

# **GROWTH ACROSS REGIONS**

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**A discussion paper on the  
Commission's objectives**

# Contents

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<b>The Commission</b>	<b>3</b>
<b>Executive summary</b>	<b>5</b>
<b>Introduction</b>	<b>7</b>
<b>Interpreting the objective</b>	<b>12</b>
Three infrastructure pathways	<b>22</b>
<b>Conclusions</b>	<b>25</b>
<b>Acknowledgements</b>	<b>27</b>
<b>Endnotes</b>	<b>28</b>

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# The Commission

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## The Commission's remit

The Commission provides the government with impartial, expert advice on major long term infrastructure challenges. Its remit covers all sectors of economic infrastructure: energy, transport, water and wastewater (drainage and sewerage), waste, flood risk management and digital communications. While the Commission considers the potential interactions between its infrastructure recommendations and housing supply, housing itself is not in its remit. Also out of the scope of the Commission are social infrastructure, such as schools, hospitals or prisons, agriculture, and land use.

The Commission's objectives are to support sustainable economic growth across all regions of the UK, improve competitiveness, and improve quality of life. The Commission delivers the following core pieces of work:

- a National Infrastructure Assessment once in every Parliament, setting out the Commission's assessment of long term infrastructure needs with recommendations to the government
- specific studies on pressing infrastructure challenges as set by the government, taking into account the views of the Commission and stakeholders, including recommendations to government
- an Annual Monitoring Report, taking stock of the government's progress in areas where it has committed to taking forward recommendations of the Commission.

The Commission's binding fiscal remit requires it to demonstrate that all its recommendations for economic infrastructure are consistent with, and set out how they can be accommodated within, gross public investment in economic infrastructure of between 1.0% and 1.2% of GDP each year between 2020 and 2050. The Commission's reports must also include a transparent assessment of the impact on costs to businesses, consumers, government, public bodies and other end users of infrastructure that would arise from implementing the recommendations.

When making its recommendations, the Commission is required to take into account both the role of the economic regulators in regulating infrastructure providers, and the government's legal obligations, such as carbon reduction targets or making assessments of environmental impacts. The Commission's remit letter also states that the Commission must ensure its recommendations do not reopen decision making processes where programmes and work have been decided by the government or will be decided in the immediate future.

The Commission's remit extends to economic infrastructure within the UK government's competence and will evolve in line with devolution settlements. This means the Commission has a role in relation to non-devolved UK government infrastructure responsibilities in Scotland, Wales and Northern Ireland (and all sectors in England).

The Infrastructure and Projects Authority (IPA), a separate body, is responsible for ensuring the long term planning carried out by the Commission is translated into successful project delivery, once the plans have been endorsed by government.

## The Commission's members

**Sir John Armitt CBE (Chair)** published an independent review on long term infrastructure planning in the UK in September 2013, which resulted in the National Infrastructure Commission. Sir John is the Chair of National Express Group and the City & Guilds Group. He also sits on the boards of the Berkeley Group and Expo 2020.

**Professor Sir Tim Besley CBE** is School Professor of Economics and Political Science and W. Arthur Lewis Professor of Development Economics at the LSE. He served as an external member of the Bank of England Monetary Policy Committee from 2006 to 2009.

**Neale Coleman CBE** is a co-founder of Blackstock Partnership. He worked at the Greater London Authority from 2000-2015 leading the Mayor's work on London's Olympic bid, the delivery of the games, and their regeneration legacy. Neale has also served as Policy Director for the Labour Party.

**Professor David Fisk CB** is the Director of the Laing O'Rourke Centre for Systems Engineering and Innovation Research at Imperial College London. He has served as Chief Scientist across several government departments including those for environment and transport, and as a member of the Gas and Electricity Markets Authority.

**Andy Green CBE** holds several Chair, Non-Executive Director and advisory roles, linked by his passion for how technology transforms business and our daily lives. He chairs Lowell, a major European credit management company and has served as Chair of the Digital Catapult, an initiative to help grow the UK's digital economy.

**Bridget Rosewell CBE** is a director, policy maker and economist. She served as Chief Economic Adviser to the Greater London Authority from 2002 to 2012 and worked extensively on infrastructure business cases. She has served as a Non-executive Director of Network Rail and Non-executive Chair of the Driver and Vehicle Standards Agency. She is currently Chair of the Atom Bank and the M6 Toll Road.

**Professor Sadie Morgan OBE** is a founding director of the Stirling Prize winning architectural practice dRMM. She is also Chair of the Independent Design Panel for High Speed Two and one of the Mayor of London's Design Advocates. She sits on the boards of the Major Projects Association and Homes England.

**Julia Prescott** is a co-founder and Chief Strategy Officer of Meridiam and sits on the Executive Committee of Meridiam SAS. She has been involved in long term infrastructure development and investment in the UK, Europe, North America and Africa. Since 2019 she has sat on the board of the Port of Tyne.

# Executive summary

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This discussion paper sets out the Commission's strategic stance on the relationship between economic infrastructure and local economic growth. It covers two main areas:

- the Commission's interpretation of its objective to 'support sustainable economic growth across all regions of the UK' and the evidence supporting this
- the Commission's framework for considering how infrastructure can help to improve economic outcomes in different areas.

Over the past two centuries, regional inequality in economic outcomes in the UK has been persistent. Differences in productivity across UK regions are large, in absolute terms and when compared internationally. Regional variations in economic outcomes are driven by a range of factors. Infrastructure can play an important role.

The UK government has set itself the ambition of 'levelling up' economic outcomes between regions, emphasising the role of infrastructure in regional rebalancing. This is part of a series of government policies on regional rebalancing. While infrastructure is necessary to support growth, it is rarely sufficient to fundamentally alter the economic geography of a country. Infrastructure policy must be combined with other measures such as improving skills and innovation.

## The Commission's interpretation of the objective

The Commission recognises that addressing regional disparities is part of its objective to 'support sustainable economic growth across all regions of the UK'. It will interpret its objective as being to support faster growth in low productivity regions and balancing this with maintaining the economic performance of high productivity regions.

The Commission has identified the following measures to assess progress against the objective:

- gross value added (GVA) measures of overall economic activity and labour productivity, and data on median incomes before and after housing costs as relevant indicators of regional economic performance
- three definitions of regions which capture clusters of cities, towns and other settlements at a large scale to measure progress against the objective, and several alternative definitions to enable the analysis of productivity disparities within and between regions at different spatial scales. This reflects the fact that intra-regional or local growth disparities are often as pronounced as inter-regional ones
- measures of dispersion, which can help the Commission understand the level of regional and sub regional disparities, and identify which areas may require intervention.

