A Final Report
15 October 2019

HS2 and the Economy of the North

steer economic development

The Northern Powerhouse Partnership
Our ref: 237-335-01

A Final Report

HS2 and the Economy of the North

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Contents

Figures

Tables

Executive Summary

1. The Northern Powerhouse Partnership commissioned Steer Economic Development (Steer-ED) in September 2019 to review the economic benefit of High-Speed 2 (HS2) in the context of the Government's aim of rebalancing the national economy and the North's ambition to achieve its growth potential.

The North's economic potential

2. 2016's Northern Powerhouse Independent Economic Review (NPIER) identified a significant and persistent productivity gap between the North and the rest of England, driven by underperformance in Skills, Enterprise, Innovation, Connectivity, and Trade and Investment.

3. Should the North realise its growth potential, the NPIER points to a potential aggregate GVA prize of £1,008bn between 2035 and 2050. But, the NPIER warned that the North's capacity-constrained rail network was limiting growth. If transport investment could unlock 10% of this prize, it would increase GVA by £100bn.

4. More widely, the Northern Powerhouse will play a central role in the delivery of the UK's Industrial Strategy and the Net Zero Carbon Emission targets set for 2050. In this context, investment in high-speed rail and associated connectivity in the North is essential if the economy of the North is to play its full role in generating ideas and innovation, matching people to productive jobs, attracting high-value inward investment, retaining growing businesses, and rebalancing the UK economy (sectorally and spatially).

The rationale and context for HS2

5. HS2 was developed to meet the pressing challenges to increase the capacity of Britain's rail network and to facilitate and accelerate economic growth, as an integral part of rebalancing the economy.

6. This report acknowledges that lack of capacity on the North's rail network acts as an important, but by no means exclusive, constraint on the North's productivity growth. New north-south capacity provided by HS2 will release vital capacity on existing lines, which enhancements of existing lines could not deliver at sufficient scale.

7. Rebalancing the national economy requires the North to grow at faster rates than it has historically. HS2 can help support the North's competitiveness by improving its inter-city links to London and the 'world city' economic functions it offers, as well as neighbouring regions and international gateways. Northern Powerhouse Rail's (NPR's) key and complementary purpose is to help the North's great cities function more like a single labour market, which will in turn enable agglomeration and support productivity. Critically, NPR, through its use of HS2's infrastructure on the west and east of the Pennines, is symbiotic with HS2.

8. The focus of this report is on the benefits of HS2, however the report does identify significant interdependency between HSR and NPR.

9. The published HS2 business case is based on single 'business as usual' view of the future economic growth and its distribution. It assumes the Government's Northern Powerhouse and Midlands Engine policy has no impact on the long-term scale or distribution of economic and

population growth. In addition, use of the 'business as usual' growth scenario in the business case potentially reinforce the dominance of London.

10. In contrast, this report argues that a scenario-based approach is more appropriate to assess the transformational impacts of large transport infrastructure projects such as HS2. Alternative future scenarios, that reflect the likely outcomes from the Transport for the North, Midlands Connect and other national policy agenda such as the NetZero – along with changes in technology and business models, suggest that HS2 can deliver high value-for-money, even after accounting for recently announced potential cost increases and delay.

A new approach to transport investment appraisal

11. The report highlights that current economic appraisal approach used to measure the transformational impacts of large infrastructure projects is too narrowly framed and too restrictive as regards the beneficial interactions between connectivity and capacity and economic growth. The current approach used is overly 'compartmentalised' around sector definitions and because of this does not fully capture the impacts of interventions that have (and are specified to have) cross-sectoral effects.

12. Through the provision of additional rail capacity, both directly and by allowing reallocation of capacity on the classic rail network to passenger and freight services, HS2 will lead to additional economic benefits that are not captured within the conventional welfare framework.

13. HS2 will support regeneration around stations and within city centres. Local authorities across the North have seized the opportunity that HS2 brings to develop Growth Strategies focused around their HS2 station hubs. This report has identified that at a city region level these benefits are substantial, although it is not possible to simply add city region assessments to come to a value of the net impact on the North or the country as a whole.

14. For transformational projects such as HS2, we should move forward via scenario-based economic appraisals that compare plausible futures against each other by capturing key 'ecosystem' interactions - thus illuminating the multiple indirect impacts of major transformative transport investments and the contingent nature of activity – including the impact of plans and changes to plans on investor confidence and delivery of contingent Growth strategies.

15. In many respects, this position is recognised by the Department for Transport (DfT), but there is currently a misalignment between the timescales for its research work developing appraisal techniques and the timescales for making decisions with respect to the future of HS2.

16. Given the above, this report argues that taking any decision on the future of HS2 without explicitly considering these alternative scenarios would therefore be premature.

Recommendations

17. The report closes with the following recommendations:

> **RECOMMENDATION 1**: Robust scenario planning work is required to confirm the Conventional Case for HS2 is robust across a wider range of plausible and likely future scenarios rather than just the single DfT 'business-as-usual' case (which assumes the continued dominance of London);
> **RECOMMENDATION 2:** Work is required urgently to demonstrate how the various sets of evidence produced by the City Regions and others for the economic impacts of HS2 can be better integrated to form part of the overall benefits picture, be this for the North and/or the wider UK;
> **RECOMMENDATION 3**: The full impacts of HS2 cannot be fully assessed within the current welfare cost benefit assessment framework, a broader 'ecosystem' approach is required to reflect the macro interactions between HS2 and the economy. This approach will help to bridge the gap in the available evidence on the impact of HS2 and how it will contribute to the delivery of the Government's objectives for rebalancing the economy;
> **RECOMMENDATION 4:** Given the UK Government's integrative approach to developing a new Industrial Strategy, we recommend that this growing momentum be translated into a new Industrial Strategy-aligned theory and practice of economic appraisal for transformational projects such as HS2.

18. This new approach should set out to position transport connectivity in general (and high-speed rail in particular) as integral to the delivery of Industrial Strategy. This means facilitating innovation, economic development and environmental sustainability in multiple domains. It means considering how transport affects, and shapes the performance and evolution of, the supply chains that link different sectors.

19. The UK cannot afford to let its current 'compartmentalised' approach to appraising the economic impact of transformational connectivity limit our future economic growth potential, and especially in the North.

1 Introduction

1.1 This report, produced by Steer Economic Development (Steer-ED) on behalf of the Northern Powerhouse Partnership (NPP), is an independent assessment of the economic benefit of High-Speed 2 (HS2) to the economy of the North of England.

1.2 In August this year, the UK Government launched an independent review, chaired by Douglas Oakervee, into the benefits and impacts of HS2. This Review is expected to report to the Secretary of State later this Autumn.

1.3 Given this background, NPP is keen to support the Oakervee Review by providing the North's insights and perspectives, and to this end commissioned Steer-ED to assess the benefit of HS2 to the North, this within the context of a rebalanced national economy and the North achieving its potential in a dynamic global market.

1.4 This report presents sequentially the reviews undertaken throughout the study. The report draws on established data and evidence produced to date, assesses its strengths and weaknesses, and identifies potential benefits that have not been assessed or considered in full or at all in Government decision making.

1.5 The report's focus is on examining the scope and scale of the North's economic growth potential and its trajectory, what needs to be done to realise the transformation of the North's economy, and the role that enhancing connectivity in general and capacity between the North and the rest of the country has to play within this. In the context of an expanding economy of the North requiring access to international trade and investment, the report reviews the limitations of conventional welfare assessments, and given the scale of the investment required to deliver HS2, questions whether a more comprehensive and broader economic analysis is now required. The report does not provide forecasts on the incremental economic benefit of HS2 to the North that are not included in conventional Government welfare benefit assessments. It was not possible to provide such forecasts in the timescales, and these are therefore beyond the scope of this report.

1.6 The remainder of the report is structured as follows:

- Chapter 2: The North's economic potential
- Chapter 3: The rationale and context for HS2
- Chapter 4: Understanding the impact of HS2 on the Northern economy from a regional economic ecosystem perspective (a contribution to the broader Strategic Case)
- Chapter 5: Conclusions and recommendations.

2 The North's Economic Potential

Introduction

2.1 This chapter provides a summary of the economic and policy context for investments in high-speed rail (HSR) in the North. It draws on the Northern Powerhouse Independent Economic Review (NPIER) of 2016,[1] to highlight:

- The most important drivers of productivity in the North, namely – skills, enterprise, innovation, transport, and trade and inward investment;
- The scale of the North's productivity potential, which provides a scale and boundary to the likely productivity impact of HS2 and other transport infrastructure investments;
- The inter-relationships between transport and other drivers of productivity, in order to identify the role of transport in driving productivity.

2.2 This chapter also highlights the important role that the Northern Powerhouse plays in delivering the UK Industrial Strategy, the Climate Change Act and the shift to Net-Zero Carbon by 2050, and re-balancing the economy.

Drivers of the Northern Powerhouse's productivity

Key Messages

- There is a consistent productivity gap between the North and the rest of the UK of 25%
- The gap is longstanding in its nature, and will require a generation-long focus to address
- Transport is necessary, but not sufficient to deliver the transformation. Skills, Enterprise and Innovation are all important

The Northern Powerhouse Independent Economic Review

2.3 The 2016 NPIER was a collaboration between the then newly formed Transport for the North (TfN) partnership, Local Enterprise Partnerships and Local Authorities in the North of England, and central Government. The purpose of the NPIER was to provide:

- Data, evidence, and intelligence to underpin TfN's Northern Transport Strategy, input in to the Spring 2016 Budget, and inform subsequent proposals for transport investment;
- Evidence and arguments around which a 'narrative' for the Northern Powerhouse could be forged; and
- The 'analytical bedrock' on which subsequent developments – including, strategy and action planning – could be developed.

[1] Transport for the North (TfN) commissioned the NPIER on behalf of wider partners in the North. It has provided the evidence base for subsequent strategy work and investment decisions undertaken by TfN, NP11 and partners in the North.

2.4 The NPIER built an evidence base in relation to the Northern Powerhouse's international-class strengths and assets or the '*peaks through the clouds'*, as Sir Richard Leese, Leader of Manchester City Council and one of the driving forces behind the 2016 NPIER, described them.

2.5 The NPIER identified four 'international-class' pan-Northern 'Prime Capabilities', i.e. clusters of sectoral, academic, occupational, and infrastructural strengths, in:

- **Advanced Manufacturing Processes and Materials**: Automotive, Aerospace, Offshore Engineering, High Precision Engineering, Chemicals, Marine Engineering, and Graphene and Advanced 2-D materials;
- **Energy**: generation, storage, and low carbon technologies and processes; in particular, Nuclear Energy, Offshore Wind Energy, and battery technologies;
- **Health Innovation**: Life Sciences, Medical Technologies and Devices, e-health and service delivery, and Stratified Medicine; and
- **Digital**: High-Performance Computing, Cognitive Computation, Data Analytics, Simulation/Modelling, Machine Learning, and Media.

2.6 It argued that the combination of these Prime Capabilities provides the basis of the North's future economic growth, driving exports and inward investment in the North.

2.7 The NPIER also identified three 'national-class' 'Enabling Capabilities': Finance, Business and Professional Services; Logistics (which increasingly encompasses retail as well as warehousing and distribution); and Education – particularly Higher Education – as a source of future talent and skills. These Enablers are important as sectors and employers in their own right – both driving productivity growth and generating employment. They also provide skills, knowledge and services that support the growth of the Primes, and as such, they require investment and support to enhance the health of the economic development ecosystem.

2.8 The NPIER reviewed the North's relative productivity performance. It identified a persistent productivity gap – in terms of Gross Value Added (GVA) per head from 1981 onwards – between the North and the UK of 25% (15% excluding London). Its analysis built on understanding long-term trends in GVA and population and identified key drivers of productivity performance:

- Employment rates – the North has lower employment rates and a greater proportion of the working-age population detached from the labour market than the England average;
- Skills – the distribution of lower level occupations (a proxy for skills) in the North was estimated to account for around 4% of the productivity gap;
- Innovation and technology – the North produces 40%-50% fewer patents per worker than England and England minus London, indicating an innovation gap;
- Investment – since the year 2000, fixed capital formation in the North has been 5%-25% below the averages for England;
- Enterprise – the North underperforms the England average in terms of business density, but also in the rate of business births and deaths, indicating a dynamism gap, linked also to lack of investment, e.g. Venture Capital Funds;
- Agglomeration – the North's city regions lack the mass and density (as indicated by jobs per km2) to generate significant agglomeration effects – with estimates of the impact on GVA of agglomeration in the North's core cities (Leeds, Liverpool, Manchester, Newcastle, and Sheffield) estimated in different studies at between 0.5% and 2.8%;

- Connectivity – the North suffers from fragmented and poor transport links between (and within) its city regions which dampen potential agglomeration effects; better inter-city links within the North would generate agglomeration effects, in particular, more efficient operation of the labour market; and
- Sectoral Mix – was not identified as a significant factor in determining the productivity gap with England.

