same year.²⁸ It is likely that this productivity arises, at least in part, from those agglomeration benefits arising from the clustering of manufacturing activity in the North and Midlands.

²⁷ This concerns the labour productivity in the assembly and manufacture of locomotives, rolling stock and parts thereof. Such high productivity is also confirmed by data from the ONS for 2018 (data for 2019 has been disclosed). See Office for National Statistics (2021), 'Non-financial business economy, UK: Sections A to S', 24 June, accessed 30 June 2021.

²⁸ Office for National Statistics (2020), 'Firm-level labour productivity estimates from the Annual Business Survey (ABS): summary statistics'. The latest data available is for 2018. For consistency, we report labour productivity in 2019 prices using the latest GDP deflator published by the government: HM Treasury (2021), 'GDP deflators at market prices, and money GDP March 2021 (Quarterly National Accounts)', 31 March.

Figure 4.9 Labour productivity of the rolling stock supply chain compared to the manufacturing sector and the UK economy



Note: Labour productivity is estimated as the GVA per employee. Labour productivity for the rolling stock supply chain is calculated based on the GVA and employment levels estimated by our analysis, using ONS and Eurostat data. It excludes the supply chain for maintenance of rolling stock. The labour productivity for the manufacturing sector and the UK economy is for the latest available year of data, 2018, expressed in 2019 prices.

Source: Oxera analysis of data from the ONS and Eurostat. The data on labour productivity for the manufacturing sector and the UK economy is from Office for National Statistics (2020), 'Firm-level labour productivity estimates from the Annual Business Survey (ABS): summary statistics'.

The importance of industrial clusters and the productivity benefits that arise from them are well known in the economics literature (further detail is provided in Box 4.1 below).²⁹ The evidence presented in this subsection demonstrates the productivity of the rolling stock supply chain, while the previous subsection showed the density of the rolling stock supply chain (and wider manufacturing) located in the North and the Midlands: it is therefore likely that some of this productivity is due to the rail supply chain clustering in particular geographic areas.

²⁹ For example, see Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', Discussion Paper, July.

Box 4.1 Agglomeration benefits

Agglomeration benefits arise through a number of different mechanisms, as set out in more detail below.



Source: Oxera analysis based on Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', Discussion Paper, July.

4.5 Security of supply

In addition to the direct value outlined above, the UK rolling stock supply chain provides security of supply to the wider rail industry in cases where there is disruption to global supply chains. Overall, the UK rail supply chain enabled passenger and freight rail services to continue operating despite the disruptions in the global supply chains caused by the COVID-19 pandemic.³⁰

However, the impacts of the pandemic resulted in significant reductions in container availability and significant increases in prices for importation of goods.³¹ In addition, the recent blockage of the Suez Canal demonstrates the fragility of global supply for strategically important industries and parts/components.³²

4.6 Export opportunities

Finally, the UK-based rolling stock supply chain has significant opportunities to increase exports to other countries, generating value for the UK economy. Current export values are relatively small—for example, our analysis shows that the direct impact of exports of rolling stock and parts was £43m in terms of GVA, which corresponded to approximately 500 FTE employees. According to

³⁰ This information was shared with Oxera during its engagement with market participants.

³¹ Shin, H. (2021), 'How The Shipping Container Crisis Demonstrates The Risk Of Imbalance In The Global Trade', *Forbes*, 25 May, <https://www.forbes.com/sites/forbesbusinessdevelopmentcouncil/2021/05/25/how-the-shipping-container-crisis-demonstrates-the-risk-of-imbalance-in-global-trade/?sh=4745d851090f>, accessed 7 July 2021.

³² HIS Markit (2021), 'Suez Canal blockage: Supply chain vulnerability', 29 March, <https://ihsmarkit.com/research-analysis/suez-canal-blockage-supply-chain-vulnerability.html?ite=996689&ito=1274&itq=6ce2e7dd-138c-4e17-9d74-94a815d3f1c4&itx%5Bidio%5D=771763160>, accessed 7 July 2021.

the Rail Sector deal published in 2018, the industry is aiming to double rail exports by 2025, enhancing the UK's overall exporting capability.³³

This section has set out a number of ways in which the UK rolling stock supply chain brings value to the UK, and that growth in the rolling stock supply chain could assist in achieving a number of UK government objectives—and particularly 'levelling up'.

³³ HM Government (2018), 'Industrial Strategy: Rail Sector Deal', p. 39.

5 How could the UK rolling stock supply chain provide extra value to the UK?

The previous section outlined the multiple ways in which the rolling stock supply chain brings value to the UK. When thinking about opportunities for the supply chain to bring *extra* value to the UK, it is vital to remember that there is significant assembly of rolling stock in the UK³⁴ and that maintenance activity is largely located in the UK, but that many components are imported.

As such, a key question is: what drives the selection of UK or non-UK suppliers for these components? In answering this question, we spoke to a wide range of companies in the UK rolling stock supply chain, including OEMs, Tier 1 suppliers, and other companies.

Through this market engagement, we identified a number of reasons why firms use (and do not use) UK suppliers, as illustrated in Figure 5.1 and Figure 5.2 below. This range highlights the complexity of the supply chain and the associated purchasing decisions.

There are fundamental differences between the new-build and maintenance markets. On new-build, market participants tell us that the longer planning times make non-UK suppliers more competitive because of the typically lower prices that those non-UK suppliers can charge, whereas for the maintenance market, the short turnaround times required make UK-based suppliers more competitive.

³⁴ Maintaining the current level of UK assembly plants is likely to require those assembly plants diversifying to serve both UK and export demand.