## The Commission's framework for infrastructure and economic outcomes

The Commission has developed a framework that identifies three pathways through which infrastructure investment can help to achieve economic outcomes in different regional areas. These are: addressing constraints to growth; contributing to transformation; and universal provision.

Meeting the objective will require a balanced portfolio of interventions across the three pathways. The most appropriate pathways and type of infrastructure measures will vary according to the characteristics and strategic needs of different places. This aligns with the recommendations of the Commission's Cities Programme, which identifies the importance of local decision making in capturing and acting upon local preferences and needs, thereby building consensus toward local infrastructure strategies.

This framework, alongside the interpretation of the objective, will shape the Commission's approach to current and future work, most notably the Rail Needs Assessment for the Midlands and the North and policy recommendations in the second National Infrastructure Assessment.

## Future work

The Commission will also develop discussion papers on the remaining aspects of its objectives including quality of life and sustainability. This will complete the series of discussion papers on the Commission's objectives.

# Introduction

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The National Infrastructure Commission has three objectives, which are specified in its charter:

- support sustainable economic growth across all regions of the UK
- improve competitiveness
- improve quality of life.

The Commission is publishing a series of discussion papers reviewing each of the objectives. These will clarify the Commission's interpretation of its objectives and explain how the Commission could measure the contribution its recommendations make towards its objectives. The first discussion paper on the Commission's 'improving competitiveness' objective was published in April 2020.<sup>1</sup>

This discussion paper is the second in the series, focusing on the Commission's sustainable economic growth across all regions of the UK objective. It sets out the Commission's interpretation, the evidence supporting this and how it relates to infrastructure. This paper focusses on economic growth across regions. The Commission intends to return to the 'sustainable' aspect of the objective once the work underway on natural capital has progressed.

The paper also considers the role of infrastructure in the context of the government's 'levelling up' agenda.

The Commission would prefer its objectives to be measurable, allowing the Commission to assess progress. The limitations of infrastructure evidence and data may restrict the degree to which this is possible at present. Nevertheless, the Commission's choice of definition will take potential measurability into account, in the expectation that evidence and data will continue to improve.

There will be overlapping and complementary areas across the Commission's objectives. In general, overlaps are not problematic, and the discussion papers will highlight the most relevant ones for each objective. However, for the purposes of monitoring, it will be useful for the Commission to maintain some distinction between its objectives.

There is a key overlap between the economic growth and quality of life objectives, given the role of infrastructure in providing a range of economic and wider societal outcomes. This overlap is discussed later in the discussion paper when setting out the Commission's framework on how infrastructure investment can help to achieve economic outcomes in different regional areas.

The Commission welcomes comments on this discussion paper, including evidence on how infrastructure affects economic growth and ways that the Commission could monitor and measure its impact. Please send any comments to [NICdiscussionpapers@nic.gov.uk](mailto:NICdiscussionpapers@nic.gov.uk) by 31 March 2021.

## Background to the objective

Economic growth is a complex process. Most long-term growth comes from productivity growth, driven by technological progress: new innovations, improving access to physical and human capital, and incorporating best practice. The Commission has previously identified three main ways in which infrastructure contributes to economic growth:

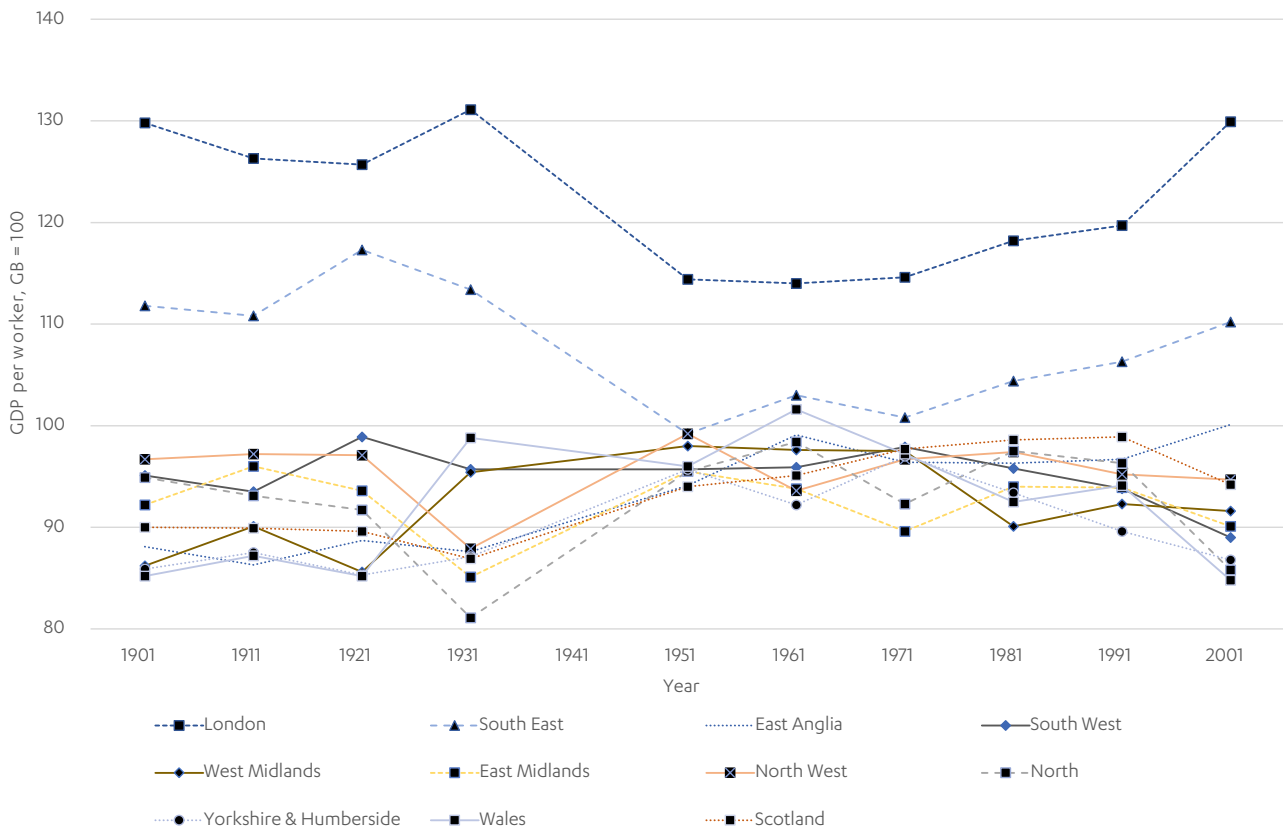
- **improving the quantity and quality of infrastructure services:** This can lower costs for firms - for example, a more efficient transport network will reduce the cost of distribution, increasing the amount of output that firms can produce for a given level of inputs (fuel, lorry driver time etc)
- **directly enabling productivity enhancing technological change:** For example, broadband enables customers and suppliers to find one another and interact at very low cost, improving the efficiency of a wide range of services, such as travel agencies, retail and banking. It also enables the creation of entirely new services, such as social media
- **supporting the efficient working of the housing and labour markets:** Without infrastructure, housing cannot be built where people want to live, and people cannot move between where they want to live and where jobs are located. Businesses tend to locate in the most productive areas, influenced by the quantity and quality of infrastructure services provided. In addition, infrastructure enables cities and other population centres to form. People are more productive when they work in these dense concentrations, especially in high skilled services. Water and wastewater, waste removal, flood risk management, energy and transport have always been essential for cities to function.<sup>2</sup>