2.9 In terms of specific drivers of productivity, the NPIER highlighted the skills gap as the most significant factor driving the productivity gap, followed by investment (particularly inward investment) and enterprise, innovation, and connectivity. The NPIER also noted the importance of the interactions between these drivers in facilitating productivity growth.

The scale of the Northern Powerhouse's productivity potential

Key Messages

- The NPIER's scenarios show the economic potential to generate an additional £1,000bn GVA between 2035 and 2050 in addition to Business-as-Usual, provided constraints to growth are removed
- Improved connectivity is a necessary condition for improved productivity growth in the North

2.10 The NPIER developed a number of potential forward-looking scenarios that compare the growth that might be expected in the North, if:

- The future is like the past ('business as usual' or BAU);
- The aspirations embodied in the LEPs' Strategic Economic Plans are fulfilled ('SEPs' expectation');
- The North's future performance is transformed, relative to the past ('Transformational Growth Scenario' or TSG); and
- The 'Transformational' scenario is adjusted to reflect a higher UK GDP growth context (consistent with the Office for Budgetary Responsibility's long-term view) ('Transformational Plus').

2.11 The NPIER highlighted the Transformational Growth Scenario, which was largely developed bottom-up by constructing futures for the various sectors of the economy, allowing for the Review's identification of 'Prime' and 'Enabling' capabilities. Table 2-1 provides a summary of the GVA, employment and productivity growth paths of BAU and the TGS.

Table 2-1: Average % annual growth rates for Business-as-Usual and Transformational Growth 2015-2050

Scenario	GVA	Jobs	Productivity
Business-as-Usual (North)	2.0	0.3	1.7
Transformational Growth (North)	2.4	0.5	1.9
UK	2.2	0.5	1.7

Source: Northern Powerhouse Independent Economic Review, 2016, Workstream 4 Final Report, p. 20

2.12 The NPIER scenarios show that between 2035 and 2050 GVA BAU will rise from £445.5bn a year to £603.4bn a year, while the Transformational Growth Scenario will see annual GVA grow from £477.2bn to £694.6bn. [2]

2.13 In terms of establishing the potential aggregate additional GVA of the Transformational Growth Scenario, the NPIER calculations show BAU would deliver cumulative GVA of £8,332bn between 2035 and 2050 and the Transformational Growth Scenario would deliver £9,340bn. This amounts to additional GVA of £1,008bn between 2035 and 2050.[3] In future any future modelling of the economic impact of investment in the North, this may be considered an upper-bound as to what might be generated between the opening of HS2 and 2050.

The inter-relationships between transport and the other drivers of productivity identified in the NPIER

2.14 The NPIER reviewed evidence on transport's role in driving productivity. It noted, 'it is impossible to…say '*Xm of transport spending will close the performance gap by Y%*' because '[t]he interplay between different factors…is too complex to capture and separate out within an empirical modelling framework.' In relation to transport, however, it highlighted the importance of:

- Intra-city transport for matching jobs to skills;
- Inter-city regional transport within the North for delivering agglomeration effects, in particular improved matching of high-level skills to appropriate jobs and greater confidence in the ability to develop a career in the North, as well as knowledge spill-overs;
- Inter-city national transport (i.e. transport beyond the region but within the country), in particular, access to finance and international connectivity via London; and
- International transport for inward investment and exports – to facilitate smart specialisation in the North's Prime Capabilities (Advanced Manufacturing Processes and Materials Energy, Health Innovation, and Digital).

2.15 The significance of recent trends in the growth of knowledge-based employment and Knowledge Intensive Businesses (KIBs) in city centres was highlighted in the report, which went on to argue the need to 'enhance pan-Northern city-centre to city-centre rail links, east-west and north-south…to facilitate the bigger labour markets that support the success of knowledge-based businesses'. The report also noted the different transport needs of manufacturing businesses located on large out-of-town sites – which need good links to city-centre locations to access KIBs, research and innovation assets, and business support services. The NPIER went on to argue that rail, rather than road, was the main transport infrastructure required to support this growth.

2.16 The NPIER, however, went on to argue that the poor quality, slow journey times, unreliable and fractured rail services of the North with complex pricing arrangements which limit legibility of the services available, act as a brake on the North's growth, in particular, via lower levels of longer-distance commuting. This situation limits many workers' ability to access higher level/paid jobs for which they are suited and acting as a deterrent to overseas investors

[2] Figures at 2014 prices.

[3] The projected additional GVA produced in the year 2050 as stated in the NPIER was £97bn.

who wish (a) to access skilled workers and (b) their offices/sites from overseas locations. It also noted the importance of better freight connections, especially to ports to facilitate goods trade.

2.17 The Review went on to note that 'it is no longer the case that the North has spare transport capacity to accommodate growth'; the lack of capacity on the North's rail network thus acts as a barrier to growth. The Review went on to note that having capacity in the system enables growth when and where it needs to happen.

The Northern Powerhouse: UK Industrial Strategy and Net-Zero Carbon Emissions by 2050

2.18 Since the NPIER was published in 2016, the UK Government has published its Industrial Strategy identifying four Grand Challenges (AI/Data; Clean Growth; Future Mobility; and Ageing Society) and its ambitions for delivering excellence across the Five Foundations of Growth (Table 2-2). And the Government has amended the 2008 Climate Change Act to establish a Net Zero Carbon Emissions Target of 2050.

Table 2-2: UK Industrial Strategy

Five Foundations of Growth	Vision and Ambitions
Ideas	The UK as the world's most innovative economy
People	Good jobs and greater earning power for all
Infrastructure	A major upgrade to the UK's infrastructure
Business Environment	The best place to start and grow a business
Places	Prosperous communities across the UK

Source:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/730043/industrial-strategy-white-paper-print-ready-a4-version.pdf

2.19 Furthermore, the 2070 Commission (an independent inquiry into city and regional inequalities in the United Kingdom) has proposed the following actions to deliver balanced, sustainable, equitable growth: (1) Embedding Spatial Justice into Tackling Climate Change; (2) Delivering a Connectivity Revolution; (3) A Network of UK-global Centres of Excellence; (4) Strengthening the Foundations of Local Economies; (5) Shifting Devolution up the Gears; (6) Shaping the Future through National Spatial Plans; and (7) Levelling the Playing Field for Accessing Funds. These recommendations point to the need for integrated action to tackle spatial inequalities and climate change, in relation to Connectivity, the Commission recommends: (1) A national connected network between cities; (2) Sustainable mobility within all major urban areas; and (3) Connectivity beyond, for marginalised communities in coastal & rural areas that have lost transport and local services.[4]

2.20 The Northern Powerhouse's Prime Capabilities (Advanced Manufacturing, Energy, Health Innovation and Digital) play a central role in the delivery of the UK Industrial Strategy and Net Zero Carbon Emissions by 2050 with Digital Capability, e.g. in relation to Data, the Science and

[4] http://uk2070.org.uk/2019/09/20/second-report-of-the-uk2070-commission-published/

Technology Facilities Council high performance computing, data analytics and artificial intelligence research facility at the Hartree Centre; and in relation to Clean Growth, nuclear capabilities in the North West and North East, and offshore wind energy capabilities in the North West, North East and Yorkshire & Humber;

2.21 Investment in HSR and associated connectivity in the North – in line with the 2070 Commission's recommendations – is essential, if the Northern Powerhouse is to play its full role in generating ideas and innovation, match people to the jobs in which they will be most productive, achieve carbon-neutral mobility, attract high-value inward investment, retain its growing businesses, and rebalance the UK economy both sectorally and spatially.

Summary and Implications

2.22 The NPIER identified a significant and persistent productivity gap between the North and the England average; This productivity gap is explained by underperformance in relation to skills, enterprise, innovation, connectivity, and trade and investment (including inward investment);

2.23 The Review drew on a range of research, which points to the following:

- Good transport is a necessary but not sufficient condition for sustainable growth;
- The most significant driver of the North's productivity performance is its skills/occupational mix;
- A significant proportion of the growth in high-value employment will be focused in cities;
- Better transport links between the North's cities will have the effect of integrating labour markets, which will increase the range over which employers and workers can search for the right might of job to skills, thereby improving productivity and also provide long-term reassurance to workers that they can develop their careers in the North;
- These effects will be enhanced further by improved intra-city links;
- Rail is the key transport infrastructure which will unlock the labour market potential – the road network cannot respond to the city-centre demand;
- The North's rail network is capacity constrained, which means that without an increase in capacity the North's productivity growth will be constrained; and
- Methodological difficulties in attributing GVA growth by individual drivers of productivity and specific interventions but provided scenarios which point to a potential aggregate GVA prize for the economy of the North of £1,008bn between 2035 and 2050. If transport investment unlocks just 10% of this prize it would enable £100bn, if HS2 facilitates half of this impact it would enable £50bn.

2.24 Since the NPIER was published in 2016, the UK Government has published the UK Industrial Strategy and established a Net Zero Carbon Emissions Target of 2050. The Northern Powerhouse's Prime Capabilities are central to these two strategies. If it is to play its full part in delivering these strategies the Northern Powerhouse requires significant investment in HSR to unlock transport capacity to unleash its economic capabilities.

Implications

- A significant and persistent productivity gap between the North and the England average
- This productivity gap is explained by underperformance in relation to skills, enterprise, innovation, connectivity, and trade and investment (including inward investment)
- The North's rail network is capacity constrained, which acts as a constraint on the North's productivity growth
- Economic growth scenarios point to a potential aggregate GVA prize of £1,008bn between 2035 and 2050. If transport investment unlocks just 10% of this prize it would enable £100bn.

2.25 The above analysis has been used in relation to the Strategic Transport Plan for the North and developed by additional work to understand Connectivity and Labour Markets in the Northern Powerhouse. This is taking account of changes in skills, occupational mix and commuting patterns, and Agglomeration and Clustering to provide a typology of places that provides a deeper understanding of different spatial types and economic potential in the Northern Powerhouse.

2.26 The way that the NPIER has been interpreted by TfN to inform its Strategic Transport Plan is that to help realise the transformation in economic growth that NPIER describes, a complementary and integrated package of transport investment is needed that:

- Supports the North' s competitiveness by improving its inter-city links to London and the World City economic functions that it offers, as well as neighbouring regions and international gateways. HS2 is central to realising this ambition.
- Makes the great cities of the North work more like a single labour market, which will bring productivity gains. This is a key purpose of Northern Powerhouse Rail (NPR), a scheme which through its use of its infrastructure on the west and east sides of the Pennines is symbiotic with HS2.
- Investment to enhance intra city-region connectivity. As well as productivity gains per se, such investment will maximise the benefits of HS2 and NPR, and of the development and regeneration opportunities around HS2/NPR hubs.

3 The Rationale & Context for HS2

Introduction

3.1 This chapter sets out the current understanding of the context and rationale for the HS2 investment and identifies what has (and has) not been considered in current investment appraisal work.

3.2 It is based on a rounded review of extant evidence. It does not include any new modelling projections, forecast or scenarios.

The challenges to address

3.3 HS2 has been developed to meet two interrelated challenges:

- **A transport challenge**: the pressing need to increase the capacity of Britain's railway network;
- **An economic challenge:** the need to facilitate and accelerate economic growth, while at the same time rebalancing the national economy.

The Transport Challenge

3.4 Over the last 25 years, passenger numbers on Britain's railway network have more than doubled. Over this period, the rail network has received substantial investment that has increased its capacity. This has been achieved by introducing new longer trains, as well as investing in the network and stations to increase the number of trains that can be run. Nonetheless, the increase in capacity has not kept pace with the growth in demand and on-train crowding is both a problem for existing passengers and a deterrent to future growth.