Figure 5.1 New-build market: illustrative arguments for and against using UK suppliers

UK	<p>Niche products: a number of respondents identified that there are niche products for which UK suppliers have a strong market position, such as cab doors.</p> <p>Tender requirements/incentives: there were a number of examples where government requirements for UK-sourced value drove OEMs to increase the share of UK-based supply chains.</p> <p>Quality: the UK-based supply chain is thought to provide a high-quality product—not just within the rail industry, but also in other manufacturing sectors, such as carpets.</p> <p>Relationships: several market participants highlighted that it is often easier to build relationships with suppliers that are closer, and that any issues can often be resolved more easily.</p>
Non-UK	<p>Products not available in UK: there are a wide range of products that are not currently available from the UK-based supply chain, such as aluminium body shells. Therefore, these products must be sourced from non-UK suppliers.</p> <p>Price: in many cases, non-UK suppliers represent a lower initial cost than UK-based suppliers. The reasons for this are a matter of debate, and a range of explanations have been put forward—such as lower labour costs or savings from economies of scale. It was also pointed out that manufacturers in other geographies may face lower costs due to lower health and safety and employment conditions and environmental standards compared to the standards in the UK. Any difference in these standards would result in higher costs for UK suppliers. Conversely, it was noted that the increased administrative burden imposed on importing products to the UK after the UK's departure from the European Union ('Brexit') is helping some UK-based suppliers in this regard.</p> <p>Centralised multinational supply chains: many of the OEMs and Tier 1 suppliers in the UK market are part of multinational companies that have centralised supply chains operating across Europe or further afield. Therefore, these companies prefer using those established supply chains. In addition, some purchasing functions are based outside the UK, with decision-makers potentially lacking knowledge about UK capability and expressing a preference for established (non-UK) suppliers.</p>

Note: This list is indicative and based on the market research conducted by Oxera; not all arguments will apply in all procurements, and not all industry participants will agree with the descriptions.

Source: Oxera analysis.

Figure 5.2 Maintenance market: illustrative arguments for and against using UK suppliers

UK	<p>Faster turnarounds: speed is often of critical importance in maintenance operations, when customers require a vehicle to be out of operation for the minimum possible time. UK-based suppliers are closer than non-UK suppliers and therefore able to respond to the needs of the maintenance faster. In addition, it is often not possible to anticipate the full extent of the maintenance work required until the vehicle is at the maintenance facility, making it impossible to maintain a full stock of components.</p> <p>More responsive: some market participants stated that UK-based suppliers are often more responsive than suppliers based outside the UK.</p>
Non-UK	<p>Products not available in UK: as per new-build.</p> <p>Price (where stock can be ordered in advance): as explained in the UK-based section, it is often not possible to fully anticipate the components that will be required. However, a substantial amount for scheduled maintenance can be predicted and components sourced in advance. Where this is the case, non-UK firms may have a competitive advantage on price for the reasons outlined above.</p> <p>Centralised multinational supply chains: as per new-build.</p>

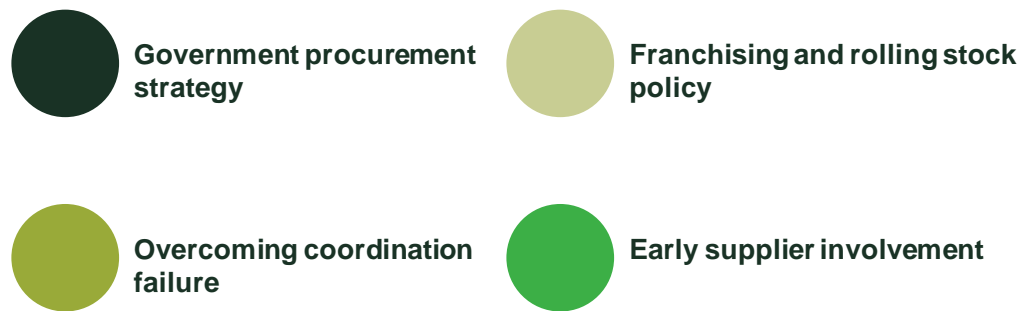
Note: This list is indicative and based on the market research conducted by Oxera; not all arguments will apply in all procurements, and not all industry participants will agree with the descriptions.

Source: Oxera analysis.

These findings suggest that there are opportunities for the rolling stock supply chain to expand: particularly in the areas of relatively niche, high-quality, high-value products that do not require integration with an existing rail supply chain, but do benefit from exposure to cross-sector manufacturing expertise and/or where the relationship with customers is particularly important. These factors play to the existing strengths of the UK rolling stock supply chain. Examples of these areas might include batteries; heating, ventilation and air conditioning (HVAC) systems; and interiors. It is plausible that other, broader, systems and subsystems could be expanded within the UK, but these would require a larger shift given their integration into wider, international, supply chains.

This assessment demonstrates that there is scope for the UK rolling stock supply chain to grow, creating more highly skilled jobs and value to the UK economy. However, there are some barriers to this. Our discussions with members of the supply chain and insights from our wider industry experience highlight a range of levers that the government or industry could use to overcome these barriers and influence the size and shape of the UK rolling stock supply chain. These are summarised in Figure 5.3 and presented in more detail in the subsections below.

Figure 5.3 Levers to influence the size of the rolling stock supply chain



Source: Oxera analysis.

5.1 Government procurement strategy

There are some good examples of government procurement strategy for new-build fleets influencing OEMs' decisions about where and how to procure components of new trains. For example, industry participants told us that the approach to the Intercity Express Train procurement by the DfT resulted in a greater engagement of the UK supply chain than was historically the case. However, industry participants suggested a number of aspects where the UK government could make greater use of its procurement strategy, including the following.

- **Greater clarity and emphasis on how local source requirements are scored/assessed in the procurement:** several interviewees suggested that the UK government was insufficiently clear in what the requirements were for UK-based supply chains or components, and contrasted this with the position in other countries—particularly the USA (see Box 5.1 below), where the position is much clearer and firms can decide on whether they wish to participate in the procurement or not.
- **A clearer focus on whole life costs, rather than initial or only partial-life costs:** a number of interviewees stated that government procurement often focuses on initial costs or costs for only part of the asset life, and suggested that UK-based firms may be able to supply products at lower whole-life costs.
- **Enforcing equality of environmental and labour standards across the supply chain:** several interviewees took the view that the UK government and OEMs/Tier 1 suppliers did not support UK-based manufacturing because the standards of environmental protection and labour (such as health and safety and employment costs, such as pension requirements) were not equal between UK-based companies and some non-UK competitors. These interviewees suggested that if the procuring entities placed greater emphasis on ensuring that all suppliers met the standards applied to UK manufacturers, this would remove a competitive disadvantage for UK-based manufacturers.
- **Greater use of social-value metrics in procurement, rather than focusing on price:** a number of interviewees stated that if the government focused on the overall contribution of procurement decisions to the UK, rather than price, this would be to the benefit of UK-based manufacturers. Some interviewees noted that the tools to do so are already available to the UK government through the Social Value Act or other procurement tools, but that these were not used.