Regional inequality in economic performance in the UK has been persistent over the past two centuries.<sup>3</sup> London was richer and more productive than the North of England even in 1900, despite the industrial revolution beginning in the North.<sup>4</sup> Differences in productivity across UK regions are large, in absolute terms and by international standards.<sup>5</sup> **Figure 1** presents long-run trends in regional productivity during the twentieth Century.

Regional variations in economic outcomes are driven by a range of interacting factors. Highly skilled people and businesses tend to cluster together as they are more productive, and earn higher wages, when they do – an effect known as ‘agglomeration’. Amenities, such as hospitality, entertainment and other services, also tend to concentrate in areas of highly paid people. This in turn attracts further highly skilled and paid workers, which raises property prices, and pushes out lower paid workers, who then seek places with lower rents or property prices, and cheaper shops and services, creating self-reinforcing cycles of success and deprivation. As the UK’s economy has shifted towards business services, cities have tended to benefit from these factors, leaving some smaller towns and rural areas behind.



**Figure 1: Trends in regional disparities in Great Britain during the twentieth Century (GDP per worker)<sup>6</sup>**



Note: Data for 1941 is missing in the source data, so a dummy value is created such that there is a constant linear change between 1931 and 1951.

However, recent trends in the past few decades suggest some improvements. Productivity differences between regions have decreased slightly,<sup>7</sup> and incomes have been growing faster outside cities in places such as the North and Midlands.<sup>8</sup> However, this has not been enough to reverse the significant increases in regional inequalities that occurred in the last quarter of the 20th Century. The legacy of deindustrialisation means former industrial towns suffer from persistently low productivity and incomes, even if they are not falling further behind.<sup>9</sup> There are also growing concerns of increasing inequality in productivity and income within regions.<sup>10,11</sup>

Other countries also face persistent regional economic variation. However, the extent of regional variation within England appears to be unusually high compared to other countries,<sup>12,13</sup> although regional boundaries are drawn inconsistently across countries, which can limit international comparisons.<sup>14</sup> England is also unusual in that few of its major cities, apart from London, have productivity above the national average, leading to a high productivity gap between the North and the South.<sup>15</sup> This disparity is presented in **Figure 2**.

Infrastructure is far from the only factor explaining these trends. Geography, history, local culture and governance are important factors determining the economic activities of a region, while clusters of highly skilled workers and high productivity activity can become self-sustaining over time.<sup>16</sup>

Another part of the explanation relates to regional differences in resilience to economic shocks.<sup>17</sup> Recent analysis of 85 UK cities' economic resilience from the past three recessions show that southern cities have tended to be more resilient in terms of the speed, extent and nature of recovery from shocks compared to their northern counterparts. For example, following the 2008 recession a high proportion of northern cities emerged on a lower growth path, while a high proportion of southern cities settled on a growth path equal to or more than the pre-recession growth rate.<sup>18,19</sup>

Provision of infrastructure is an important part of the picture. There is evidence suggesting that variations in public and private 'capital stocks' (e.g. productive assets, such as the road and rail network, that support and complement workforce activities) mirror productivity differences.<sup>20</sup> A recent study finds that regional variations in capital stocks per worker make a significant contribution to regional variations in labour productivity, but the geography of human capital is also highly relevant.<sup>21</sup>

In this context, the UK government has set the ambition of 'levelling up' between regions, emphasising the role of infrastructure in regional rebalancing.<sup>22</sup> This is part of a succession of government policies on regional rebalancing.<sup>23</sup> However, while infrastructure is necessary, it is rarely sufficient to fundamentally alter the economic geography of a country.

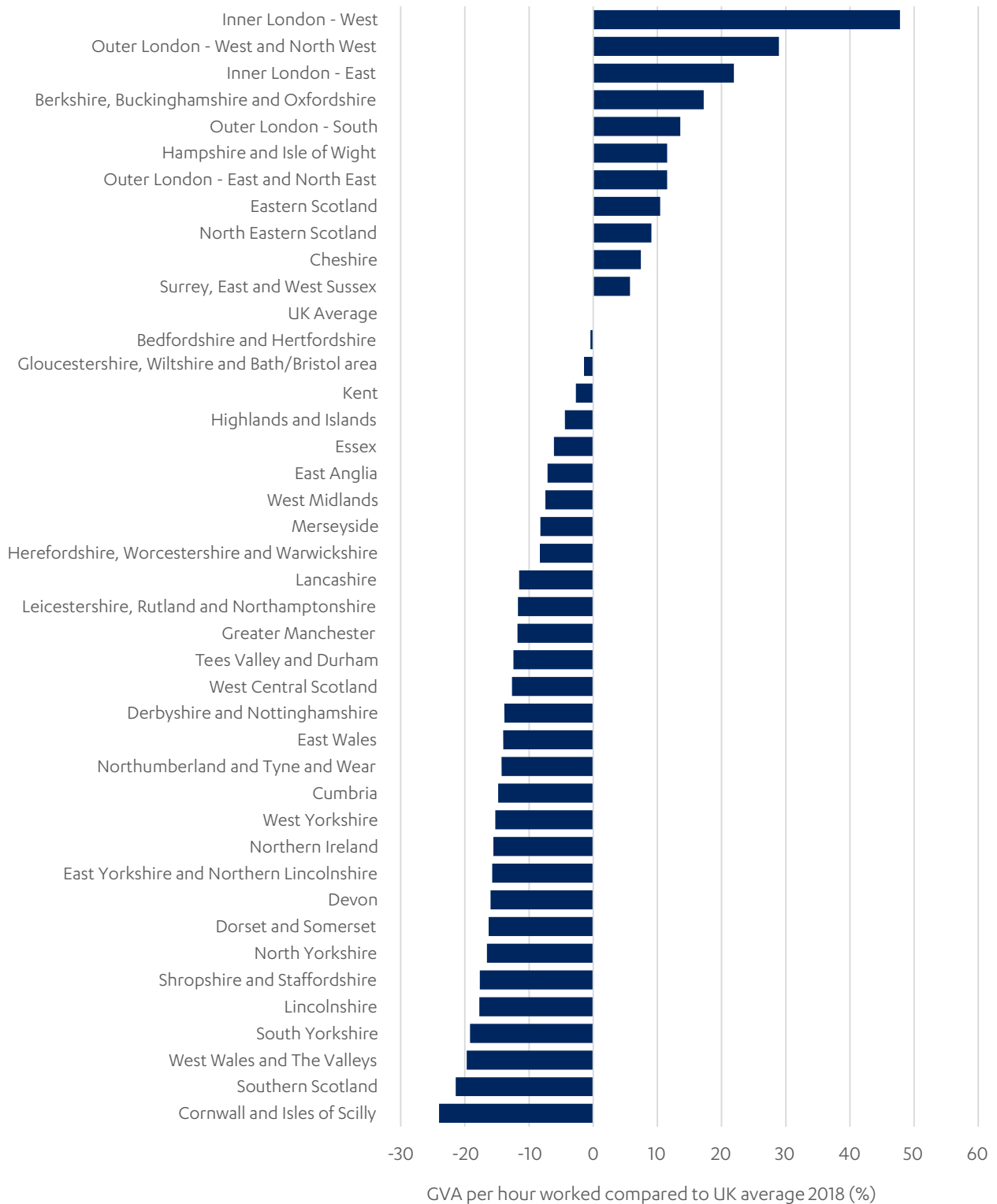
The rest of this paper breaks down the Commission's objective into three components, with a dedicated section on each one:

- what is meant by growth?
- what is meant by regions?
- what is meant by 'across all'?

Each section demonstrates how the Commission has assessed the evidence, focusing on the extent to which progress in meeting the objective could be measured by the Commission.

This is followed by a section that sets out the Commission's framework for infrastructure and economic outcomes. The framework presents 'three pathways' in which infrastructure investment can contribute to reducing regional disparities and help achieve wider societal outcomes (e.g. quality of life). The section also identifies some of the challenges posed in measuring progress against the objective, and how the framework helps to address these.

Figure 2: Regional productivity variation in the UK (NUTS2 Regions, GVA per hour worked)<sup>24</sup>



# Interpreting the objective

## What is meant by economic growth?

Gross domestic product (GDP) is the primary indicator of economic activity within the UK.<sup>25</sup> There are three main ways of estimating this, two of which use gross value added (GVA) approaches which capture the value of goods and services produced at a number of different sectoral and geographic scales.<sup>26</sup> Most long-term economic growth comes from productivity growth, which in turn drives higher living standards.<sup>27</sup>

GVA on a 'per hour' basis is a measure of labour productivity – the quantity of goods and services produced per hour of labour input. For a given region or subregion, this is calculated by dividing GVA by the total hours worked by the workforce. It is considered to be a comprehensive indicator of labour productivity and is the preferred measure at subnational level. This is because it takes into consideration regional labour market structures, different working patterns (such as the mix of part-time and full-time workers), industry structure and job shares.<sup>28</sup> **Figure 2** provides an illustration of how GVA per hour data can be used to show the spread of high productivity and low productivity places across the UK.

Overall economic output can only be improved by either increasing the amount of inputs or by raising productivity. In other words, 'productivity growth' and 'economic growth' are not interchangeable terms, rather changes in productivity contribute to longer term economic growth.<sup>29,30</sup> Therefore, for the purposes of measuring 'growth' as part of this objective, the Commission will primarily use GVA measures of overall economic activity and labour productivity on a 'per hour' basis.

## Challenges in measuring economic activity

In doing so, the Commission acknowledges that measuring economic activity is complicated by the fact that people don't live where they work, and because costs of living vary in different regions.

Firstly, economic geography is influenced by the location decisions of households and businesses. For example, city centres, with their clusters of highly skilled people and businesses, are significantly influenced by commuter inflows of workers who live in the surrounding towns and other settlements (i.e. the 'commuter belt'). This can create differences in where people earn and spend their income, with knock on effects to local economic geography.

Data on incomes,<sup>31,32</sup> which are associated with productivity performance, can be used to further understand how differences in where people live and work influence regional economic outcomes. The differences between workplace productivity and residents' earnings may not be substantial at large regional scales, as there are limits to how far people commute. Localised effects however may be more variable. The granularity of income data means differences in where people work and live can be accounted for.

However, income measures can be distorted by very high earners. For example, average (i.e. mean) incomes are significantly influenced by the higher proportion of workers at the top of the income distribution in places such as London. This can be addressed by considering median incomes instead.<sup>33</sup>

Secondly, variation in regional living costs also play an important part in determining how the effects of economic growth on living standards are experienced. A lack of robust regional price indices<sup>34</sup> poses challenges to adjusting sub national GVA data, however when looking at incomes it is possible to take into account regional data on living costs, particularly housing.<sup>35</sup>

Considering variation in living costs can provide a more nuanced view of regional disparities. For example, the Institute for Fiscal Studies show that when average incomes are adjusted for housing costs, London and the South East are close to the national average.<sup>36</sup> The desire of workers to live near (or have access to) high productivity and high wage jobs, is 'capitalised' into higher property prices and rents, so living standards are not necessarily higher even if wages are. This contrasts with the significantly larger variation in productivity between London and the South East, and the rest of the UK demonstrated in their analysis and in **Figure 2**. However, higher rents may also reflect higher amenity values, such as access to services, which do contribute to living standards.

For these reasons, the Commission will in addition to GVA measures consider median incomes measured before and after housing costs as a relevant indicator of regional economic performance, illustrating the economic experience of people who live and work in different regions.

## What is meant by regions?

In the broadest sense, 'regions' refers to a geographic typology which sub divides the UK into 12 areas. At its core it refers to the four nations of the UK (England, Scotland, Wales, Northern Ireland), with England being split into nine regions (e.g. London, North West, South West). This typology is the basis of the Office for National Statistics (ONS) 'Nomenclature of Territorial Units for Statistics' NUTS1 classification,<sup>37</sup> one of many statistical and administrative definitions used to aggregate economic and non-economic data at different spatial scales.

A key feature of UK regional disparities is that they are as much within these broad regions as between them. However, as outlined in the previous section, one of main challenges of regional data is capturing economic activity in a consistent way, especially given the variation in where people live, work and commute, and the administration of public services. For example, the NUTS1 typology refers to regions that have very different populations and population densities (see **Table 1**) partly because all regions and nations outside of London combine urban and rural populations. The population density of London is more than ten times greater than the next highest (North West).

**Table 2** below presents three key definitions of regions. For the purposes of the 'regions' part of the objective, the Commission will use the definitions of regions set out here. ONS NUTS1 and 2 are recognised definitions that provide total coverage across the UK, which capture clusters of cities, towns, and other settlements based on administrative boundaries (e.g. local authorities, combined authorities, city regions).