3.5 As well as crowding on trains, significant parts of the national rail network are operating at their practical capacity in terms of the number of trains that can be run in any hour. While this maximises the capacity that can be provided, it has the knock-on effect of reducing both the *reliability* and the *resilience* of the railway network. Because there is very little spare capacity, individual delays can quickly amplify into a cascade of delayed services – the network is not reliable. The lack of capacity also means that when things do go wrong it can take many hours to recover from the effects of even small incidents. Even planned engineering work can cause significant disruption - the network is not resilient.[5]

[5] The capacity pressures on the north-south main lines and the impact this can have on punctuality and reliability have been analysed in some detail. See for instance:

DfT (2013) *The Strategic Case for HS2* and in particular Chapter 2

DfT (2015) *Supplement to the October 2013 Strategic Case for HS2 Technical Annex: Demand and Capacity Pressures on the West Coast Main Line*

Recent work by Volterra for Leeds City Council (*Leeds – the Case for HS2,* September 2019) notes that reliability on ECML, which has not benefited from investment in the way the WCML, is notably poor,

3.6 Limited capacity also constrains the network's ability to cater for increased freight flows. This is especially the case for inter-modal containers that are imported or exported through our ports and are the backbone of international trade.

3.7 If rail travel – both for passengers and for freight – is to continue to grow, more network capacity is needed. This means the ability to run longer trains and to run more trains. For many routes, enhancing the existing network is the optimum solution in terms of value for money, deliverability and affordability. However, such solutions can take a long time to implement and be highly disruptive to existing users. There are tangible limits to how much capacity and speeds can be further increased: West Coast Route Modernisation (WCRM) took a decade to complete and cost £9bn.[6] While WCRM did lead to faster and more frequent inter-city journeys from the West Midlands, the North West and Scotland to London, which in turn brought significant economic benefits, the limited capacity uplift that it provided was quickly used up.

The Economic Challenge

3.8 Towns and cities, and in particular the centres of towns and cities, are drivers of economic growth. Their success has been one of the underpinnings of the growth of the national economy and this has meant increases in commuting and business travel, as well as more travel by people accessing the shops, leisure facilities and other services located in town and city centres.

3.9 Enhancing towns and cities' transport connectivity is one factor that will allow them to realise their further potential. Our roads are already congested and while their targeted enhancement is warranted, the cost of meeting all demand is prohibitive and the environmental impacts of the scale of new roads that would be needed is unacceptable. In contrast, rail offers a way of increasing capacity for commuters, business and leisure travel that is environmentally acceptable *and* economically worthwhile.

3.10 On top of this, there is a need to rebalance the national economy. This will be achieved by helping regions grow at a faster rate than they have historically. HS2 can help support the North's economic competitiveness, while Northern Powerhouse Rail (NPR) will help the North's great cities work more like a single labour market, which in turn will support growth in its productivity.

3.11 As Transport for the North (TfN) has set out in its statutory advice to Government (its *Strategic Transport Plan*[7]), what is needed are improvements to inter-city, inter-regional, commuter and freight connectivity. Rail has a key role to play in meeting each of these needs.

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with LNER the third worst performing TOC with 8.1% of its trains Cancelled and Seriously Late (CaSL), 3 percentage points worse than intercity services on WCML.

[6] See, for example, House of Commons Committee of Public Accounts (2007), *The Modernisation of the West Coast Main Line*
https://publications.parliament.uk/pa/cm200607/cmselect/cmpubacc/189/189.pdf

[7] TfN (2019) *Strategic Transport Plan*, https://transportforthenorth.com/wp-content/uploads/TfN-final-strategic-transport-plan-2019.pdf

Key Messages

- The transport challenge is that there is a pressing need to increase the capacity of Britain's railway network
- The economic challenge is the need to facilitate and accelerate economic growth, while at the same time rebalancing the economy
- As established by the Northern Powerhouse Independent Economic Review, transport connectivity is one important factor that has constrained growth

Why HS2?

3.12 The genesis of HS2 was the recognition that there is a need to increase the nation's rail capacity. HS2 will provide a step change in north-south connectivity for inter-city services. By providing new north-south lines, it will provide a step change in the number of trains that can be run – HS2 is being planned to cater for up to 18 trains per hour. At 400m long, these trains offer almost double the 600 seats provided by the longest intercity Pendolino in operation on West Coast Main Line today[8].

3.13 The question is not whether additional capacity is needed, but when it will be needed and what additional quantum is required. Furthermore, there is a related question of when additional capacity can actually be provided. Even if delayed a number of years, as has recently been suggested will be the case, HS2 Phases 1 and 2a (to Birmingham and to Crewe on the West Coast Main Line) will deliver a greater uplift in north-south capacity and sooner than any plausible alternative. Similarly, HS2 Phase 2b, which will take high-speed rail to Sheffield and Leeds, will deliver a greater capacity uplift than any plausible alternative for the east of the country.

3.14 The new north-south intercity capacity that HS2 will bring also allows the existing 'classic' lines to be used in a different way. Existing inter-city capacity can be reallocated to better serve inter-regional movements, as well as offer better links between smaller towns and cities to London and to other principal cities including Liverpool, Manchester and Leeds. It offers the opportunity to create new capacity for north-south freight.

3.15 The alternative to building a new line would be to enhance existing lines, but as well as delivering a smaller capacity uplift and ultimately, not deliver the scale of benefit needed to accelerate economic growth and support rebalancing, this this would also be highly disruptive to existing rail users.

3.16 Then comes the question of speed: the evidence is that the marginal economic benefits of making the new inter-city capacity high-speed are greater than the marginal capital cost. Work that has looked at alternatives to HS2 has consistently demonstrated that new high-speed

[8] See Para 3.14, DfT (2017) *High-speed Two Phase Two Strategic Case*, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/629393/high-speed-two-phase-two-strategic-case.pdf

north-south lines are the optimum way to provide the additional capacity that is required.[9] A high-speed network offers better value for money because of the scale of its capacity uplift combined with the additional benefits that come with the large reduction in station-to-station journey times. This scale of benefit gives HS2 the potential to contribute to geographically rebalancing the national economy and accelerating growth.

Key Messages

- The genesis of HS2 was the recognition that there is a need to increase the nation's rail capacity
- New north-south intercity capacity provide by HS2 allows existing 'classic' lines to be used in a different way
- Alternatives to building new lines, e.g. enhancing existing lines would be highly disruptive and deliver a smaller uplift in capacity – and not deliver the scale of benefit needed to accelerate and rebalance economic growth

What is the economic value of HS2?

3.17 The sources of economic value of HS2 can be divided into two broad, and to an extent, overlapping categories. First, there are the benefits that accrue to existing travellers. These are people who would otherwise use rail but choose to use HS2 because of the journey time advantages it will offer, as well as people who would otherwise travel by car or air but choose to use HS2. Benefits also accrue to users of the existing networks who may travel in less crowded trains, or travel on less congested roads. These existing people enjoy what is termed a welfare benefit.

3.18 There are also benefits to the economy through, for example, increased employment in locations well served by HS2, people being more productive and through a range of spill-over effects. These benefits tend to be expressed in terms of measures of the size of the economy such as GVA.

[9] There is an extensive body of work that has considered strategic alternatives to HS2. As well as looking at non-rail options, this workstream has considered the case for alternative provision of new rail capacity, including upgrades to existing lines. Each piece of work has reinforced the conclusion that a new line is the optimal way of providing new north-south capacity. See:

Atkins (2010) *High-speed 2 Strategic Alternatives Study*

Atkins (2011) *Strategic Alternatives to the Proposed 'Y' Network*

Network Rail (2011) *Review of Strategic Alternatives to High-speed Two*

Atkins (2013) *HS2 Strategic Alternatives*

Network Rail (2013) *Options for Potential Capacity and Connectivity Enhancements to the Existing Network*

Atkins (2015) *Rail Alternatives to HS2 Phase 2a*

Atkins (2016) *Strategic Alternatives to HS2 Phase 2b*

3.19 To an extent there is an overlap between these two sources of benefit. For example, people who travel for business and who enjoy a faster journey enjoy a benefit which can be expressed both in welfare terms and as a direct benefit to the economy.

3.20 Conventionally, within its cost benefit analysis framework Government only considers welfare benefits and a limited sub-set of potential wider economic impacts, while adopting a limiting assumption that the investment has no effect on the overall size of the national economy or the distribution of population and employment, other than at the margin.

3.21 Even with these limitations, the assessment of welfare benefits is important when considering the case for HS2. They make a direct contribution to economic performance, although the transmission mechanisms between welfare benefits and the 'real' economy are not readily analysable. Importantly, sizeable welfare benefits are a pre-condition to realising sizeable wider economic impacts. Even though there is not a proportionate relationship, the greater the welfare benefits, the greater is the potential to secure wider economic impacts.

3.22 In his recent Stocktake, HS2 Ltd chairman Allan Cook set out what he saw as the benefits of HS2 that are currently captured within a cost benefit analysis and those benefits that are not. His assessment is reproduced as Table 3.1 below.

Table 3.1: Sources of HS2 Benefits

Benefits to the economy included in the Benefit Cost Ratio	Benefits to the economy excluded from the Benefit Cost Ratio
Faster, more frequent, more reliable, less crowded journeys for business travellers	Benefits during the construction period such as jobs and skills
Agglomeration: Better transport reduces the effective distance between firms and between firms and workers, increasing productivity	Transformational benefits to the economy including changes to the location and investment decisions of firms and productivity benefits from better connecting city/regional economies
Increased labour supply due to improved transport	Regeneration around HS2 stations and local growth strategies and plans (noting that these depend on HS2's catalysing effect to underpin their further investment and release the benefits)
Firms operating in markets dominated by a few suppliers cut prices / increase output	

Source: Page 12, *HS2 Chairman's Stocktake*, August 2019

3.23 The benefits in the right-hand column of Table 3.1 are excluded from the benefit cost ratio. At present, because of methodological uncertainties on how such wider economic impacts are forecast and monetised, Government inherently has less confidence with these than it does with conventional welfare benefits. Also, unquantified or non-monetised impacts (positive and negative) are part of the overall consideration.

3.24 Importantly, while cost benefit analysis based on the assessment of welfare impacts is a central part of Government's value for money assessment, it is not the only consideration and wider economic impacts are considered too, especially and as in the case of HS2, when a strategic goal of the intervention is to secure economic change.

3.25 The most contemporary Business Case for HS2 was published by Government in 2017.[10] This says that the Benefit Cost Ratio of the full Y-shaped network is 1.9:1 when the benefits include only the benefits associated with faster, more frequent, more reliable, and less crowded journeys (this is called the 'initial' BCR). This BCR is 2.3:1 if the full range of benefits identified by Allan Cook in the left-hand column of Table 3.1 is included (this is the 'adjusted' BCR). These BCRs assume a capital cost of the full Y-network of £56bn, expressed in 2015 prices.[11]

3.26 In his Stocktake, Allan Cook suggests that the outturn cost of the full Y-network is likely to be in the range of £72-78 bn in 2015 prices. Should the costs fall in this range, this would suggest that the initial BCR would be close to 1, which in turn would suggest that before account is taken of wider economic impacts, the scheme has low value for money.

3.27 When thinking about how the economic analysis informs the assessment of the value for money of HS2, there are three questions to be addressed:

- Does the conventional welfare case (leading to the initial and adjusted BCRs) fully reflect the potential economic impacts of HS2?
- How should the wider impacts identified by Allan Cook and not currently robustly quantified inform HS2's value for money assessment?
- Are there any further economic impacts that should be considered when assessing value for money?

The Conventional Case

3.28 The published HS2 business case is based on a single view of future economic growth and distribution of population and employment. Essentially, this is a ''business as usual' scenario which represents the Department for Transport's (DfT's) best estimate of the long-term response to demographic and economic trends.

3.29 While there are good reasons for the DfT to adopt this approach, there is also a growing recognition in the Department and elsewhere that there is uncertainty associated with any scenario and therefore a need to consider alternative futures. Furthermore, it inherently assumes that Government-led policy initiatives which would change the scale and distribution of national economic activity will not be successful. There are also other exogenous changes such as the move to a less carbon intensive economy or new digital technology that have the potential to have a material impact on the way that people travel in the future.

3.30 This need to consider alternative future scenarios is particularly apposite when developing transport strategies or considering the case for the largest scale investments such as HS2.

3.31 Transport for the North has conducted long-range scenario planning utilising a wide-range of expert stakeholder input and state-of-the-art modelling of Northern land-use, labour and travel markets. Its work suggests that the scale of future inter-city rail demand growth in the North will be between 41% and 250% by 2050. For comparison, the DfT reference case lies at

[10] DfT (2017) *High-speed Two Phase Two Economic Case* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/634196/high-speed-two-phase-two-economic-case.pdf

[11] See Page 13, *op.cit.*

the lower end of this range 67% and independent scenario planning work by Network Rail (in their Long-Distance Market Study) was 168%. Figure 3.1 illustrates the potential spread of demand growth across the alternative future scenarios.