Box 5.1 The Buy America Act 1933

The Buy America Act commits all contracts for public works in the USA to have a clause mandating the use of only:

(2) manufactured articles, materials, and supplies that have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured in the United States.

With exceptions for if those materials are not 'mined, produced or manufactured in the United States in sufficient and reasonably available commercial quantities and are not of a satisfactory quality', such that using domestic production would materially increase the cost of the contract, or if the use of domestically produced material would not be consistent with the public interest.

Source: U.S. Government Publishing Office (2011), 'Title 41 – Public Contracts', 4 January, <https://www.govinfo.gov/content/pkg/USCODE-2019-title41/pdf/USCODE-2019-title41.pdf>, section 8303, accessed 30 June 2021.

Although there was no specific or detailed strategy involving future rolling stock procurement in the recently published Williams–Shapps Plan for Rail, the government committed to undertake work to assess the current procurement process, considering supply chain sustainability and sustaining jobs creation and economic activity.³⁵ There is, therefore, a case for the UK government to consider the above recommendations by the market participants when assessing different approaches to procurement.

5.2 Franchising and rolling stock policy

A substantial number of new vehicles have been ordered for the GB rail network over the last few years, with the Rolling Stock Strategy Steering Group commenting:³⁶

The number of new vehicles committed for delivery in the five-year period that commenced in April 2014 (CP5) and in the early years of CP6 is now 7,187—more than 50% of the current in-service fleet of 14,025.

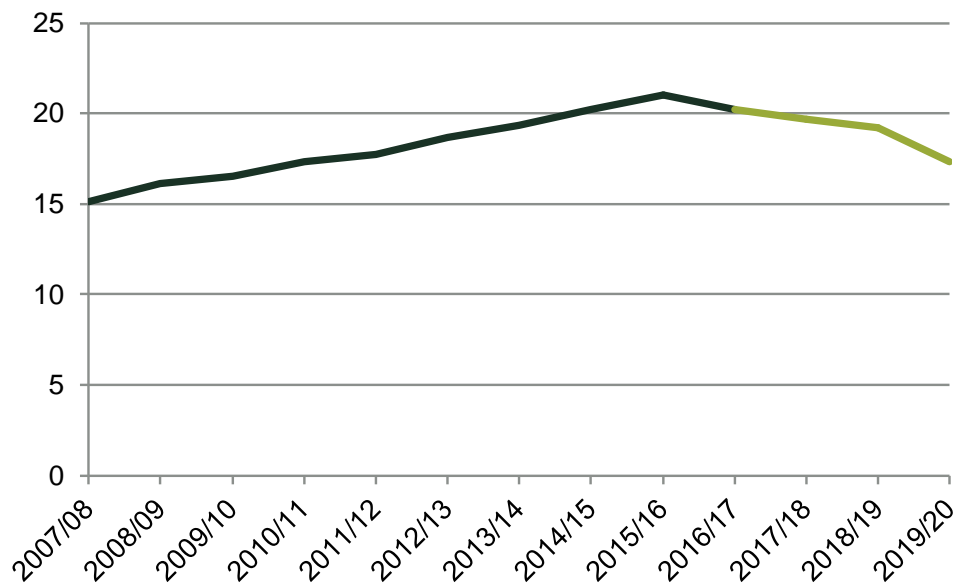
However, this wave of new vehicles came after an extended period of no new vehicles being ordered, as can clearly be seen from Figure 5.4 below, where the average age of GB rolling stock increased by an average of 0.74 years for each year between 2007/08 and 2015/16.³⁷

³⁵ Department for Transport (2021), 'Great British Railways – The Williams-Shapps Plan for Rail', May, p. 81.

³⁶ Rolling Stock Strategy Steering Group (2018), 'Long term passenger rolling stock strategy for the rail industry', March, p. 1.

³⁷ If there was no new rolling stock introduced into the market and no retirement of old rolling stock, the average age would increase by one year each year. If the entire fleet was in a 'steady state', with no increase in size and new vehicles replacing the old vehicles, then the age would not increase.

Figure 5.4 GB rolling stock age (years)



Note: Data source changes after 2016/17. Data from RSSB (2017/18 onwards); DfT (up to and including 2016–17).

Source: Office of Rail and Road (2020), 'Rail infrastructure and assets', Table 6313, 5 November.

As noted in several industry reviews over the last ten years, this uneven demand profile is not a new challenge for the industry. As stated in the McNulty review in 2011:³⁸

GB rail procurement has a very uneven demand profile, coupled with a short-term approach to relationships and investment with poor cost transparency.

The impacts of this are set out in a briefing by the Railway Industry Association (on infrastructure, but the impacts are the same for rolling stock)³⁹ and are outlined in Box 5.2 below. Although the briefing paper concerns impacts on the rail infrastructure supply chain, the effects are similar in different parts of the industry and are mirrored by our market engagement.

Box 5.2 Impacts of a 'boom and bust' funding cycle

Impacts on businesses of a 'boom and bust' funding cycle include:

- reduced confidence for businesses to invest in developing skills and new products;
- reduced staff levels;
- redeployment of resources to different sectors or non-UK activities;
- threatening the survival of SMEs with specialist products and services;
- increase the costs of work, or make UK-based suppliers less cost competitive than non-UK suppliers;
- reduced ability for rail businesses to innovate in people, processes and products.

Source: Oxera analysis of Railway Industry Association (2019), 'Boom and bust funding', July.

³⁸ Department for Transport and Office of Rail Regulation (2011), 'Realising the potential of GB rail: summary report', May, p. 56.

³⁹ Railway Industry Association (2019), 'Boom and bust funding', July.

One clear lever to improve the UK-based supply chain is to have a clear—and credible—pipeline for rolling stock procurement over a 20-year period, enabling the supply chain (at all levels) to better organise and plan. While there has been some effort on this in recent years (for example, see the DfT’s ‘Rolling stock perspectives’ document),⁴⁰ it is not yet seen by the industry as being sufficiently credible on which to base large commercial investments.

Alongside the announcement of the formation of GBR, the government pledged that there would be a ‘Whole Industry Strategic Plan’, with the first 30-year strategy to be ready in 2022.⁴¹ The strategy will ‘ensure that the railways respond to public priorities such as levelling up, the environment, housing and regeneration’.⁴²

This plan has the potential to be a lever in supporting the supply chain: it will need to be clear and coherent on future procurement, which must then be followed through, with changes to the strategy clearly communicated to the supply chain at an early stage. The supply chain should also be engaged in creating the plan and the detailed work that will underpin it.