Table 1: UK population data by NUTS1 typology (mid-2019 estimates)<sup>38</sup>

	Population (millions)	Population density (population per km <sup>2</sup> )
United Kingdom	66.8	275
Wales	3.2	152
Scotland	5.5	70
Northern Ireland	1.9	137
England (of which)	56.3	432
North East	2.7	311
North West	7.3	520
Yorkshire and the Humber	5.5	357
East Midlands	4.8	310
West Midlands	5.9	457
East	6.2	326
London	9.0	5,701
South East	9.2	481
South West	5.6	236

'City Regions' and NUTS2 provide greater granularity compared to NUTS1, and in doing so partly address the urban and rural issues highlighted previously. City Regions are of particular policy interest to the Commission, given that they represent the UK's largest urban centres such as Greater London, West Midlands, Greater Manchester, Glasgow and Cardiff.

Table 2: Key definitions of regions

Definition / source	Description	Example regions in North East
ONS NUTS1 <sup>39</sup>	<b>12 regions</b> , made up of nine statistical regions in England, plus the nations of Scotland, Wales and Northern Ireland.	North East
ONS NUTS2 <sup>40</sup>	<b>41 regions</b> , all sub-divisions of NUTS1 areas. Correspond to groups of counties in England, groups of districts of Inner London, groups of unitary authorities in Wales, and groups of council areas in Scotland and Northern Ireland.	Tees Valley and Durham, Northumberland and Tyne and Wear
City Regions <sup>41</sup>	<b>18 regions</b> . City Regions are a subset of the 31 city deals which have been negotiated since 2012. <sup>42</sup> These are made up of combined authorities (mixture of local authorities and/or Local Enterprise Partnerships and other local bodies) that have negotiated deals with central government for greater local autonomy over financial and planning matters.  For statistical purposes, the ONS focus on 18 City Regions in urban areas of the UK, including Combined Authorities with elected Mayors, other city regions that do not yet have official status, and other comparable areas such as Growth Deal areas.	North of Tyne, Tees Valley

However, there are several alternative spatial definitions which provide different degrees of granularity and coverage across the UK. These definitions typically refer to specific places and areas (e.g. a city, a local authority), rather than a 'region' which is usually a cluster of these.

These are more appropriate for carrying out different types of spatial analysis than as a way for the Commission to measure progress against the objective. One example is examining disparities in economic performance within city regions – for example within Greater Manchester, productivity in Trafford is over a third higher than in Oldham.<sup>43</sup> **Table 3** presents a non-exhaustive list of these alternative geographies.

**Table 3: Alternative spatial definitions**

Definition / source	Description	Example areas in North East
ONS NUTS3 <sup>44</sup>	<b>139 areas</b> , all sub-divisions of NUTS2 areas. Correspond to counties, unitary authorities and council areas in England, Wales, Scotland and Northern Ireland.	Hartlepool and Stockton-on-Tees, South Teesside, Darlington, Durham CC, Northumberland, Tyneside, Sunderland
ONS Built Up Areas <sup>45</sup>	<b>5,493 areas</b> ranging in population size from 100 to 9.8 million. Covers England and Wales only. Provides information on the villages, towns and cities where people live, and allows comparisons between people living in built-up areas and those living elsewhere.	Tyneside (includes Newcastle and Sunderland) and Teesside (includes Middlesbrough and Redcar)
ONS Rural Urban Classification <sup>46</sup>	<b>This classification categorises districts and unitary authorities (i.e. local administrative units) on a six-point scale from rural to urban.</b> Covers England and Wales only. It defines areas as rural if they fall outside of settlements with more than 10,000 resident population.	Newcastle (Urban with Major Conurbation), Hartlepool (Urban with City and Town), Redcar and Cleveland (Urban with Significant Rural), County Durham (Largely Rural)
ONS Travel to Work Areas <sup>47</sup>	<b>228 areas.</b> It does not correspond to administrative boundaries but captures the de facto boundaries of local labour markets across the UK on the basis of commuting patterns recorded in census data.	Newcastle, Middlesbrough and Stockton, Sunderland
Centre for Cities Primary Urban Areas <sup>48,49</sup>	<b>63 areas</b> , focusing on UK's largest towns and cities. It is distinct from administrative geographies (e.g. city regions, combined authorities), focusing instead on the 'physical footprint' of a city – the contiguous built-up area of a settlement, where buildings are less than 200 metres apart. In other words, Newcastle PUA will have a different boundary to the local administrative one.	Newcastle PUA, Sunderland PUA, Middlesbrough PUA

Definition / source	Description	Example areas in North East
<b>Local administrative units</b> <sup>50</sup>	<b>391 areas</b> , made up of local authority or local council areas across the UK. These are typically responsible for providing services (e.g. social care, planning, waste management), and collecting local taxes (e.g. council tax, business rates). <sup>51</sup> Local Enterprise Partnerships (LEPs) <sup>52,53</sup> are examples of areas which overlap local administrative units. Their role is to help shape local economic priorities and undertake activities to encourage local economic growth and the creation of jobs.	Newcastle upon Tyne, Redcar and Cleveland
<b>Infrastructure networks</b>	This refers to the boundaries that infrastructure network companies operate within. Performance data is usually collected based on these company boundaries in sectors such as water and energy. While these can be regional in scale, they don't necessarily overlay or conform to regional or administrative boundaries. For example, while electricity transmission in England and Wales is covered by one company (National Grid), distribution companies operate across six different areas with radically different geographies – to illustrate, Western Power Distribution covers the Midlands, South Wales and South West England. <sup>54</sup>	Northern Powergrid (Electricity Distribution)

In summary, the Commission's approach to regions is as follows:

- to measure progress against the objective, the Commission will use the regional geographies set out in **Table 2**, which provide total coverage across the UK, capturing clusters of cities, towns, and other settlements based on recognised boundaries (e.g. administrative)
- for other types of analysis, the Commission has identified alternative definitions that may be appropriate depending on the line of inquiry and data available. Some of these are set out in **Table 3**.

**Table 4** brings together the Commission's approach to 'regions' by presenting some example lines of inquiry and links these to the appropriate regional and spatial definitions identified in **Tables 2** and **3**.



**Table 4: Example lines of inquiry and suitable regional and spatial definitions**

Line of inquiry	Appropriate definitions
Measuring progress against the objective by assessing regional trends in economic output and labour productivity	Analysis that assesses trends over time or at a point in time typically uses ONS NUTS1 or NUTS2 – <b>Figure 1</b> and <b>Figure 2</b> provide an example of this. Analysing City Regions would also be appropriate in this context.
Understanding variation in transport connectivity	The Commission's transport connectivity discussion paper <sup>55</sup> used ONS Built Up Areas to estimate connectivity for the 1,000 most populated places in Great Britain. Cities, following the Centre for Cities interpretation of primary urban areas, were matched to built-up areas where applicable.
Understanding variation in labour productivity within regions	Requires sub regional measures of labour productivity, which are usually produced for small aggregate areas (e.g. ONS NUTS2-3, local administrative units, City Regions). <sup>56</sup>
Considering funding/delivery options for infrastructure projects	Local and combined authorities (e.g. City Regions) would be most suitable, particularly when considering devolution of funding and responsibilities.