3.32 The highest rail growth forecast by TfN (60% higher rail growth than the NTEM scenario by 2037) is their 'Compact and Travel Friendly' scenario, predicated on successful delivery of a package of transport interventions (including Northern Powerhouse Rail) across the region and an accelerated trend of urban densification. The lowest 'Dispersed and Digital' scenario is predicated on stronger preferences for digital interaction and an increased spread of development throughout suburban and rural areas (see also Figure 3.1).

3.33 The existing TfN scenarios are not consistent with the Net Zero policy agenda for tackling climate change and work is underway to look at wider packages of policy interventions, including a focus on sustainable transport that could help realise these goals. It is likely that such refreshed scenarios will show a further shift of travel away from car to rail. The evolution of the treatment of new technologies and business models in transport (particularly highly accessible first mile/last mile on-demand and shared travel options) are likely to further increase the attractiveness of rail.

3.34 In Table 3.2, informed by the TfN scenario work, we illustrate the impacts of a number of alternative scenarios on the conventional case for HS2:

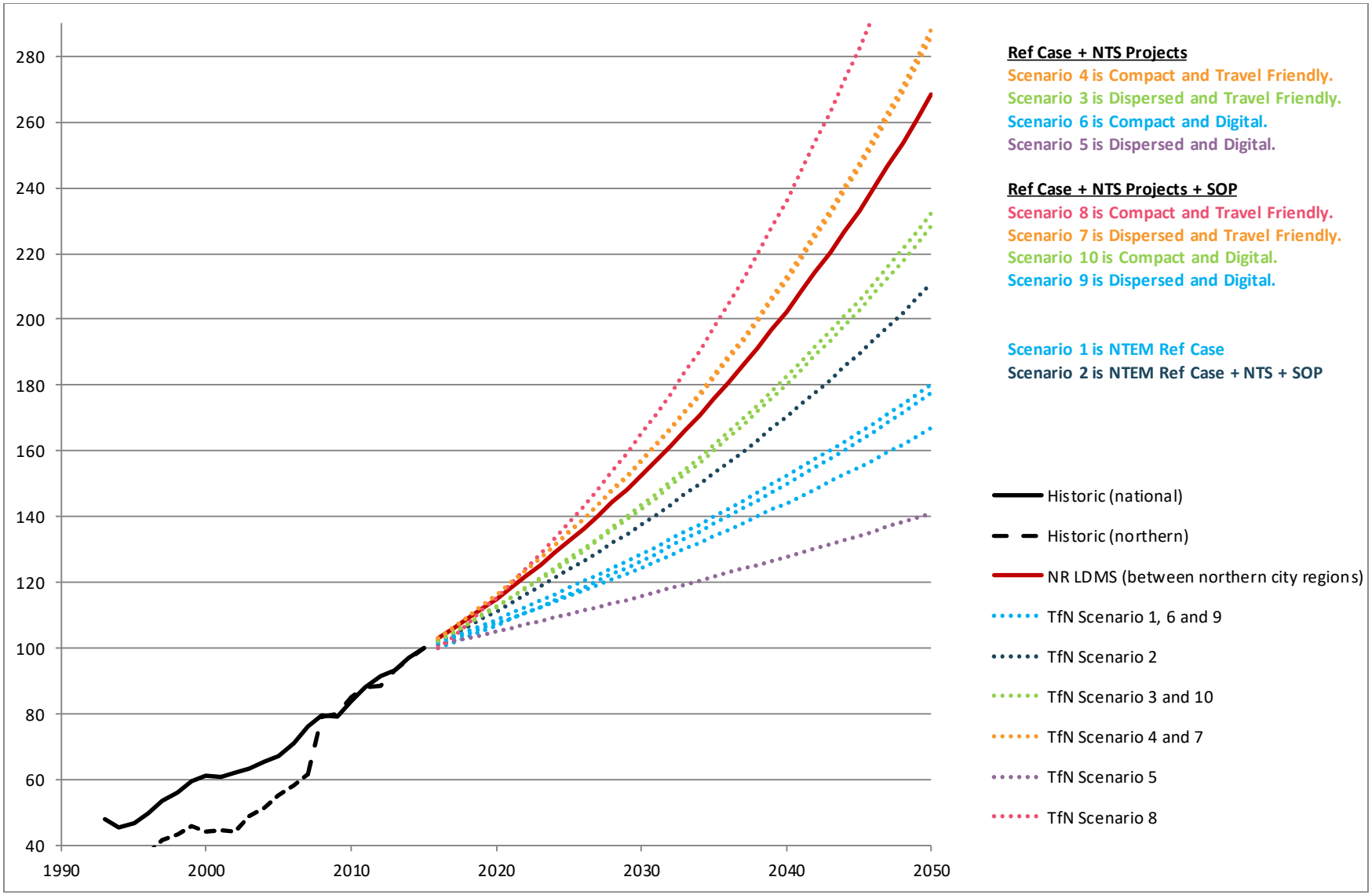
- The DfT's 'Business-as-Usual' reference scenario;
- A 'Net Zero' scenario (assuming a +40% increase[12] in inter-city rail demand, revenue and wider economic impacts);
- A 'Travel Friendly' scenario (assuming a +60% increase[8] in inter-city rail demand, revenue and wider economic impacts).

3.35 In each alternative scenario, we have taken into account the following, both of which reduce the benefit cost ratio of HS2:

- The capital cost estimate increasing from £56bn to between £78bn (2015 prices). This is the top end of the range suggested by Allan Cook – alone this changes the benefit cost ration (BCR) from 2.3:1 to 1.4:1
- The potential five-year delay in opening – together with the increased cost estimate, this further changes the BCR to 1.1:1

[12] The 'Travel Friendly' alternative scenario illustrated here assumes the demand uplift in 2037 in TfN's Compact and Travel Friendly scenario above the NTEM scenario in 2037 will be matched by equivalent growth in national north-south rail demand. The 'Net Zero' alternative scenario conservatively assumes that only 2/3 of that demand uplift is applied to national north-south rail demand. Further more detailed work – in particular on potential Net Zero scenarios and their impact on rail demand is urgently needed.

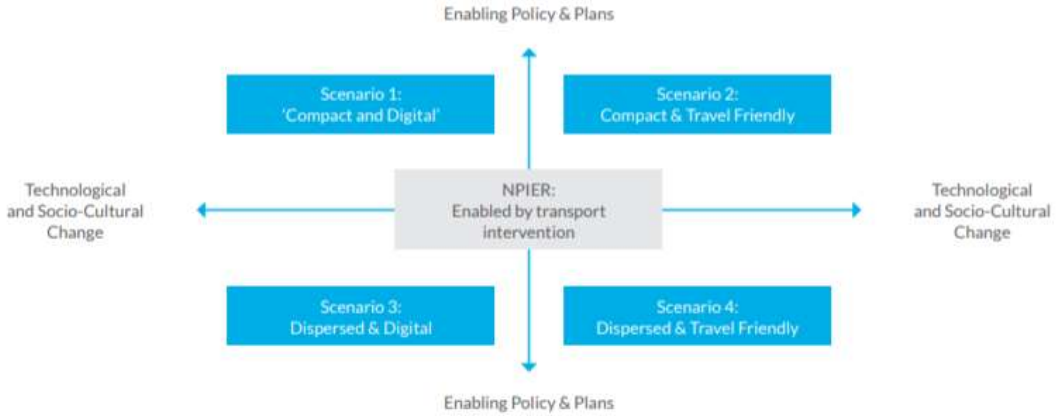
Figure 3.1: Projected Demand Growth under Alternative Future Scenarios 2015-2050



Abbreviations: NTS is Northern Transport Strategy, the precursor to TfN's Strategic Transport Plan, SOP is Strategic Outline Programme, NR LDMS is Network Rail Long Distance Market Study, NTEM is National Trip End Model (DfT)

Figure 3.2: Alternative Scenarios in greater detail

Scenario 1: Compact & Digital	Scenario 2: Compact & Travel Friendly
• Urban areas are 'Compact' with brownfield development in the cores • Local transport systems focus on serving radial movements • Technological development has led to a preference for 'Digital' rather than physical connectivity • Energy costs and therefore travel costs are high	• Urban areas are 'Compact' with brownfield development in the cores • Local transport systems focus on serving radial movements • Technological development has led to advances in 'Travel Friendly' connectivity options • Energy costs and therefore travel costs are low
Scenario 3: Dispersed & Digital	**Scenario 4: Dispersed & Travel Friendly**
• Urban areas are 'Dispersed' with mixed greenfield and brownfield development in the suburbs and urban fringes • Local transport systems provide for all types of cross-district movement • Technological development has led to preference for 'Digital' rather than physical connectivity • Energy costs and therefore travel costs are high	• Urban areas are 'Dispersed' with mixed greenfield and brownfield development in the suburbs and urban fringes • Local transport systems provide for all types of cross-district movement • Technological development has led to advances in 'Travel Friendly' connectivity options • Energy costs and therefore travel costs are low



Source: TfN, *Future Transport Demand in the North of England*

3.36 These Alternative Scenarios - based at this stage on broad-brush assumptions and not detailed modelling - reflect a likely outcome from the Transport for North, Midlands Connect, and other national policy agendas such as NetZero, along with changes in transport technology and business models[13]. They suggest that HS2 can still deliver high value-for-money, even after accounting for recently announced potential cost increases and delays.

[13] Our approach has been to factor the net transport benefits and wider economic impacts in proportion to the assumed growth in demand, while costs have been factored by the ratio of total costs suggested by Allan Cook with the previous cost estimate. Further cost and benefit factors have been derived to account for the potential delay to the project. We have not altered operating costs, but in reality, increased demand may lead to greater operating costs. However, the relationship is unlikely to be linear with demand. Nonetheless, this does not undermine the conclusion from this analysis, which is that different views of the future can return a materially different assessment of HS2's BCR.

Table 3.2: Impact of Alternative Scenarios (with Cost/Delay Increases) on the BCR of the Conventional Case for HS2

	Based on £56bn capex	Alternative Scenarios all based on £78bn capex and five-year delay to opening		
	Conventional Case	**Updated Conventional Case**	**NetZero Scenario**	**Travel Friendly Scenario**
Net transport benefits	74.6	63.0	88.2	100.8
Wider Economic Impacts	17.6	14.9	20.8	23.8
Net benefits including WEIs	92.2	77.9	109.0	124.6
Capital Costs	55.8	78.4	78.4	78.4
Operating Costs	27.6	27.6	27.6	27.6
Total Costs	83.4	106.0	106.0	106.0
Revenues	43.6	36.8	51.6	58.9
Net Costs to Gov	39.8	69.2	54.4	47.1
BCR without WEIs	1.9	0.9	1.6	2.1
BCR with WEIS	2.3	1.1	2.0	2.7

Source: Steer Analysis, 2019

3.37 What the analysis presented here suggests is that the benefit cost ratio that is used in the assessment of HS2's value for money are highly dependent on the future growth scenario (size of the economy, distribution of jobs and employment, as well as societal changes such as the influence of technology). There is uncertainty about the future. One way of recognising this uncertainty would be appraising HS2 using multiple outturn scenarios rather than a single view of the future.

Key Messages

- When thinking about how the economic analysis informs the assessment of the value for money of HS2, there are three questions to be addressed
- Does the conventional welfare cost benefit analysis fully reflect the potential economic impacts of HS2?
- How should the wider impacts identified by Allan Cook and not currently robustly quantified inform HS2's value for money assessment?
- Are there any further economic impacts that should be considered when assessing value for money?
- The published HS2 business case is based on a single view of future economic growth and distribution of population and employment. Essentially, this is a ''business as usual' scenario, which inherently assumes that the Government's Northern Powerhouse (and Midlands Engine) policy platform has no impact on the long-term scale or distribution of growth

- There is a need to consider alternative future scenarios which is particularly apposite when developing transport strategies or considering the case for large scale investments such as HS2
- Alternative future scenarios, that reflect the likely outcomes from the Transport for the North, Midlands Connect and other national policy agenda such as the NetZero – along with changes in technology and business models – suggest that HS2 can deliver high value-for-money, even after accounting for recently announced potential cost increases and delay.