5.3 Overcoming coordination failure and developing strategic capability

The rolling stock supply chain in the UK is relatively fragmented, with several OEMs maintaining and building assembly plants and hundreds of firms active in the supply chain.

This fragmentation means that there are some capabilities, such as manufacture of aluminium bodysHELLS and aluminium extrusion,⁴³ that would require very large investments and potentially high risk, such that an individual company would be unlikely to make those investments (or, indeed, such that the rail industry as a whole will not be able to make them, depending on the scale of the investments required). However, when the rail industry, or the UK manufacturing sector, are considered in their entirety, there may be enough total demand to alleviate this risk.

There is therefore a clear case for the government to consider whether there are investments of this type that would not be made by participants in the rolling stock supply chain (or more generally) because their scale or the coordination/risk required would be too large for an individual company. The capacity to make these investments However, the capacity arising from these investments could provide UK-based strategically important components or sub-assemblies.

In addition to this coordination role, there is also a clear case for the government to consider whether there are strategically important capabilities that would bring value to the UK if they were UK-based, but which would be located outside the UK without government support due to market failures or international competition.

Where a case for such development of capacity/capability exists, there are a range of potential support mechanisms that could be brought to bear. These include specific procurement requirements, funding support through the UK infrastructure bank, and wider policy instruments.

⁴⁰ Department for Transport (2018), *Rolling stock perspective fourth edition*, October.

⁴¹ Department for Transport (2021), ‘Great British Railways – The Williams-Shapps Plan for Rail’, May, p. 38.

⁴² Department for Transport (2021), ‘Great British Railways – The Williams-Shapps Plan for Rail’, May, p. 38.

⁴³ This is a case that has repeatedly arisen in our interviews with market participants.

5.4 Early supplier involvement

A number of interviewees (from OEMs and the supply chain) highlighted the lack of meaningful early supplier engagement in the rail industry compared with the automotive or aviation industries. Early supplier engagement is a practice that is widely encouraged in different industries, as it enables better project development and drives improved outcomes.⁴⁴

Several interviewees highlighted the 'boom and bust' cycle of the rolling stock manufacture and maintenance industry (outlined above) and the lack of a long-term, credible plan as a key contributing factor to this lack of early supplier involvement.

The view from these respondents was that the greater predictability of new models being produced in the automotive and aviation markets created greater predictability in the supply chain, and therefore enabled Tier 1 suppliers and OEMs to work more collaboratively within it. In turn, this brought benefits to the supply chain and the wider industry in terms of greater innovation and lower costs.

5.5 Achieving Net Zero

As the carbon embodied in manufactured goods is increasingly taken into account, then a greater UK-based rolling stock supply chain would contribute to the UK's carbon-reduction targets through reducing the volume of carbon emissions associated with transporting manufactured products around the world in integrated supply chains. In itself, this increased focus on embodied carbon may help to increase the size of the UK's rolling stock supply chain (although by the same token, it may increase the challenges associated with exporting UK-based products).

⁴⁴ For example, Network Rail's SME action plan includes increased early contractor involvement as a key pillar, see Network Rail (2019), 'SME Action Plan', 5 November, p. 4, <https://cdn.networkrail.co.uk/wp-content/uploads/2019/11/SME-action-plan-final.pdf>, accessed 25 May 2021. The Royal Institute of Chartered Surveyors offer training on Early Contractor Involvement: for example, see Royal Institute of Chartered Surveyors (2017), 'Early Contractor Involvement', 15 March, <https://www.rics.org/nl/training-events/cpd-foundation-subscription/cpd-foundation-on-demand/cpd-foundation-on-demand-content/early-contractor-involvement/>, accessed 25 May 2021.

6 Conclusions and next steps

The analysis in this report has, for the first time, attempted to quantify the value that the UK rolling stock supply chain delivers to the UK. This has involved a complex process of analysing multiple information sources to provide a conservative estimate of this value.

- The UK rolling stock supply chain is estimated to support 26,000–27,000 FTEs and produce GVA of £1.7bn–£1.8bn.
- The industry is largely located in the Midlands and northern England, providing support to the local economy and (if the industry were to expand) contributing to the levelling up of these regions.
- It generates productivity gains to the UK economy as it is thoroughly integrated with the UK's wider industrial base, with 38% of the GVA from the manufacture of transport equipment generated in the Midlands.

The evidence suggests that 50–85% of the value-add in this supply chain is sourced from outside the UK, with the value-add of components being particularly low in the UK. Interviews with a wide range of industry participants suggests that this is for a number of reasons, including that non-UK suppliers are generally significantly cheaper than UK-based suppliers, but also that many UK-based suppliers are part of wider multinational groups that have centralised production facilities outside of the UK.

Nevertheless, there are some good examples of where UK-based suppliers have been successful, including where a UK company has found a niche market, where government tender opportunities have incentivised the supply chain to use UK-based components, and in the maintenance market, where the short turnaround times make the use of non-UK suppliers infeasible.

Looking forward, it is clear that there are further opportunities for the UK-based supply chain to grow, but that this will depend on the actions of government, the OEMs and Tier 1 suppliers. Market participants told us repeatedly that the government can use its procurement policies to drive manufacturing to the UK, but that greater clarity on the 'rules of the game' are needed to make that more effective.

Market participants also told us that reducing the level of 'boom and bust' cycles in new-build would help them to plan their businesses more effectively, and therefore to invest in new equipment and skills. SMEs involved in the industry told us that the OEMs and Tier 1 suppliers could be more collaborative and contrasted the contractual approach with the automotive industry, where partnership working is generally stronger.

As the industry now embarks on a period of major reform, the key questions that arise from this assessment are as follows.