Note: the above is merely illustrative and is non-exhaustive

## What is meant by 'across all'?

The Commission recognises that addressing disparities between regional areas is part of its objective to 'support sustainable economic growth across all regions of the UK'. This means supporting faster growth in low productivity regions and maintaining the economic performance of high productivity regions. All regions should be supported to achieve economic growth, but faster rates in lower productivity regions will reduce the gap between regions over time.

It should be emphasised that reducing disparities does not mean eliminating them entirely. The main reason for this is due to inherent differences in UK geography which mean businesses have to decide between having access to the things that they want – e.g. knowledge (for high-skilled businesses) and workers – against the cost of locating in places where these are available. This creates fundamental differences between types of places, particularly urban and rural areas.<sup>57</sup> Another factor to consider is industry mix, particularly areas that have concentrations of certain sectors (e.g. financial services, manufacturing). This can play a role in determining the productivity potential and future growth of a place.<sup>58,59</sup>

The Commission will assess progress in reducing regional disparities using absolute and relative measures of dispersion. Dispersion captures how spread out a set of observations are, usually relative to a benchmark such as the average (e.g. mean, median). This may include the spread of labour productivity, or other measures, across regions compared to the UK average. **Figure 2** provides a graphical example of this.

Absolute measures express dispersion in terms of the original units of the data. This could include measures such as the range, standard deviation, and interquartile range. By comparison, relative measures express dispersion as a percentage or ratio of a common denominator such as the average of the data. This allows for meaningful comparison of dispersion over time and between different datasets (e.g. income, labour productivity).

**Table 5** below provides a description of measures, while **Table 6** applies these to trends in labour productivity for NUTS2 regions for the years 2004, 2011 and 2018.

**Table 5: Description of absolute and relative measures of dispersion**

Measure	Description	Advantages	Disadvantages
Range (absolute)	Finds the difference between the minimum and maximum values in a set of observations	<ul style="list-style-type: none"> <li>Provides an overview of the extent of disparities, expressed as the difference between lowest and highest places.</li> </ul>	<ul style="list-style-type: none"> <li>Minimum and maximum values can be outliers which may be atypical places (e.g. those with very low or very high productivity)</li> <li>Doesn't tell you about the disparities between the majority of places.</li> </ul>
Coefficient of range (relative)	Expresses the range as a ratio/percentage of the sum of the minimum and maximum values		
Standard deviation (absolute)	Finds the average distance of a set of observations from the mean	<ul style="list-style-type: none"> <li>Captures extent of disparities relative to average (i.e. the mean), capturing all places.</li> </ul>	<ul style="list-style-type: none"> <li>Can be influenced by outliers, which may mask changes in disparities between regions closer to the UK average</li> <li>Doesn't tell you which places are driving changes in regional disparities.</li> </ul>
Coefficient of variation (relative)	Expresses the standard deviation as a ratio/percentage of the mean		
Interquartile range (absolute)	Finds the difference between the lower (i.e. 25 <sup>th</sup> ) and upper (75 <sup>th</sup> ) quartile in a set of observations, where the 50 <sup>th</sup> quartile is the median	<ul style="list-style-type: none"> <li>Captures disparities near the average rather than those at the extreme ends which may be atypical places (e.g. those with very low or very high productivity).</li> </ul>	<ul style="list-style-type: none"> <li>Only captures middle 50 per cent of places (i.e. observations), so excludes a lot of places which may be of interest (e.g. are very low productivity places falling further behind?).</li> </ul>
Coefficient of quartile deviation (relative)	Expresses the interquartile range as a ratio or percentage of the sum of the lower and upper quartile values		

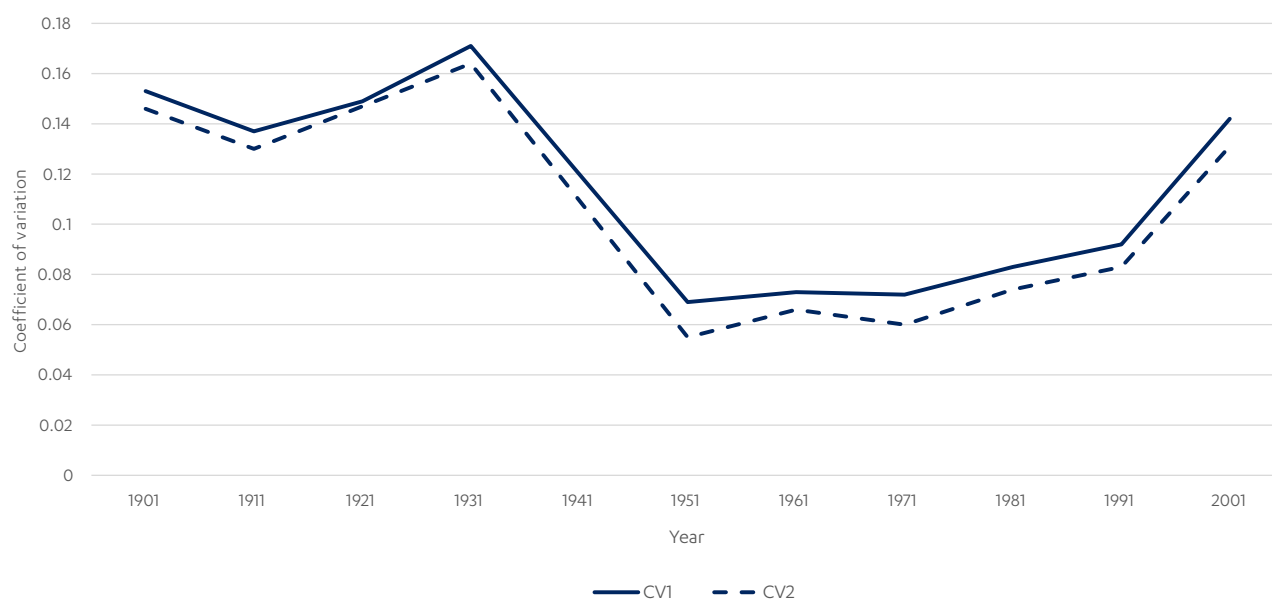
Table 6: GVA per hour worked (£, 2016 prices) – analysis of dispersion between UK NUTS2 regions<sup>60</sup>