The Economic Case

3.38 Through the provision of additional rail capacity, both directly and by allowing reallocation of capacity on the classic rail network to passenger and freight services, and because of the journey time improvements that it will bring, HS2 will lead to additional economic benefits that are not captured within the conventional welfare framework. As Allan Cook has identified, these will come about because HS2 will support and facilitate additional economic growth when measured at the national scale, as well as change where in the country jobs and employment will happen. It is a stated objective of Government that one reason to invest in transport infrastructure is to 'build a stronger, *more balanced economy* by enhancing productivity and responding to local growth priorities' [our emphasis].[14] Understanding *where* economic growth will happen, as well as how HS2 affects the overall *size* of the economy, must therefore be central when identifying HS2's value for money.

3.39 Commissioned by HS2 Ltd, in 2013 work was undertaken by KPMG to identify the potential scale of the additional economic activity that would come about because of HS2.[15] This work identified that HS2 would lead to a £15bn per annum boost to the national economy (expressed in 2013 prices). KPMG said that of the £15bn:

- The majority (£13bn) would be business related, accruing as businesses grow and relocate to take advantage of the connectivity and capacity uplift that HS2 will bring both directly and through the reallocation of capacity on the classic lines;
- Up to half would be in city regions outside London.

3.40 The KPMG work has been subject to some trenchant criticism, with the LSE's Professor Henry Overman one of the most vocal critics.[16] Fundamentally, Professor Overman's criticism was methodological rather than conceptual. Writing in 2013 he said 'HS2 will bring some regional

[14] See Para 3.1 DfT (2017) *Transport Investment Strategy* Cm 9472 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/624990/transport-investment-strategy-web.pdf

[15] KPMG (2013) *HS2 Regional Economic Impacts* http://www.highspeeduk.co.uk/D07%20UU%20hs2-regional-economic-impacts%202013.pdf

[16] Overman H (2013) *The Regional Economic Impacts of* HS2 http://spatial-economics.blogspot.co.uk/2013/09/the-regional-economic-impacts-of-hs2.html and Overman H (2013) *HS2 Regional Economic Impact: Garbage in ...?* http://spatial-economics.blogspot.co.uk/2013/09/hs2-regional-economic-impact-garbage-in.html

economic impacts and they should be counted in the benefit cost case.'[17] His argument was not that HS2 would not have an impact on regional economies, rather it was about how these impacts had been calculated and in particular, that the method deployed by KPMG overstated the scale of the impact. However, since the KPMG work, no further work has been published by either the Department for Transport or HS2 Ltd to develop an updated forecast of what the national and regional economic impacts of HS2 will be: there is a clear gap in the available evidence on the extent that HS2 will realise one of the Government's stated objectives for transport investment.

3.41 In his Stocktake, Allan Cook identifies that HS2 can support regeneration around stations. Local authorities across the North have seized the opportunity that HS2 brings to develop Growth Strategies focussed around their HS2 station hubs. They are developing land-use masterplans and complementary programmes of investment to help maximise the scale of redevelopment and regeneration that will take place around HS2 stations. As part of this work, city regions from across the North are developing their own estimates of what will these Growth Strategies will do in terms of increases in jobs and GVA. Other authorities are looking more widely and have sought to assess the scale of HS2's jobs and GVA impacts across their city regions.

3.42 Local growth and regeneration are essentially cases in point of how HS2 will affect the national economy – HS2's national economic impact is simply the sum of all of its local impacts. What the analysis that city regions are doing is filling a hole in the national evidence base. However, because different city regions use different analytical approaches and because they do not explicitly consider the issue of displacement of economic activity from one location to another, it is not possible to simply sum the city region estimates of economic impact to come to an aggregate view.

3.43 Allan Cook also identified that HS2 will bring benefits during the construction period. The Treasury's position is that any employment-related impacts of construction projects are simply displacement from one part of the economy to another. That is, if people were not employed building HS2 they would be employed on other construction projects elsewhere. While this position is reasonable for a typical transport infrastructure project, for a project of the scale of HS2 it ignores a number of potential impacts:

- Through upskilling and the development of new approaches and construction techniques, HS2 leads to an increase in the productivity of the construction sector (both trades and design and management) that leads to a long-term increase in the productivity of the sector;
- It creates the opportunity for firms involved in the construction of HS2 to export their skills and experience to a global market

3.44 For this report, we have compiled recent work developed by city regions from across the North that has sought to identify the impact of HS2 on local economies. These studies have sought to quantify the impact of HS2 on GVA and job numbers. Each of the studies we have reviewed has been supplied to us by their respective commissioning authorities in response to

[17] *op. cit.*

a request to provide what they considered to be the most pertinent pieces of their own analysis.

3.45 The studies we have reviewed have looked at impacts in the immediate vicinities of HS2 stations, as well as the wider city regions. Some studies have sought to quantify construction impacts. Headline findings from a number of these studies are summarised in Table 3.3 and Table 3.4. In these Tables, we have classified the economic benefits as either City Region impacts or Growth Strategy as per Allan Cook's identification of benefits as not being included in the cost benefit calculus. While some city regions have considered construction impacts, the evidence available to us is not as comprehensive as the other two sources of benefits and so these benefits are omitted from the tables.

3.46 The additional impacts of HS2 will not be limited to those quoted in the two tables – they simply reflect the evidence available to us. HS2 will also serve Crewe, Wigan, Preston and Carlisle on the west side of the country, as well as Darlington and Newcastle on the east. Authorities in each of these areas anticipate gains to their local economies and are working to develop plans and strategies to secure and maximise these impacts.

3.47 In many respects and as we have already noted, these studies are seeking to fill a gap in the national level evidence base. City regions have identified substantial local impacts, which are additional to those that underpin the cost benefit analysis and if they were to materialise would contribute to the Government's goal of rebalancing the national economy by supporting and facilitating economic growth in the North. However, there are limitations to these analyses and it is not possible to simply add these numbers together to derive a net impact across the North. This is because:

- Different analytical frameworks have been deployed which means that the definition of what is additional GVA (say) in one area may not be the same as in another area;
- Different studies deploy different price basis;
- Perhaps most substantively, no consideration is given to displacement when calculating net impact. This can have two facets. The first is that HS2 will result in some economic activity shifting to a better-connected location. The second is that city region A's estimate of additional GVA growth over and above displacement may overlap with city region B's estimate – the two city regions could be claiming the same growth estimate.

3.48 If the full range of benefits that HS2 will bring are to be considered when coming to a view on HS2's value for money, it seems essential that work is undertaken to produce a coherent and comprehensive national assessment of the wider impacts identified by Allan Cook. This will take some time to do, but any decisions on the future of HS2 without this assessment would be premature. Even with additional work, there will inevitably be still some uncertainty around these estimates (due to the limitations of data and modelling techniques), but it must be better to consider this uncertainty when coming to a view on value for money than simply ignore monetised estimates of these benefits.

Table 3.3: City Region Assessment of Benefits – City Region Impacts

	Impacts	Jobs	GVA
Liverpool City Region		24,000 jobs (Impact of HS2 direct services via NPR)	Benefits (60) year £14, 502M based on connection via NPR.
Greater Manchester			KPMG benefits by 2037, 2013 prices, Greater Manchester £0.6-1.3bn per year, 0.8%-1.7% increase in local economic output. (20)
Leeds City Region/West Yorkshire	Eastern Leg. Increase in GDP relative to current levels of accessibility, every year, Leeds City Region: £150M. (7) Productivity benefits, WEI modelling, £750M Leeds CR PV 2002 discounting, Almost 80% of Leeds benefits are accrued in financial and business services (9) Additional GDP per year based on direct estimated benefits - two thirds by HS2 East regions. Leeds CR: £128M per year point estimate (11).	Additional jobs across Leeds City Region: At least 20% of HS2 workforce from Leeds City Region. 5% of these workers previously unemployed. 40,000, (5,000 direct from HS2) by 2050. (14) Additional jobs in Leeds City Centre from planned investment (including HS2) 24,500 by 2050. (14) New direct jobs created by HS2 in Leeds, 50,000 by 2050 (21)	GVA added to regional economy: £54bn by 2050, extra to the region every year from 2050, £3.8bn (14) Productivity benefits, 2037 and persist in years following opening of HS2, point estimate, 2013 prices, West Yorkshire £1bn (19) KPMG benefits by 2037, 2013 prices, West Yorkshire £1bn per year, 1.6% increase in local economic output. (20)
Sheffield City Region/South Yorkshire	Eastern Leg. Increase in GDP relative to current levels of accessibility, every year, Sheffield City Region: £105M, unclear price base (7) Additional GDP per year based on direct estimated benefits - two thirds by HS2 East regions. Sheffield CR: £99M per year point estimate. (11)	Net additional jobs against base year (2018 - 2048), Low growth 11,630, High Growth 22,970 (3) Job impacts in Sheffield 10,000 (requires more work according to report) (21)	Productivity benefits, 2037 and persist in years following opening of HS2, point estimate, 2013 prices, South Yorkshire £0.5-0.9bn (19) KPMG benefits by 2037, 2013 prices, South Yorkshire £0.5-0.9bn per year, 1.9%-3.2% increase in local economic output. (20)

	Impacts	Jobs	GVA
Wider North	Conventional Transport benefits: HS2 to Manchester £37,292M, HS2 to Leeds via the three cities and Sheffield City Region £59,896M, 2002 discounting (8) Productivity benefits: East vs West, £2.6bn vs £2.1bn (9) (70%) of the productivity benefits of the eastern route are created by the faster journeys to London. (30%) of productivity benefits from the eastern route will also result from High-speed Rail bringing city regions outside London closer together. Additional GDP per year based on direct estimated benefits - two thirds by HS2 East regions. North East £14M, per year, point estimate. (11)	Additional jobs in York Central. 7,000 by 2050 (14)	GVA York Central, £1.6bn Economic uplift (14)

Table 3.4: City Region Assessment of Benefits – Growth Strategy Impacts

	Impacts	Jobs	GVA
Liverpool City Region			Increase in land values £179M (60 year Net Present Value, 2010 prices) (2) Increase in Business Rates £395M (60 year Net Present Value, 2010 prices) (2).
Greater Manchester		HS2 job impacts, Manchester - Piccadilly & Airport - 60k, Crewe - 37k around station.	

	Impacts	Jobs	GVA
Leeds City Region/West Yorkshire	Leeds Station will be transformed as part of plans to bring HS2 to Leeds. 134% increase in passenger numbers to 30M in next 30 years - comparable with Kings Cross (12)		
Sheffield City Region/South Yorkshire	Net uplift of housing units against base case 2018-48, Low Growth - 1,701, High Growth - 2,182 (3)		30 year period 2018-48 based on land and property development - Against the base case, Low Growth - £7,132M, High Growth - £13,228M (3)
Wider North			

References to Table 3.3and Table 3.4 are included in an Appendix to this report.

Key Messages

- Through the provision of additional rail capacity, both directly and by allowing reallocation of capacity on the classic rail network to passenger and freight services, HS2 will lead to additional economic benefits that are not captured within the conventional welfare framework
- In his stocktake, Allan Cook identifies that HS2 can support regeneration around stations and within city centres. Local authorities across the North have seized the opportunity that HS2 brings to develop Growth Strategies focussed around their HS2 station hubs.
- Allan Cook also identified that HS2 will bring benefits during the construction period
- HS2 will create the opportunity to reallocate capacity on existing classic railway lines to other passenger services and freight
- City regions have sought to fill the gap in the national evidence base through their own analysis. This work has identified that at a city region level these benefits are substantial, although it is not possible to simply sum city region assessments to come to a value of the net impact on the North or the country as a whole

Other Benefits

3.49 As already set out, HS2 will create the opportunity to reallocate capacity on existing classic railway lines to other passenger services and to freight. In particular, it creates the opportunity to add new long-distance freight services on the West Coast and East Coast Main Lines. Work published by DfT in 2017 notes that HS2 has the potential to free up enough capacity to create additional freight paths between London to the Liverpool area, where there are several important freight terminals[18]. That work goes on to note that capacity released on the ECML could be used to serve intermodal flows from East Anglia and the Thames Gateway to Yorkshire and North East England. It also creates an opportunity for containers to be landed in the Mersey estuary to be transported by rail to the distribution centres in the Midlands, rather than being landed at Thames Estuary or South Coast ports. This offers further potential benefits from relieving pressure on the congested rail and road networks.

3.50 The benefits of the take up of additional freight paths have not been explicitly considered within the HS2 cost benefit analysis. These benefits would come about for two reasons:

- A productivity gain to the logistics sector;
- Due to fewer lorries using the road network and the Strategic Road Network in particular

3.51 Analysis undertaken for the Liverpool City Region has suggested that additional freight services from the Liverpool City Region to routes using the West Coast Main Line could generate up to £158m[19] per path.