- How will the rolling stock supply chain engage with the design of GBR such that the opportunities for both growth and smoother procurement cycles are embedded in the decision-making processes within GBR when it begins operating? For example, how will the rolling stock supply chain be represented in the national and regional workstreams that are being set up?
 - How will the GBR take the opportunity presented by the Williams–Shapps review to embed the supply chain closer to the centre of the industry than has historically been the case?
-

- Who in the rolling stock supply chain could provide strategic insight to the Department for Transport (DfT) and GBR on the key issues that affect price, innovation and wider key purchasing criteria, and that would drive optimal value for money for the taxpayer?
 - What will the government (including Network Rail and GBR) do to reward the wider economic, social and environmental impacts of UK-based manufacturing in its procurement processes?
 - How will government (including Network Rail, GBR and the DfT) reform the industry programme to provide a transparent, stable and credible forward view of the industry's needs, which will enable the rolling stock supply chain to plan and invest in people and equipment?
-

A1 Technical appendix: establishing the economic footprint

To assess the economic impact of the UK-based rolling stock supply chain, this study used data from the ONS and Eurostat and information from ROSCOs and OEMs. When publicly available data was adopted, we used the UK Standards Industrial Classification of Economic Activities (SIC) to identify information related to rolling stock manufacture and maintenance.

The limitation of this data is that the rolling stock supply chain will not be captured in its entirety, due to the way that businesses are classified in the national statistics. Enterprises are classified according to their type of economic activity and the products that they produce. However, an enterprise may perform one or more economic activities that belong to different classes. In addition, at an aggregate level, a category contains enterprises producing products with the same characteristics but different uses.

For example, a manufacturer of gears and bearings would supply a wide range of industries producing similar products. Since there is an overlap of the supply chain of rolling stock manufacture and maintenance and the supply chain of other adjacent industries (e.g. the automotive industry), it is difficult to isolate the share of activity that corresponds to demand from the rail industry.

However, a SIC-based method has the advantage of permitting the use of ONS data, which has gone through various quality assessments. In addition, it allows us to identify the corresponding imports of components used in the manufacture of rolling stock and therefore better estimate of the size of demand of rolling stock in the UK.

We assessed information based on the following SIC codes:

- 3020: Manufacture of railway locomotives and rolling stock;
- 3317: Repair and maintenance of other transport equipment

Box A1.1 provides a list of the economic activities included in these two groups, according to the ONS.⁴⁵

⁴⁵ Office for National Statistics (2009), 'UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007) – Structure and explanatory notes'.

Box A1.1 SIC 2007 codes used in this study

30.20 Manufacture of railway locomotives and rolling stock

This class includes:

- manufacture of electric, diesel, steam and other rail locomotives;
- manufacture of self-propelled railway or tramway coaches, vans and trucks, maintenance or service vehicles;
- manufacture of railway or tramway rolling stock, not self-propelled: passenger coaches, goods vans, tank wagons, self-discharging vans and wagons, workshop vans, crane vans, tenders, etc.;
- manufacture of specialised parts of railway or tramway locomotives or of rolling stock: bogies, axles and wheels, brakes and parts of brakes; hooks and coupling devices, buffers and buffer parts; shock absorbers; wagon and locomotive frames; bodies; corridor connections, etc.;
- manufacture of mining locomotives and mining rail cars;
- manufacture of mechanical and electromechanical signalling, safety and traffic control equipment for railways, tramways, inland waterways, roads, parking facilities, airfields, etc.;
- manufacture of railway car seats.

33.17 Repair and maintenance of other transport equipment

This class includes the repair and maintenance of other transport equipment of division 30, except motorcycles and bicycles. It includes:

- repair and maintenance of locomotives and railway cars (except factory rebuilding or factory conversion);
- repair of animal-drawn buggies and wagons.

This class excludes, among other things, factory overhaul and rebuilding of locomotives and railway cars and repair and maintenance of railway engines.

Source: Office for National Statistics (2009), 'UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007) – Structure and explanatory notes'.

The following section provides some further information for the main dataset used in our analysis. Sections A1.2–A1.4 describe the estimation of the different parts of the direct impact of the rolling stock supply chain, while section A1.5 provides information on the indirect impact estimation. Finally, section A1.6 outlines the steps used to calculate the total impact of the rolling stock supply chain.

A1.1 PRODCOM statistics

We use PRODCOM statistics from the ONS to obtain the sold production of rolling stock. PRODCOM reports information on the UK manufacturers' sales by product.⁴⁶ The advantage of PRODCOM is that it breaks down the four-digit SIC codes into further subcategories of products, and therefore offers more flexibility. In addition, PRODCOM data can be easily combined with exports

⁴⁶ For further information on the PRODCOM statistics, see Office for National Statistics (2016), 'UK manufacturers' sales by products (PRODCOM) – Background information to PRODCOM', 15 February, <https://www.ons.gov.uk/businessindustryandtrade/manufacturingandproductionindustry/methodologies/ukmanufacturerssalesbyproductprodcom>, accessed 15 May 2021.

and imports data,⁴⁷ since the classification can be converted to the combined nomenclature used in trade data through a conversion table.⁴⁸

Table A1.1 below provides a list of the products comprising the manufacture of rolling stock.

Table A1.1 Products listed in the specified PRODCOM product category

3020	Manufacture of railway locomotives and rolling stock
30201100	Rail locomotives powered from an external source of electricity
30201200	Diesel-electric locomotives
30201300	Other rail locomotives; locomotive tenders
30202000	Self-propelled railway or tramway coaches, vans and trucks, except maintenance or service vehicles
30203100	Railway or tramway maintenance or service vehicles (including workshops, cranes, ballast tampers, track-liners, testing coaches and track inspection vehicles)
30203200	Rail/tramway passenger coaches; luggage vans, post office coaches and other special purpose rail/tramway coaches excluding rail/tramway maintenance/service vehicles, self-propelled
30203300	Railway or tramway goods vans and wagons, not self-propelled
30204030	Parts of locomotives or rolling-stock
30204050	Mechanical or electromechanical signalling, safety or traffic control equipment for roads, inland waterways, parking facilities, port installations or airfields
30204060	Mechanical signalling, safety or traffic control equipment for railways or tramways; parts of mechanical (including electromechanical), signalling, safety or traffic control equipment for railways, tramways, roads, inland waterways, parking facilities, port installations or airfields
30209100	Reconditioning of railway and tramway locomotives and rolling-stock

Source: Office for National Statistics (2020), 'UK manufacturers' sales by product', 1 July.

The latest version, April 2021, included data up to 2019. Not all subcategories were provided due to data concealment from the ONS (where the ONS does not disclose data that may identify individual companies).

A1.2 Direct GVA of assembly and manufacture of rolling stock

We estimated the direct GVA generated by the activities of UK rolling stock manufacture following the steps described in Table A1.2. This analysis is based on an SIC-based approach, using ONS PRODCOM data on production of rolling stock assembly and manufacture, ONS data on employment in the sector, and Eurostat data on production and trade of rolling stock manufacture.