Year	2004	2011	2018	Percentage change (2004-18)
<b>Summary statistics (£)</b>				
Minimum	23.2	24.3	25.6	10%
25th percentile	26.9	28.3	28.4	6%
Mean (UK GVA per hour worked)	30.6	32.9	33.8	11%
Median	28.3	29.4	29.9	6%
75th Percentile	32.4	34.9	36.0	11%
Maximum	42.7	47.4	50.1	17%
<b>Absolute dispersion (£, 2016 prices)</b>				
Range	19.4	23.1	24.5	26%
Standard Deviation	4.3	5.4	5.5	26%
Interquartile Range	5.5	6.6	7.6	38%
<b>Relative dispersion (ratio)</b>				
Coefficient of range	0.08	0.09	0.10	20%
Coefficient of variation	0.14	0.16	0.15	10%
Coefficient of quartile deviation	0.09	0.11	0.12	27%
<b>Absolute dispersion (indexed, 2004 = 100)</b>				
Range	100.0	119.0	126.1	26%
Standard Deviation	100.0	125.7	125.9	26%
Interquartile Range	100.0	121.3	137.8	38%
<b>Relative dispersion (indexed, 2004 = 100)</b>				
Coefficient of range	100.0	111.5	119.9	20%
Coefficient of variation	100.0	115.0	110.5	10%
Coefficient of quartile deviation	100.0	113.8	126.8	27%

**Table 5** demonstrates that the usefulness of dispersion measures depends on the context. For example, in tracking progress against the objective over time (i.e. reducing regional disparities), the coefficient of variation can simultaneously account for national changes in labour productivity (i.e. the mean), and whether or not disparities between regions are improving (i.e. regional productivity levels are closer to the UK average), or deteriorating (i.e. regional productivity levels are moving further apart).

As an example, **Figure 3** presents spatial inequality in the UK during the twentieth Century, using a coefficient of variation approach. While it demonstrates the entrenchment and persistence of regional inequality, it also shows there have been periods of disparities improving and deteriorating.

**Figure 3: Trends in spatial inequality in Great Britain during the twentieth Century (coefficient of variation, GDP per worker)<sup>61</sup>**



Note: CV1 is coefficient of variation for all regions treating London and South East as separate regions. CV2 combines London and the South East as one region. Data for 1941 is missing in the source data, so a dummy value is created such that there is a constant linear change between 1931 and 1951.

Other measures by comparison do not account for average UK productivity in the same way as the standard deviation or coefficient of variation, but still provide useful insights. For example, the range would help explain the extent of disparities between the lowest and highest productivity places. The interquartile range would measure disparities for the 50 per cent of places clustered around average productivity, and excludes outliers which may be atypical places (i.e. those with very low or very high productivity).

**Table 6** demonstrates that labour productivity dispersion has increased across all measures between 2004 and 2018, although there are a significant range of estimates. The 20-30 per cent increases in relative dispersion as measured by the range and quartile deviation coefficients indicates growing disparities between the lowest and highest productivity regions, and between regions clustered around UK average productivity.

However, the change measured by the coefficient of variation estimate of dispersion is noticeably smaller compared to the other relative measures. As previously described, it is the only measure that simultaneously accounts for changes in national (i.e. UK average) and regional productivity in estimating dispersion. The small change is likely explained by the percentage changes across all regions between 2004 and 2018 falling within a narrow range (6-17 per cent), as reflected by the summary statistics.

In summary, the Commission has identified a number of measures of dispersion to help understand changes in regional and sub regional disparities in labour productivity over time. The Commission's analysis shows that no one measure is superior or all encompassing but used together the measures can help the Commission understand the level and direction of travel for regional disparities, as well as which areas may be a particular focus for intervention.

However, these do not give the Commission a direct measure for the impact that infrastructure has on varying regional productivity. As outlined in the introduction, a wide range of factors beyond infrastructure are responsible for determining these outcomes. Because of this the Commission will, in interpreting its objective to support economic growth across all regions, pay particular attention to the ways in which infrastructure can contribute to regional productivity in different places – as set out in the following section.

## Framework for infrastructure and economic outcomes

The UK government's 'levelling up' agenda<sup>62</sup> is part of a succession of government policies on regional rebalancing.<sup>63</sup> While the UK's poor productivity performance and regional disparities are sometimes blamed on the country's infrastructure,<sup>64</sup> investing in new infrastructure on its own is unlikely to be enough to transform the economic outcomes of a place - be that a region, city or a town. These issues are explored in further detail in the Commission's discussion paper on infrastructure and economic growth.<sup>65</sup>

Any successful strategy for economic transformation will therefore need to be comprehensive and will need to recognise the scale of the regional variation challenge and its self-reinforcing nature. There are many interrelated issues, including skills, that would need to be addressed to break the cycle. Other factors, such as the availability of good housing, schools, local transport and amenities, low crime rates and good governance will also affect outcomes, such as where people choose to live. Local decision making, and knowledge about specific circumstances, will also be important in aligning complementary policies with infrastructure investments.

However, a basic level of infrastructure underpins economic life in all places regardless of relative performance. The ability of people to access work and business to reach customers depends on a reasonable level of infrastructure provision everywhere. This economic need also relates to the importance of infrastructure in supporting other forms of capital (e.g. human, social), and quality of life. The latter is another of the Commission's objectives, which the Commission will be looking at in a future discussion paper.

Infrastructure interventions must also consider the needs and desired outcomes for people and places. The Commission's advice to cities developing local infrastructure strategies emphasises the need to capture local needs and preferences by engaging with a wide range of stakeholders, including across political parties and professions.<sup>66</sup> Unintended consequences can arise if there is too much focus on reducing inequalities between places, as this may overlook the impacts on the people living there. For example, transport investment in an area may raise local incomes but only by displacing existing residents who are pushed out by high land prices and replaced by people on higher incomes – a process known as gentrification. It is a common critique of the regional rebalancing agenda and highlights one of the key trade-offs when reducing regional disparities.<sup>67</sup>

On the same note, interventions that simply relocate activity from one town to another are unlikely to improve prospects in the region overall, since one town's gain would then be another's loss. However, interventions that increase productivity for a region as a whole can improve prospects for some towns without others losing out.<sup>68</sup>

### Three infrastructure pathways

The Commission have developed a framework that identifies three pathways through which infrastructure investment can help to achieve economic outcomes in different regional areas, supporting the objective of growth across all regions and the reduction of disparities between them. These are:

- addressing constraints to growth
- contributing to transformation
- universal provision.

**Table 7** sets out a summary of the pathways. The framework reflects how the Commission will structure its thinking, and could be used to assess the contribution of the Commission's recommendations to achieving regional rebalancing.