[18] Steer Davies Gleave (2017) *HS2 Released Capacity Study: Summary Report*

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/629168/high-speed-two-phase-two-strategic-case-appendix-hs2-released-capacity-study-summary-report.pdf

[19] PV over 60 year in 2010 prices and discounted to 2010

Northern Powerhouse Rail

3.52 In this Chapter, we have deliberately focussed on the benefits associated with HS2. It is the future of HS2 that is currently being considered, after all. However, in this context it also helpful to note the interdependency between HS2 and NPR. As currently specified by TfN, NPR would use the HS2 Phase 2b infrastructure on its approach to Manchester via Manchester Airport. Additional benefits could accrue to HS2 by its services using NPR infrastructure between Warrington and Liverpool as this would provide a faster route to Liverpool than HS2 services using the classic line between Crewe, Runcorn and Liverpool and it also would allow capacity on the classic line to be reallocated to local and/or freight services. East of the Pennines, NPR services between Sheffield and Leeds would use a section of the HS2 Phase 2b line. Put simply, the current preferred NPR option cannot be delivered without HS2.

3.53 Should HS2 Phase 2b not go ahead, there appear to be two potential outcomes:

- Build elements of the HS2 Phase 2b infrastructure as part as the NPR programme, which means that the cost 'saving' of not building these parts of HS2 Phase 2b would be illusory – it would be simply be re-allocated;
- Changing the specification of NPR, which would both delay its progression towards implementation and potentially diminish its benefits and increase its net cost.

Summary and Implications

- If rail travel – both for passengers and for freight – is to continue to grow more network capacity is needed.
- As established by the Northern Powerhouse Independent Economic Review, transport connectivity is one important factor that has constrained growth.
- Once a decision has been made to provide new inter-city rail capacity, revenue and benefits are maximised by building it to operate at the high-speeds found across Europe and in the Far East.
- Inherently, the published HS2 business case assumes that the Government's Northern Powerhouse (and Midlands Engine) policy platform has no impact on the long-term scale or distribution of growth.
- Alternative future scenarios that reflect the likely outcomes from the Transport for the North, Midlands Connect, and other national policy agendas such as NetZero – along with changes in transport technology and business models – suggest HS2 can deliver high value-for-money, even after accounting for recently announced potential cost increases and delays.
- Robust scenario planning work is required to confirm the conventional case is robust across a wider range of plausible and likely future scenarios rather than just the single DfT 'Business-as-Usual' case.
- City Region work has identified that HS2 will result in substantial and material uplifts to their local economies, uplifts that can be amplified by implementation of their Growth Strategies. However, it is not possible to simply add all these local impacts to het a national picture.
- Work is urgently required to demonstrate how the various pieces of evidence produced by the City Regions and others for the economic impacts of HS2 form part of the overall benefits picture.
- Significant interdependencies exist between HSR and NPR.

4 Transport: a wider economic ecosystem perspective

Introduction

4.1 Informed by the 'usual' approach taken to assessing HS2's benefits, this chapter points the way towards a fundamental shift in how we assess the transformational impacts of large transport infrastructure projects in the UK. This complements the preceding discussion by:

- Considering how we might articulate a methodology for developing scenario-based appraisals that include complex economic benefit drivers, and;
- Aiming to gain better traction with senior policymakers by providing a clear 'Theory of Change' and supporting strategic narrative that can add context and colour to support traditional cost benefit analysis.

4.2 Public policy has started to flesh-out 'place-based' strategic approaches (e.g. Science and Innovation Audits, Local Industrial Strategies, Strength in Places funds etc). This place-based policy work seeks to identify and exploit distinctive and geographically-specific aspects of competitive advantage. The shift to a national-level Industrial Strategy has reinforced this approach by providing a framework for weaving together innovation, supply chains and the other dimensions of industrial competitiveness. These are aspects of place-based strengths that rely heavily on transport, including high speed rail.

4.3 This pragmatism in Industrial Strategy, and recognition of the importance of 'place', has yet to be reflected in the policy approach to appraising and evaluating transport investments. If this gap in policy thinking is not closed, there is a risk that restrictively narrow transport appraisal methods, de-coupled from Industrial Strategy, will hinder future economic prosperity. Transport investment appraisal needs to become much more of an integral part of Industrial Strategy, particularly when considering productivity and its drivers.

4.4 Consequently, this Chapter starts to examine more appropriate methods for appraising the benefits of transformational transport investments – approached as a set of different future scenarios that combine both quantitative and qualitative dimensions. If the recommended way forward is adopted, then the following strategic framework can serve as a 'direction of travel' that can include quantified economic benefits within a qualitative 'Theory of Change' account of the key transformational drivers of change that will delineate different future scenarios.

Conclusions from the academic and policy literature

4.5 The academic and policy literature relevant to the relationships between regional economic performance and transport highlights the following key conclusions:

- First, it is important to approach transport benefits from the perspective of 'functional economic geographies': how production and consumption are configured spatially and, as

a result, rely on transport. Furthermore, these functional economic geographies are linked via global supply chains, further reinforcing the enabling role of transport.[20]

- Second, and given this emphasis on functional economic geographies, whether or not specific transport investments generate a high return on investment is determined not by the 'intrinsic' characteristics of the transport system but by the 'extrinsic' impact of that transport system on the wider functional economic geography. Of course, one of these impacts (which is already addressed in transport investment appraisal) is the way in which better transport increases the size of a functional economic geography [21]. However, aspects like innovation (and creativity more generally) are vitally important 'extrinsic' dimensions – often best captured qualitatively via a Theory of Change rather than relying exclusively on quantitative methods.

4.6 This implies that high-speed rail is a dependent, not independent variable, in regional economic development. Regional industrial strategies, and the ability to deliver those strategies, are the independent variables that determine the nature and extent of the economic impacts of high-speed rail. Above all, it is the local strategies that turn potential into actual benefits. Passive responses at a regional level that treat the benefits 'as a given' are more likely to lead to disappointing outcomes. This is why similar investments in different cities, regions and countries generate different outcomes – a key insight from the evidence-base.

Selected case studies

4.7 Case studies of high-speed rail and connectivity improvements highlight the following key success factors.

Case Study 1: France - TGV

The main objective of the high-speed network (TGV) in France was to increase capacity on key corridors and improve speeds and mobility between the major cities in order to support economic 'rebalancing' and stimulate investment in post-industrial cities. Lyon was the first city to be connected into the TGV network, stimulating significant employment growth and a new 'city quarter' surrounding Part-Dieu station. Contrary to initial concerns that a high-speed link to Paris could draw businesses away from the city, instead the link has been key to attracting offices for multi-national firms to Lyon – particularly regional offices often in addition to a 'Paris HQ'.

Integration of a new TGV station at Lyon Part-Dieu into the wider masterplan for the area has acted as a major catalyst for regeneration and provides nearly 2 million sq ft of office/commercial space with more than 40,000 employees (potentially up to €2bn GVA). Access to the TGV network has supported Lyon in cementing its position as the main regional centre of the Rhones-Alpes region, home to major companies including EDF, EDRF, Emirates and Air France.

Key to Lyon's success – and the Part-Dieu business district – has been the continued growth of TGV services to destinations across France, together with its position at the hub of a multi-

[20] See for example, Rodrigue, J. P. (2006) Transportation and the Geographical and Functional Integration of Global Production Networks. *Growth and Change*. Special issue on Transport and Global Production Networks. Vol 37 (4).

[21] See Vickerman, R. W. (2015) High-speed rail and regional development: intermediate stations in border regions. *Journal of Transport Geography*, Vol 42. pp. 157-165. ISSN 0966-6923; and Blanquart and Koning (2017) The local economic impact of high-speed railways: Theories and facts. *European Transport Research Review.* Vol 9 (2).

modal transport network of regional TER rail services, enabling these benefits of high-speed rail accessibility to be spread across the wider region. It demonstrates how high-speed rail can effectively support continued growth within already-established business centres – as is being planned across all northern city regions – as well as support local development through integrated spatial and economic planning.

Implications

- High-speed rail can support the economic development and growth of 'second-tier' cities by providing improved accessibility, which can be particularly important for attracting 'regional' offices from capital cities
- an integrated and coherent spatial and economic plan – as seen at Lyon Part-Dieu – is important to ensuring the local regeneration opportunities of high-speed rail are maximised, and that cities are able to take advantage of the improved connectivity from high-speed rail
- ensuring good onward connectivity from high-speed rail stations – achieved at Lyon Part-Dieu through an extensive regional rail ('TER') network and bus and metro services – is important to ensure that the benefits of the high-speed rail link are shared across the wider region, and do not simply accrue to the area within the immediate vicinity of the high-speed rail station

Case Study 2: UK – HS1

High-Speed 1 (HS1) is a 108 km high-speed railway linking London St Pancras International station with the Channel Tunnel. The first sections of HS1 connecting to the Channel Tunnel opened in 2003 and the section into central London was completed in 2007. HS1 has intermediate stations at Stratford in London, and Ebbsfleet and Ashford in Kent.

International passenger services operate to Paris and Brussels. In 2009 a network of domestic high-speed services was introduced serving the HS1 stations and other stations on traditional lines across north and east Kent.

A recent study (Delivering for Kent – the Economic impact of HS1) estimated that the services which use HS1 support more than £400m of economic benefits annually to the UK and continental Europe. The study estimates that in the sixteen years since the first section of HS1 opened, cumulative benefits of £4.5bn have been delivered. Domestic services account for around £150m of the total annual benefit. Over two-thirds of this benefit comprises:

- Benefits from users of the wider network, who benefit from additional services from the capacity released from HS1 on the existing network. Services from London Victoria to some suburban stations in South London, for example, doubled in frequency when faster, non-stop services from London to Kent moved to HS1;
- Productivity benefits from increased agglomeration, with reduced journey times bringing firms and workers effectively closer together;
- Service quality improvements, including increased reliability and punctuality from a new, 21st century railway;
- Environmental benefits, including mode shift from private car and reduced carbon emissions.

4.8 These case studies indicate that high-speed rail has the potential to play a transformational role in supporting productivity and economic rebalancing. However, this impact does not happen automatically: maximising the benefits requires an integrated approach, ensuring that new stations are integrated into wider economic development plans and surrounding transport networks. In this sense, these case studies reinforce the conclusions from the academic literature.

4.9 The French experience – in Lyon, together with Lille, Liege and other cities – demonstrates that the benefits of high-speed rail can be maximised when stations are planned in conjunction with surrounding development, often by a public-sector development body (such as at Lyon Part-Dieu). Efficient onward public transport links ensure the benefits of improved accessibility can be spread across the wider region, rather than simply the immediate vicinity of the HSR station.

4.10 High-speed rail, as seen in France and elsewhere, can play an important role in enabling cities to rebalance their economies towards the 'knowledge economy'. HSR can help to change perceptions of a city and stimulate investment (such as Lille which repositioned itself as a tourism and cultural destination), but for benefits to be maximised, this should be accompanied by wider investment in skills and other infrastructure.

4.11 HS1 offers a case study in how HS2 can help support similar outcomes within the North of England. HS2 will help to release capacity on the existing network, with limited-stop InterCity services from Manchester, Leeds and Birmingham moving to the new line, providing greater capacity for additional regional and commuter services across the North. The improved reliability, quality and comfort of HS2 services will help to attract more passengers to the railway. The unrivalled accessibility of new HS2 stations in Manchester, Birmingham and Leeds will help to support high-density mixed-use development, as already set out in Manchester's Piccadilly Station Strategic Regeneration Framework, Birmingham's Curzon Street Masterplan and Liverpool's plan for a combined NPR/HS2 hub.

Key Messages

- Access to fast transport connectivity should be considered comprehensively in terms of its role as an enabler of a modern innovation-driven economic ecosystem.
- Transformational transport projects can only deliver results if the right structures of thought-leadership and convening power are in place.
- Selected case studies illustrate that high-speed rail can support increased productivity and economic rebalancing. However, this impact does not happen automatically. Maximising the benefits requires an integrated approach, ensuring that new stations are integrated into wider economic development plans and the surrounding transport network.