⁴⁷ It should be noted that, although PRODCOM data and international trade statistics can be combined, there may be still some comparability issues. For example, PRODCOM statistics are based on the prices the products are sold by the manufacturers. On the contrary, the trade statistics show the value of the product when it crosses the borders which may also include other additional costs, such as transport costs or profit by intermediaries. For more information on the coherence and comparability of the PRODCOM statistics with other datasets see Office for National Statistics (2018), 'UK Manufacturers' Sales by Product Survey (Prodcom) QMI', 3 July,

<https://www.ons.gov.uk/businessindustryandtrade/manufacturingandproductionindustry/methodologies/ukmanufacturerssalesbyproductsurveyprodcomqmi>, accessed at 2 June 2021.

⁴⁸ This study used the correspondence table 'PRODCOM 2019 – CN 2019' to identify the relevant traded products. The table can be found at Eurostat's list of correspondence tables:

https://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL&StrLanguageCode=EN&IntCurrrentPage=1, accessed 15 May 2021.

Table A1.2 Estimation of direct GVA of UK assembly and manufacture of rolling stock

Main outputs	Relevant metrics	Description
Sold production corresponding to UK demand (C = A - B)	Total sold production (A)	We use PRODCOM Statistics ¹ to obtain the sold production of manufacture of rolling stock. We exclude the sub products 30204050 and 30204060 related to signalling equipment.
	Exports (B)	We use trade data from Eurostat ² to estimate the exports of manufacture of rolling stock. Annual average spot exchange rates from Bank of England ³ are used to convert the value into pound sterling.
GVA to production value ratio (F = average D/E ratios for the time period where data was available)	Value added (D)	We obtained the value added of the 3020: Manufacture of rolling stock between 2011 and 2018 from the Structural Business Statistics of Eurostat. ⁴
	Sold production (E)	We obtained the production value of the 3020: Manufacture of rolling stock between 2011 and 2018 from the Structural Business Statistics of Eurostat. ⁴
Direct GVA (G = C x F)	Sold production corresponding to UK demand for manufacture of rolling stock (C)	As calculated above.
	GVA to production value ratio (F)	As calculated above.

Note: ¹ Office for National Statistics (2020), 'UK manufacturers' sales by product', 1 July; ² Eurostat (2021), 'EU trade since 1988 by CN8'; ³ Bank of England (2021), 'Annual average Spot exchange rates, Sterling into Euro'; ⁴ Structural Business Statistics provides a range of statistics related to the performance of businesses in the EU, including turnover, production value, value added, and FTE employees, among others. The classification used in the Structural Business Statistics is identical to the SIC codes at the group level (first four digits). Eurostat (2021) 'Structural Business Statistics – industry and construction'.

Table A1.3 below illustrates how the direct GVA of the assembly and manufacture of rolling stock is calculated using illustrative figures.

Table A1.3 Example of direct GVA estimation

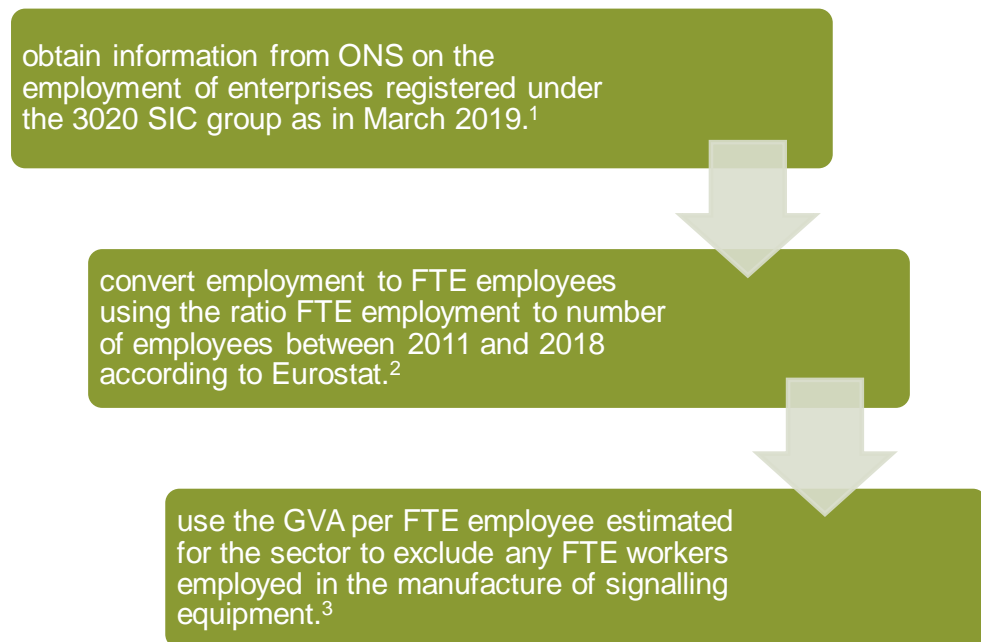
Total UK sold production of rolling stock (A)	£5m
UK Exports (B)	-£1m
UK sold production staying in the UK (C = A-B)	£4m
GVA to production value ratio (F)	0.3
Direct GVA (G = C x F)	£1.2m

Source: Oxera analysis.

A1.3 Direct FTE employees of assembly and manufacture of rolling stock

In order to estimate the corresponding FTE employees supported by the manufacture of rolling stock in the UK, we followed the steps illustrated in Figure A1.1.

Figure A1.1 Estimation of direct employment of UK assembly and manufacture of rolling stock



Note: ¹ In this study, we used the most recent data available wherever that was possible. Although information on employment for the 3020 SIC group is available for 2020, we used data for 2019 in order to be consistent with the rest of the data used in the estimation of the impact of rolling stock manufacture. Office for National Statistics (2021), 'Analysis of enterprises in regions of the United Kingdom for specified UK SIC 2007 group & UK SIC2007 class (transport related) 2019 and 2020', 2 March. ² Eurostat (2021) 'Structural Business Statistics – industry and construction'; ³ We assume that all the sub-products of the 3020 SIC category, including the manufacture of signalling equipment, have the same labour intensity.

Source: Oxera analysis.