**Table 7: Infrastructure and regional rebalancing pathways**

Role of infrastructure	Description
Addressing constraints to growth	<p><b>This involves enabling future growth in congested places by investing in capacity upgrades, with the expectation that this will also benefit surrounding areas.</b></p> <p>This assumes that necessary conditions (e.g. complementary policies, social infrastructure) are in place, with insufficient infrastructure acting as a bottleneck to future economic growth. These could be places with high congestion and high employment growth, as identified in the National Infrastructure Assessment.<sup>69</sup></p> <p>This pathway aligns with the Commission's overall recommendation on prioritising capacity upgrades and local transport improvements in regional cities, in addition to continuing to invest in London.<sup>70</sup> It also applies to the Commission's recommendations to improve road and rail infrastructure across the Cambridge-Milton Keynes-Oxford arc.<sup>71</sup> The expectation is that surrounding places (e.g. towns, coastal areas) would benefit from spillover effects from cities, which aligns to evidence on the importance of cities in the success of nearby towns.<sup>72</sup></p>
Contributing to transformation	<p><b>This involves prioritising infrastructure investment alongside wider policies to increase growth in low productivity places (e.g. skills, land-use planning, research and development and business support).</b> This would have a strong focus on low productivity places, with an emphasis on promoting a positive cycle of investment and growth. This provides a pathway towards reducing disparities, although this would require a step change in growth that outpaces 'successful places' for a sustained period.</p> <p>Alignment of complementary policies is crucial in achieving infrastructure-led transformation, as well as acknowledging unintended consequences of phenomena such as gentrification. The importance of cities in the regional development and success of nearby towns also needs to be considered.</p>

Role of infrastructure	Description
Universal provision	<p><b>This involves setting common/minimum standards for infrastructure services, and working to reduce differences in access and opportunity across the UK.</b> This pathway has implications beyond economic growth. While some interventions might feed into longer term changes in regional growth, these will also contribute to improvements in quality of life, resilience to shocks and other societal outcomes. This aligns with National Infrastructure Assessment recommendations on national standards of flood resilience and public investment in full fibre broadband where commercial viability is an issue.<sup>73</sup> The Assessment also highlights how such interventions can benefit different types of places, particularly ‘hard to reach’ towns, villages and other settlements.<sup>74</sup></p> <p>Determining further standards would necessarily be complex as needs vary by geography, infrastructure sector, and anticipated beneficiaries. For example, while a minimum level of service across the UK is possible and desirable in some cases such as full fibre broadband, other sectors such as transport should be considered as a ‘portfolio’ of infrastructure (e.g. buses, trains, cycling) in order to identify the right interventions in the right areas towards a common goal (e.g. improved connectivity).</p>

The pathways outlined in **Table 7** are not mutually exclusive. The Commission acknowledges that a balanced portfolio of interventions across all three pathways is required to help reduce regional disparities.

A key reason for a balanced portfolio approach is to manage risk. Interventions that fall under ‘addressing constraints to growth’ or ‘universal provision’ pathways have a higher chance of success and therefore lower risk. The latter can produce tangible outcomes beyond economic growth (e.g. quality of life), while the former could involve well-targeted capacity upgrades to alleviate congestion on public transport.

By comparison, transformation is a higher risk intervention due to the number of pre-conditions required to be in place for it to be successful, and the likelihood of unintended consequences such as gentrification. Transformation projects are also long-term ‘bets’ compared to the other two pathways, but with potentially higher returns if they succeed.

Examples of transformation include the regeneration of Salford Quays, which began in the 1980s, with the extension of the Manchester Metrolink in the 1990s and continued with the development of Media City from the mid-2000s.<sup>75</sup> The regeneration of London Docklands also took place over a similar timeline, starting with the establishment of a development corporation in 1981, and the development of Canary Wharf in the late 1980s.<sup>76,77</sup>

The Commission expects a range of interventions to support economic growth would need to be deployed differently depending on the context, infrastructure sectors considered, and the desired outcomes to be achieved. A balanced portfolio of actions would include interventions that support the Commission’s economic growth (addressing constraints to growth, regeneration) and quality of life (universal provision) objectives. The Commission’s Cities Programme identifies the importance of local decision making in capturing and acting upon local preferences and needs, thereby building consensus toward local infrastructure strategies.<sup>78</sup>

Reducing disparities in productivity is unlikely to happen quickly given the persistence and entrenchment of inequality – it is clearly a long-term goal. However, adopting the right balance of investment in different pathways, in the appropriate areas, will offer the highest potential to make a nationally significant difference over time.



# Conclusions

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In interpreting the objective, the Commission recognises that addressing regional disparities is part of its objective to 'support sustainable economic growth across all regions of the UK'. This involves supporting faster growth in low productivity regions and balancing this with the needs of high productivity regions to maintain their economic performance.

However, measuring infrastructure's contribution to future productivity improvements and therefore progress in reducing regional disparities is very difficult. This is because future changes in productivity will reflect wider causes beyond infrastructure, which poses a challenge in measuring the impact of the Commission's recommendations.

To address this, the Commission has developed a framework which sets out the main pathways by which infrastructure investment can support economic and wider societal outcomes. The framework reflects how the Commission will structure its thinking going forward. It could also be used to directly assess the contribution of the Commission's recommendations in each pathway, and how this would support the long-term goal of reducing regional disparities. The Commission acknowledges that a balanced portfolio of interventions across all three pathways is required to help achieve this goal and reflect differing priorities in different places.

In conclusion the Commission has identified:

- gross value added (GVA) measures of overall economic activity and labour productivity, and data on median incomes before and after housing costs as relevant indicators of regional economic performance
- three definitions of regions which capture clusters of cities, towns and other settlements at a large scale to measure progress against the objective, and several alternative definitions to enable the analysis of productivity disparities within and between regions at different spatial scales. This reflects the fact that intra-regional or local growth disparities are often as pronounced as inter-regional ones
- measures of dispersion, which when used together can help the Commission understand the level and direction of travel for regional and sub regional disparities, as well as which areas may be a particular focus for intervention
- three ways infrastructure can help to reduce regional disparities and achieve wider societal outcomes, thereby supporting UK government's objectives on 'levelling up': addressing constraints to growth, contributing to transformation, and universal provision. A balanced portfolio of interventions across all three pathways is required to help reduce regional disparities.

## Next steps

This analysis will shape the Commission's approach to current and future work, most notably the Rail Needs Assessment for the Midlands and the North,<sup>79</sup> and the second National Infrastructure Assessment. The Commission will also develop discussion papers on the remaining aspects of its objectives, including quality of life and sustainability. This will complete the series of discussion papers on the Commission's objectives.

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National Infrastructure Commission  
Finlaison House  
15-17 Furnival Street  
London  
EC4A 1AB

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