Understanding transport's contribution to the economic ecosystem of the North

4.12 In response to the findings from academic and policy analysis, the framework outlined below treats rail connectivity as a strategic opportunity for the Northern Powerhouse – but, as stressed above, as a dependent 'enabling' factor within a broad and ambitious place-oriented Industrial Strategy. This regional industrial strategy is a key independent variable which will drive economic development, making use of improved transport connectivity as part of a broader set of relationships. Improved transport connectivity combines fast travel with slow high-volume freight transport – both are important and contribute to supply chain efficiency. These inter-relationships generate innovation, inward investment and trade expansion.

4.13 The absence of high-speed rail connectivity and freight capacity will make it harder for the North to play its role in re-balancing the UK economy. A future projection of the North without these benefits is an *entire* future scenario, and as such, missing out on these benefits cannot

be simply and easily quantified (and hence modelled) as a discrete economic impact on the North.

4.14 The economic ecosystem perspective used here considers the role of high-speed rail and slower freight capacity as one contribution to economic growth, structural change, social inclusion and reduced environmental impacts. This contribution of rail is valuable because it makes it easier for the Northern Powerhouse to deliver on its strategic intent – it is this pro-active strategic intent that is the key success factor. In this sense, this approach differs from standard 'passive' analyses that treat transport connectivity as an independent variable.

The importance of transport in modern innovation-driven supply chains

4.15 We have become used to thinking about industrial performance as a matter of 'sectors', but we also balance this sectoral view by recognising that there are supply chains - and complex economic inter-dependencies that arise from these. As these supply chains become more extended (i.e., 'longer') the output multiplier effects are amplified, especially if they are manufacturing supply chains (service supply chains have a weaker impact on output multipliers).[22]. This means that regional industrial strategy can boost multiplier effects rather than simply accept them 'as a given'. Inadequate transport restricts this ability to amplify local multiplier effects.

4.16 These regional supply chains are also often globally connected – albeit in complex ways. The income and wealth captured by a place reflects the range of global supply chains its firms participate in, and the prominence of that participation (the proportion of the value-added in each global supply chain that is 'captured' in a regional segment). This means that regional economic performance is driven by its external (national and international) connectivity and by how strongly its internal industrial structure can amplify these flows of economic activity for local benefits.

4.17 Transport, in general, is a transaction cost in these supply chains. The speed and cost of transport affects overall supply chain performance. For example, the cost of moving inventories along supply chains is strongly influenced by the speed, cost and reliability of transport (irrespective of whether this is road, rail, sea or air).

4.18 Critically, innovation is also a key driver of a region's supply chain performance. Building and retaining a competitive edge using technologies, IP and know-how helps to enhance supply chain participation and drive regional prosperity. Innovation itself is also heavily dependent on transport connectivity - the importance of face-to-face contact means that fast and reliable connectivity is a key enabler of innovation.

4.19 Finally, ease and cost of commuting affects both supply chain performance and household disposable income. Commuting is a transaction cost for households (and often a major transaction cost).

[22] See McNervey, J et al (2018) How production networks amplify economic growth. *arXiv*, 1810.07774v1.

Supply chains and the North

4.20 NPIER defined its 'Prime Capabilities' in a way that exploits these economic realities. The four Primes *Advanced Manufacturing/Materials, Energy, Health Innovation* and *Digital* are innovation-driven and productivity enabling segments of broader supply chains. They seek to position the North as a prominent node in the web of international supply chains that define much of the global economy, creating wealth, value and competitiveness in the process.

4.21 One important feature of the Primes and their supply chains is, however, that they are less 'urbanised' than comparable supply chains. The Primes distribute the benefits more broadly - but are especially reliant on effective transport. Consequently, fast, cost-effective and perhaps most importantly reliable transport is central to the North's future economic prospects. Whilst the south of England's supply chains already benefit from a far more substantial legacy of investment in transport, the North does not.

Key Messages

- Not having the high-speed rail connectivity and conventional capacity that HS2 will provide will make it harder for the North to play its role in re-balancing the UK economy.
- The importance of access to fast transport connectivity is best grasped by moving beyond simple sector-based thinking to consider how a region is positioned in global supply chains.
- Regional economic performance is driven by external connectivity and by how strongly its internal industrial structure can amplify these flows of economic activity for local benefits.
- The Northern Powerhouse's 'Prime Capabilities' sit within supply chains with global connectivity, hence fast transport connectivity and boosted capacity will play a critical role in the Primes' future success.
- The geographic dispersion of Prime Capabilities in the North reinforces the importance of transport connectivity.

The role of fast transport in a modern regional economic ecosystem

4.22 The competitive viability of a region's system of supply chains (especially *innovation-enabled supply chains*) is influenced by a combination of internal and external transport connectivity. High-speed rail plays an important role here. The combination of speed and capacity it provides, in both a new and existing network, and including the additional freight capacity it creates in existing networks, contributes to overall supply chain performance.

4.23 High-speed rail matters because it is a key part of the broader fast transport function that is central to a modern economy. This contribution is, however, most important not in regard to supply chains as they are currently configured and function (unless major disruptions take place) but in relation to how they evolve via investment and innovation. Innovation and investment require face-to-face meetings and co-working to build trust and generate new ideas. If the travel necessary for this face-to-face contact is slow and unreliable then the face-to-face contacts are reduced and, eventually, the dynamism necessary to evolve key supply chains dissipates.

4.24 Figure 4.1 provides a depiction of how fast transport connectivity drives the evolution of a modern, innovation-enabled, supply chain system. Crucially, delivering the benefits of such a system requires a 'benefits realisation' ethos from regions and their governments. The

Northern Powerhouse is distinctive in possessing this 'strategic value-added' capability and is therefore well-placed to maximise the Social Return on Investment from HS2.

4.25 The ecosystem's functions are grouped into four key domains:

- People, skills and culture;
- Infrastructure and assets base;
- Knowledge and innovation, and;
- Business and enterprise.

4.26 As with any complex system, these domains mainly serve to lay-out key features – their boundaries are permeable and the crossovers between domains are important to the ecosystem's performance. National and International supply chain systems have been placed at the centre of the ecosystem because this is how economic growth and development is delivered.

People, Skills, and Culture

4.27 Access to fast transport connectivity plays a key role in bringing vibrancy to a regional economy by setting in motion a set of cumulative (self-reinforcing) benefits that in combination boost GVA and jobs. The depiction highlights the resulting boosts to the visitor economy, an increased likelihood of attracting and retaining skilled people and strengthened interpersonal relationships that result from regular face-to-face contact (that builds trust and reciprocity). The resulting 'social capital' is an extremely valuable intangible asset for a region – most especially when this social capital is built-up alongside participation in global supply/value chains.

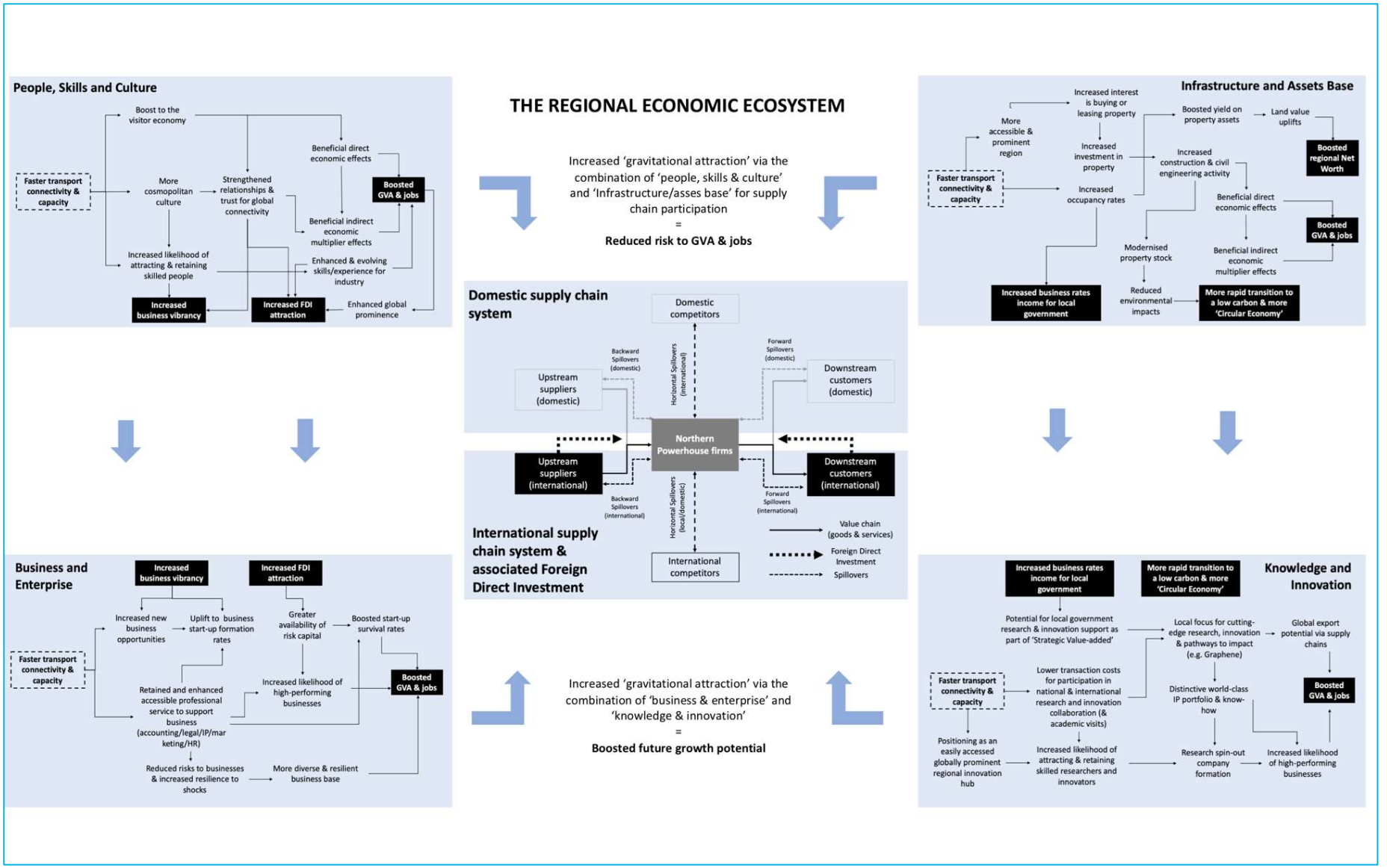
4.28 The importance of an evolving cosmopolitan culture stems from its role in attracting and retaining talented people. Fast transport connectivity plays an important role here too – isolation results in cultural stagnation. Given the ability to attract Foreign Direct Investment (FDI) rests in part on global supply/value chain participation, this combination of social capital 'outreach' and global supply chain participation provides a powerful growth driver. The effects of these inter-dependencies are to produce economic growth and raise the global prominence of a regional ecosystem, attracting attention and respect.

4.29 A modern outward-facing regional economy relies on access to fast transport connectivity to provide the all-important links to the rest of the global economy. Fast trains are a key part of this mix, although it is the collective provision of fast transport that matters the most (e.g. fast rail to airport inter-connectivity). Without this fast connectivity it is far more difficult to achieve the economic vibrancy that drives economic growth and development via people, skills and culture.

Infrastructure and access to Assets

4.30 Access to fast transport connectivity also plays an enabling role in the evolution of a region's tangible assets, particularly land-use and property. It creates increased vibrancy which sets in motion a 'chain reaction' that boosts occupancy rates, increases interest in land and property investment, and generally results in a thriving infrastructure and asset base.

Figure 4.1: A Northern-level economic ecosystem perspective on transport-enabled benefits



Source: Steer Economic Development

4.31 However, there is more to consider. A key issue is how the contribution of fast transport connectivity to the infrastructure and assets base generates indirect knock-on effects for all the other domains. There are many ways in which these crossovers take place. The diagram draws attention to the synergies with the knowledge and innovation domain. Specifically, the modernisation of infrastructure and assets opens up new possibilities to drive a region's research and innovation activity. Any new investment in this domain creates opportunities to develop and implement new technologies.

4.32 New investment stimulated by fast transport connectivity can position cities to play a prominent role in integrated lower-carbon urban innovation, part of the transition to a more 'circular economy'. However, achieving this positioning requires the 'strategic value added' of local governance to play a thought leadership role. As illustrated in this quadrant of the diagram, one approach is to combine these waves of new property investment with local research and innovation activities carried out via university-business partnerships. This leverages property and infrastructure investment as an R&D and commercialisation funding source *and* helps to build the distinctive global prominence of the region at the cutting-edge of lower-carbon and circular economy innovation. These major opportunities are far more easily opened-up with fast transport connectivity in place. It is hard to 'sell' a region as a cutting-edge exemplar of lower-carbon and circular economy technology if it is relegated to being a modern transport 'backwater'.