A1.4 Direct impact of maintenance of rolling stock

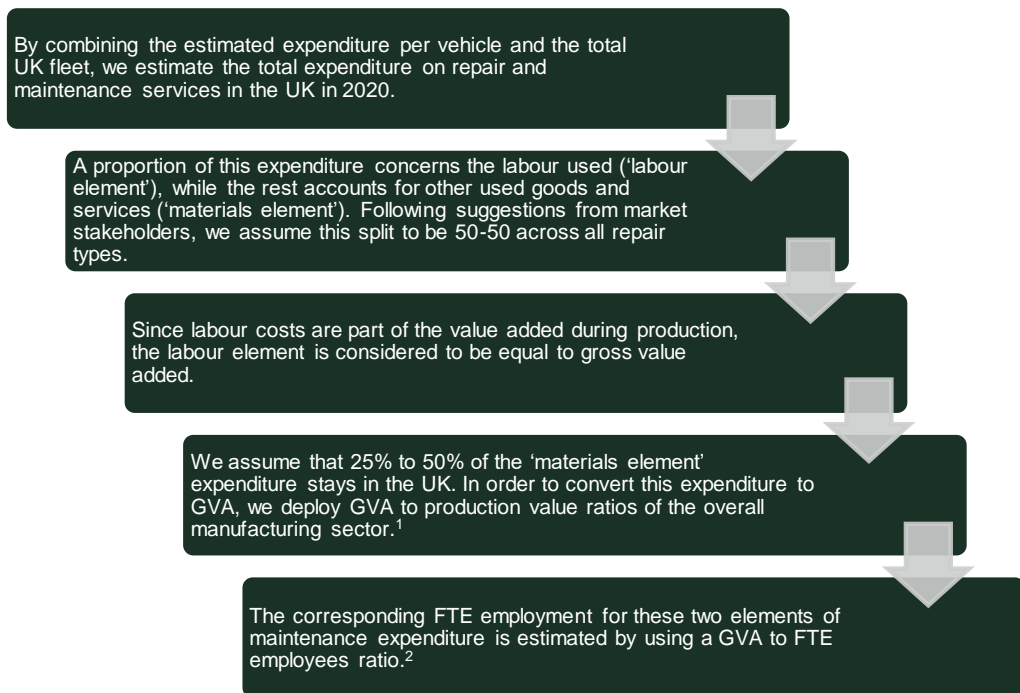
In estimating the economic footprint of UK maintenance of rolling stock, instead of a SIC-based approach, we used a top-down approach that uses information on the expenditure of ROSCOs for repair and overhaul services. We did this for the following reasons:

- the respective PRODCOM product⁴⁹ includes the repair and maintenance of signalling, safety or traffic control equipment, and therefore by including these we would give an inflated estimate of the value added from maintenance of rolling stock;
- it excludes any other activities related to the repair and maintenance of rolling stock such as consulting services, which cannot be fully isolated using other PRODCOM products. On the contrary, the expenditure of ROSCOs would reflect any product and activity used to repair a train.

Figure A1.2 describes the steps that we followed in the calculation of the direct impact of the UK activity that relates to maintenance of rolling stock.

⁴⁹ That is '33171100 - Repair and maintenance of railway and tramway locomotives and rolling-stock and of mechanical (and electro mechanical) signalling, safety or traffic control equipment', Office for National Statistics (2020), 'UK Manufacturers' sales by Product (PRODCOM)'.

Figure A1.2 Estimation of the economic impact of UK maintenance of rolling stock



Note: ¹ Eurostat (2021) 'Structural Business Statistics – industry and construction'; ² Average ratio between 2011 and 2018 of value added to FTE employment for the activity with code 3317: Repair and maintenance of other transport equipment from the Structural Business Statistics from Eurostat. Data for 2010 or after 2018 was not available.

Source: Oxera analysis.

By using expenditure information from rolling stock leasing companies, we estimated the demand for repair and maintenance services⁵⁰ per vehicle in the UK in 2020 to be approximately £49,000.⁵¹ Combined with a total fleet of approximately 19,800 vehicles in the UK,⁵² the total expenditure on repair and maintenance services was estimated at £1bn in 2020.

A proportion of this expenditure concerns the labour used, while the rest accounts for other goods and services used in the repair and maintenance of rolling stock.⁵³ Our engagement with the ROSCOs and manufacturers suggested that while the actual split of expenditure between these two elements varies depending on the type of repair conducted, a 50–50 split across all repair types would be a reasonable assumption to make for this strategic exercise.

While all labour work for overhaul services takes place in the UK, other goods and services are procured from other geographies, as well as UK suppliers.

⁵⁰ Our estimate excludes any expenditure on enhancements of rolling stock to avoid any double-counting, as refurbishment of rolling stock is considered in the SIC class of manufacture of rolling stock and therefore is part of the direct impact of manufacture of rolling stock.

⁵¹ This figure should be treated as indicative. Because older fleet requires more heavy maintenance and thus greater expenditure, the calculated expenditure per vehicle may be an overestimation. This analysis is based on aggregated information from a number of ROSCOs.

⁵² The fleet estimation is based on data from Department of Transport (2020), 'Rail vehicles built or refurbished to modern accessibility standards', 8 July. It refers to all rail vehicles in public transport, excluding any vehicles in use on heritage or tourist networks. The fleet does not contain any freight vehicles or locomotives. Therefore, our estimation should be treated as a lower bound.

⁵³ Both elements include any profit gained from the provider.

There is some evidence that in many occasions the UK supply chain is preferred over imports, as discussed in section 3.

However, in the absence of the precise proportions, we assume that the proportion of UK goods and services used in maintenance of rolling stock ranges from 25% to 50%. This is in line with what is observed in the public statistics.

For example, UK-produced specialised parts for rolling stock covered 25% of the total domestic demand in 2019.⁵⁴ On the other hand, the proportion of UK production to the overall manufacture of rolling stock, including the production of components but excluding any manufacture of signalling equipment, was 50% in 2019.

Therefore, the GVA generated from the maintenance of rolling stock is the total of two parts: the GVA generated from the labour element and the GVA generated from the use of UK products and services in the maintenance of rolling stock.

The former is equal to the actual expenditure related to labour, since labour costs are part of the value added during the production. The latter is estimated using GVA to production value ratios from Eurostat.

A1.5 Indirect impact of UK rolling stock assembly, manufacture and maintenance

This section outlines the broad methodological framework used to estimate the indirect impact of the rolling stock manufacture and maintenance industry. This is the economic impact of firms that supply this industry, but their activities are not classified as rolling stock manufacture or maintenance.

To estimate the economic effect of the demand from one industry on the output of another industry, we use input-output (IO) tables provided by the ONS.

An IO table describes production and consumption relationships across industries in the economy. For example, it shows the value of electricity required in the production of one unit of rolling stock. Consequently, combined with the output of the manufacture and maintenance of rolling stock, we can estimate the output produced in the supply chain by using the IO tables. Table A1.4 describes in further detail the steps we that used to estimate the indirect GVA.

⁵⁴ Oxera analysis based on data from ONS (2020) and Eurostat (2021).

Table A1.4 Indirect GVA estimation

Main outputs	Relevant metrics	Description
Indirect spending by product ($C = A \times B$)	Direct output (A)	This is the production value of UK rolling stock assembly and manufacture in the UK or the maintenance expenditure concerning UK resources
	Supply-chain output by unit of final output (B)	We use ONS data on UK IO tables ¹ to obtain the output multiplier for supply-chain spending given a unit of final output in a product (e.g. rolling stock)
Indirect GVA ($E = C / D$ summed across products)	Indirect spending by product (C)	As calculated above
	Output/GVA ratio by product (D)	We use ONS data on UK IO tables ² to calculate the ratio of GVA per final unit of output

Note: ¹ Office for National Statistics (2021), 'UK input-output analytical tables', Type I Leontief Inverse, 1 April; ² Office for National Statistics (2021), 'UK input-output analytical tables', Input-output table, 1 April.

Source: Oxera analysis.

Table A1.5 below illustrates the estimation of the indirect GVA in an economy where there are only two products—rolling stock and consultancy services. In reality, we calculated the indirect GVA generated from rolling stock assembly, manufacture and maintenance spending on all products in the UK.

Table A1.5 Example of indirect GVA estimation

Direct output of rolling stock assembly and manufacture (A)	£4m
Cleaning services spending by unit of final output of rolling stock assembly and manufacture (B)	£0.0001
Indirect spending of rolling stock assembly and manufacture ($C = A \times B$)	£400
Output to GVA ratio for consultancy services (D)	0.5
Indirect GVA ($E = C / D$)	£800

Source: Oxera analysis.

Having calculated the indirect GVA generated from rolling stock manufacture and maintenance activities, we then can estimate the indirect employment in the supply chain that supports these activities. Table A1.6 describes the inputs and steps used for this estimation.

Table A1.6 Indirect employment estimation

Main outputs	Relevant metrics	Description
Indirect employment ($C = A / B$ summed across sectors)	Indirect GVA by sector (A)	The indirect GVA estimated above and split by SIC section
	Average GVA per worker (B)	We use ONS data on firm-level labour productivity from the Annual Business Survey ¹ to obtain the average GVA per worker by SIC section. When this is missing, we use the average labour productivity for the whole economy from the same dataset.

Note: ¹ Office for National Statistics (2020), 'Firm-level labour productivity estimates from the Annual Business Survey (ABS): summary statistics', 1 June.

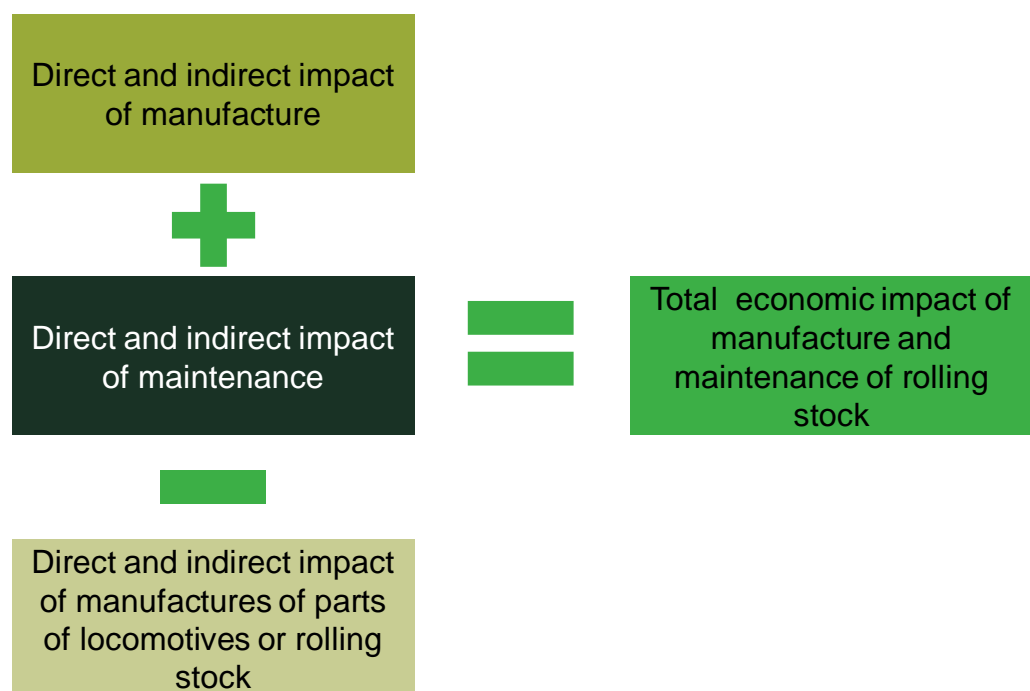
Source: Oxera analysis.

A1.6 Total economic impact of UK rolling stock supply chain

Before providing an estimate of the economic impact of the manufacture and maintenance of rolling stock in the UK, it is first necessary to remove any overlap between these two activities. Since the supply chain of maintenance of rolling stock uses output from train manufacturers, by simply summing up the impacts of the two industries, there would be an issue of double-counting the economic impact of any components produced by firms classified as rolling manufacturers.

Therefore, in order to avoid any double-counting of impacts, we deducted the direct and indirect impacts arising from the manufacture of parts of rolling stock⁵⁵ from the total economic impact of the manufacture and maintenance of rolling stock. This process is illustrated in Figure A1.3.

Figure A1.3 Estimation of total economic impact of manufacture and maintenance of rolling stock



Source: Oxera analysis.

⁵⁵ This refers to the product '30204030 Parts of locomotives or rolling-stock' in PRODCOM's product list.

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