Knowledge and Innovation

4.33 The ecosystem's prowess in knowledge and innovation is similarly hard to build if that region is disconnected from modern fast transport systems. Cutting-edge research at a global level tends to be internationally collaborative. This collaboration brings together the best minds and research equipment to generate and commercialise valuable Intellectual Property (IP). This brings the necessary scale, scope and deep expertise into play – collaborations from which all participants gain. Manchester's innovation prominence in Graphene and 2D materials is an excellent example of this type of benefit.

4.34 It is far harder to be positioned as a globally prominent hub in these international research and innovation collaborations if you are hard to get to – and to get out to the rest of the world from. Access to fast transport connectivity plays a catalytic role in realising the potential from regional innovation.

Business and Enterprise

4.35 Similarly, in the business and enterprise domain, access to fast transport connectivity plays a catalytic role. Easier face-to-face contact allows new business opportunities to be identified and exploited. The success of these new ventures is greatly assisted by the local availability of a range of business support services (accounting, legal, marketing, IP etc) that are all widely acknowledged to rely on fast transport. As highlighted in the people, skills and culture domain, boosts to FDI play a useful role in making business and enterprise tick. Risk capital is more readily accessed, and the likelihood of creating high-performing firms that can transform regional economies goes up.

Concluding observations

4.36 From an economic ecosystem perspective, currently used economic appraisal methods for major transformational transport investments are too narrowly framed and too restrictive as regards the beneficial interactions between transport connectivity and capacity and economic growth. The current approach is overly 'compartmentalised' around sector definitions.

4.37 Although this compartmentalised' approach simplifies the economic appraisal challenge (and works reasonably well for small transport investments), when it comes to major transport investments this simplification comes at a cost of diverging from the reality of how modern economies thrive (indeed how economies have thrived since at least the first Industrial Revolution).

Key Messages

- The delivery of benefits from fast transport connectivity and boosted capacity is dependent on the effectiveness of regional/local 'strategic value added' – the ability to make useful change happen via thought leadership and convening power.
- The importance of access to fast transport connectivity can be appreciated by considering its multiple roles in a modern regional economic ecosystem covering: People, skills and culture; infrastructure and assets base; knowledge and innovation, and; business and enterprise.
- The North's long-term economic potential is shaped by the interplay of these four key domains and relies on access to fast transport connectivity to exploit the benefits of its global positioning
- Given the importance of face-to-face contact in R&D, innovation, trade and investment, improved transport systems are the key enabler of highly beneficial ecosystem effects.
- Similarly, an evolving cosmopolitan culture enabled by 'fit for purpose' rail transport is a key intangible asset – in attracting and retaining the talented people who drive growth.
- Thanks to its strategic capacity, the Northern Powerhouse is well-positioned to deliver the economic benefits of access to transformational connectivity.

Summary and Implications

4.38 The following key messages emerge from this consideration of the role of fast transport in innovation-driven regional economic ecosystems.

Implications

- Improve the alignment of transformational transport investment appraisal with national Industrial Strategy
- Consider supply chain systems not sectors: a modern regional economy is made from complex supply chains that connect that region to the rest of the global economy
- Recognise that transport is an integral function in these supply chain systems: the performance of these supply chains relies on transport – both fast and slower high-volume. The more geographically dispersed the supply chain system the more important the transport function is
- Transport's key role in supply chains shapes value-added capture: slow, badly inter-connected and unreliable transport compromises the ability for a region to capture and leverage supply-chain value-added
- Recognise that innovation drives supply chain system evolution: the innovative activity that determines which supply chains stagnate and become obsolete and which thrive and drive regional prosperity requires modern transport
- The current approach used for transformative transport projects is overly 'compartmentalised' around sector definitions and because of this does not fully capture the impacts the impacts of interventions that have cross-sectoral impacts.
- We should move forward via scenario-based economic appraisals that compare plausible futures against each other by capturing key 'ecosystem' interactions – thus illuminating the multiple indirect impacts of major transformative transport investments.
- Sticking with current appraisal and related modelling methods (the 'status quo') risks perpetuating an unbalanced UK economy because the full transformational impacts of major transport investments cannot be captured without using a more realistic mix of quantitative and qualitative 'theory of change' based thinking.

5 Conclusions & Recommendations

Lack of rail capacity is a constraint to growth

5.1 HS2 was developed to meet the pressing challenge to increase the capacity of Britain's rail network and to facilitate and accelerate economic growth, as an integral part of rebalancing the national economy.

5.2 Investment in increasing capacity has not kept pace with passenger demand growth, and the resulting knock on effects have reduced the reliability and resilience of the rail network. Limited capacity also limits the ability to cater for increased freight flows, and in particular access to ports which remain the backbone of international trade. The report acknowledges that lack of capacity on the North's rail network acts as an important, but by no means exclusive, constraint on the North's productivity growth.

Why investment in new railways is important

5.3 Cities and towns, more specifically the centres of cities and towns, are the drivers of economic growth. Enhancing cities and towns' transport connectivity is one factor that will allow them to realise their further potential. The North's roads are already congested and in need of targeted enhancements, but the cost of meeting all demand is prohibitive and the environmental impacts of the scale of new roads needed is unacceptable. In contrast, this report argues that rail offers a way of increasing capacity for commuters, business and leisure travel which is environmentally acceptable and economically worthwhile.

5.4 However, while up-grading to increase capacity is the right solution for some lines, the capacity uplift upgrading can deliver is limited, as well being highly disruptive to existing rail users. New lines will provide a much greater capacity uplift, as well as create the opportunity to re-use capacity on existing lines for local, inter-regional and freight services.

The rationale for HS2 and NPR

5.5 Rebalancing the national economy requires the North to grow at faster rates than it has historically. HS2 can help support the North's competitiveness by improving its inter-city links to London and the 'world city' economic functions it offers, as well as neighbouring regions and international gateways. NPR's key and complementary purpose is to help the North's great cities function more like a single labour market, which will in turn enable agglomeration and support productivity. Critically, NPR, through its use of HS2's infrastructure on the west and east of the Pennines, is symbiotic with HS2.

5.6 The focus of this report is on the benefits of HS2, however the report does identify significant interdependency between HSR and NPR. (i.e. this includes shared use of sections of infrastructure, as well as benefits from released capacity).

The conventional welfare case does not fully reflect the economic impacts of HS2

5.7 The published HS2 business case is based on a single view of future economic growth and distribution of population and employment. Essentially, this is a 'business as usual' scenario, which inherently assumes that the Government's Northern Powerhouse (and Midlands Engine) policy platform has no impact on the long-term scale or distribution of growth.

5.8 In addition, the 'business as usual' view of growth reinforces the continued dominance of London. This approach needs to be reconsidered when measuring the transformational impacts of large-scale infrastructure projects outside London designed to support rebalancing the national economy.

5.9 This report argues that there is a need to consider alternative future scenarios which is particularly apposite when developing transport strategies or considering the case for large scale investments such as HS2. Alternative future scenarios, that reflect the likely outcomes from the Transport for the North, Midlands Connect and other national policy agenda such as the NetZero – along with changes in technology and business models – suggest that HS2 can deliver high value-for-money, even after accounting for recently announced potential cost increases and delay.

5.10 Through the provision of additional rail capacity, both directly and by allowing reallocation of capacity on the classic rail network to passenger and freight services, HS2 will lead to additional economic benefits that are not captured within the conventional welfare framework

5.11 HS2 will support regeneration around stations and within city centres. Local authorities across the North have seized the opportunity that HS2 brings to develop Growth Strategies focused around their HS2 station hubs. This report has identified that at a city region level these benefits are substantial, although it is not possible to simply sum city region assessments to come to a value of the net impact on the North or the country as a whole.

5.12 The assessment has emphasised the ways in which currently used economic appraisal methods for transformative high-speed rail and associated connectivity projects are too narrowly framed and too restrictive as regards the beneficial interactions between connectivity and capacity and economic growth. The current approach used for transformative transport projects is overly 'compartmentalised' around sector definitions and because of this does not fully capture the impacts of interventions that have (and are specified to have) cross-sectoral effects.

5.13 In many respects, this position is recognised by the Department for Transport, but there is a misalignment between the timescales for its research work developing appraisal techniques and the timescales for making decisions with respect to the future of HS2.

5.14 Given the above, this report argues that taking any decision on the future of HS2 without explicitly considering these alternative scenarios would therefore be premature.

The inter-relationships between transport and the other drivers of productivity

5.15 As established in the NPIER, transport connectivity is *'necessary but not sufficient'* to deliver transformation in the North's economy. Skills, Enterprise, Innovation, Trade and Inward Investment are all important drivers of economic activity. This report acknowledges that the interplay between these drivers is complex, difficult to capture and separate out within an empirical modelling framework. At the same time, the report argues that more sophisticated understanding is needed of the inter-relationships and interactions between the productivity drivers when examining future economic growth scenarios for the North relative to 'business as usual', and the specific impact unlocked by HS2.

5.16 Investment in high-speed rail, associated connectivity, and wider strategic infrastructure in the North needs to be assessed in this wider, broader 'ecosystem' context. A context in which HS2 enables the North to play its full role in generating competitiveness, delivering ideas and innovation, matching its people to the jobs in which they will be most productive, retaining and scaling enterprises and exporters, and attracting high-value inward investment.

Recommendations

5.17 The 'business as usual' scenario for growth is inappropriate to measure the transformational impacts of large-scale infrastructure projects, such as HS2.

5.18 In a changing world subject to complex inter-dependencies, what makes a difference is how a wide range of complementary change-drivers *combine* in real places – creating a whole that is greater than the sum of the individual parts. Restricting investment appraisal to a simple matter of whether or not a particular asset and service is present or not holding many other factors the same, whilst useful in simplifying matters, ignores the very inter-dependencies that drive economic growth.

5.19 Consequently, for major transformational projects, it makes more sense to compare different possible future scenarios that do their best to capture the key inter-dependencies and changes that drive economic growth (both quantitative and qualitative) rather than to try to define progress against a 'baseline' case that ignores this complexity – and has diminished relevance and accuracy as a result.[23] We should move forward via scenario-based economic appraisals that compare plausible futures against each other by capturing key 'ecosystem' interactions. This will illuminate the multiple indirect impacts of HS2 and the contingent nature of activity –

[23] This type of approach has been used successfully by Steer Economic Development in their work on the nature and extent of the economic impacts of direct flights between Manchester and Beijing. This used a 'mixed methods' ecosystem 'theory of change' framework that combined qualitative and quantitative aspects in an effort to avoid being biased by the choice of appraisal methodology. See, Steer Economic Development (2017) *The China Dividend: One Year In*.

including the impact of plans and changes to plans on investor confidence and the delivery of contingent Growth strategies.

5.20 The report closes with the following recommendations:

> **RECOMMENDATION 1**: Robust scenario planning work is required to confirm the Conventional Case for HS2 is robust across a wider range of plausible and likely future scenarios rather than just the single DfT 'business-as-usual' case (which reinforces the continued dominance of London);
> **RECOMMENDATION 2:** Work is required urgently to demonstrate how the various sets of evidence produced by the City Regions and others for the economic impacts of HS2 can be better integrated to form part of the overall benefits picture, be this for the North and/or the wider UK;
> **RECOMMENDATION 3**: The full impacts of HS2 cannot be fully assessed within the current welfare cost benefit assessment framework, a broader ecosystem approach is required to reflect the macro interactions between HS2 and the economy. This approach will help to bridge the gap in the available evidence about the impact of HS2 and how it will contribute to the delivery of the Government's objectives for rebalancing the economy;
> **RECOMMENDATION 4:** Given the UK Government's integrative approach to developing a new Industrial Strategy, we recommend that this growing momentum be translated into a new Industrial Strategy-aligned theory and practice of economic appraisal for transformational projects such as HS2.

5.21 This new approach should set out to position transport connectivity in general (and high-speed rail in particular) as integral to the delivery of Industrial Strategy. This means facilitating innovation, economic development and environmental sustainability in multiple domains. It means considering how transport affects, and shapes the performance and evolution of, the supply chains that link different sectors.

5.22 The UK cannot afford to let its current 'compartmentalised' approach to appraising the economic impact of transformational connectivity limit our future economic growth potential, **and especially in the North.**

A References

Chapter 3, including Tables 3.1 and 3.2

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