

Infrastructure: making the most of public investment

We all rely on infrastructure every day. We need it to communicate, to travel, to provide us with broadband, energy and water and so much more. It is integral to a healthy and vibrant economy and to society more broadly. Yet the private sector by itself is unlikely to provide enough infrastructure and in the right places, as it doesn't always make commercial sense, so local and national governments invest billions of pounds each year to take up the slack.

Knowing when, where and how much to invest are questions officials grapple with every day as they seek to use scarce public funds to optimum effect. To make informed choices, costs and benefits need to be considered in the round. This article explores the role infrastructure can play in enhancing economic performance and highlights key factors policymakers should take into account when making investment decisions.

1. The function of infrastructure in driving economic performance

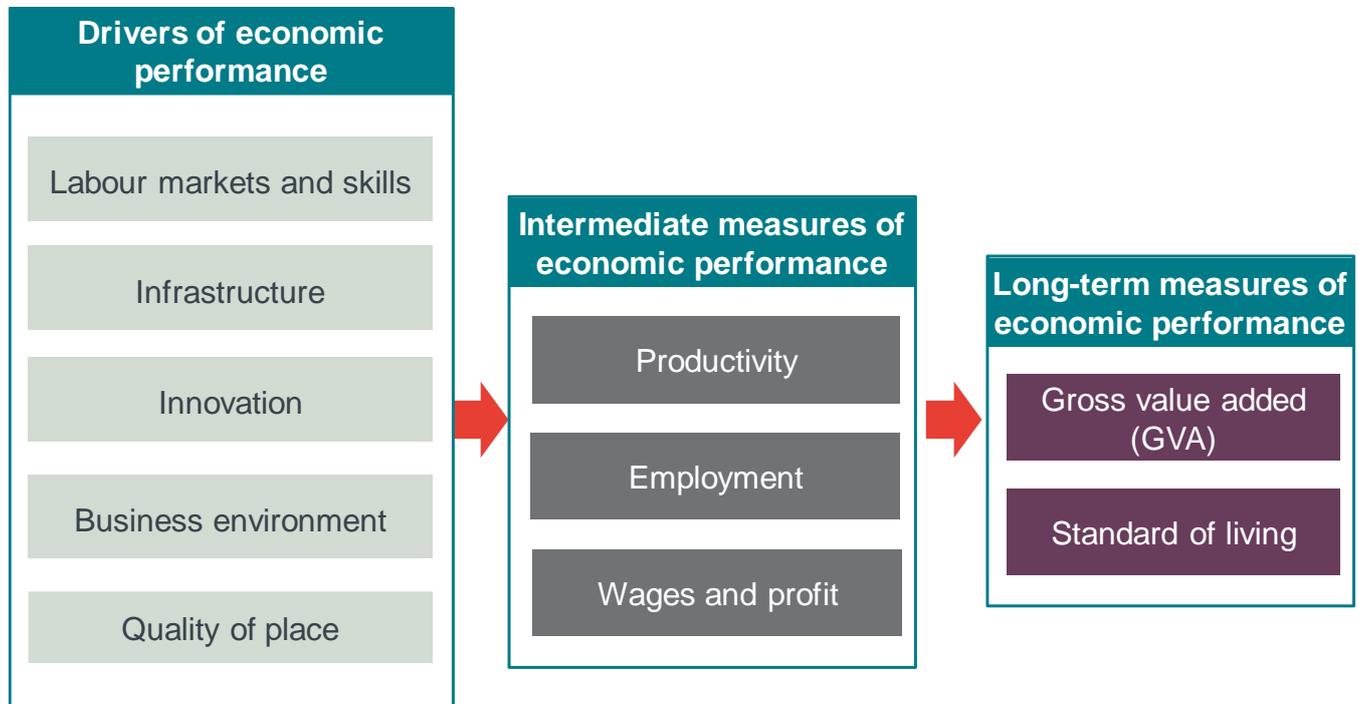
There is a well-established evidence base on how cities, city regions and other areas thrive. This evidence is clear that there are many driving forces of sustained, balanced growth, each of which is likely to be necessary but not on its own sufficient. **Figure 1** shows a stylised picture of the principal drivers.

At a high level these are:

- **Labour market and skills.** The education, training and skill levels of individuals determine their productivity and earnings. Places can grow both by improving the skills of residents and by attracting talented, qualified workers from elsewhere.
- **Infrastructure.** Places rely on infrastructure of various forms, both physical and digital. The efficiency and reliability of such infrastructure are important for economic performance. Potholed roads and slow internet speeds are not a formula for success. National and local governments play a large role in shaping the country's infrastructure, through both direct provision (e.g. transport networks) and regulation (e.g. broadband services and land use policy).
- **Business environment.** The tax regime, regulations and the gamut of government policies all influence businesses decisions. For example, business rates and labour regulation can affect where, and how much, firms invest.
- **Innovation.** Cities and other hubs can spur innovation by supporting knowledge generation, e.g. through universities. They can also help firms raise productivity or bring new products to market by means of business innovation grants or capital support for early-stage companies.

- **Quality of place.** The standard and variety of amenities in any given place help determine the quality of life, and in turn influence the location decisions of workers and firms. Hospitals, schools, green spaces, cinemas, theatres and other cultural and leisure facilities are all important, as are environmental factors such as pollution.

Figure 1 Drivers of economic performance



Source: Frontier Economics (2016) *Assessing the productivity benefits of improving inter city connectivity in Northern England*

Importantly, all the drivers in this diagram interact. Improvements in one can have knock-on impacts, both positive and negative, on others. For example, raising skills may not be sufficient if growth is stifled by a hostile business environment. Alternatively, a favourable business climate may lead firms to invest in improving the skills of their workers.

In short, to reap the full economic benefit of investment in infrastructure, the other drivers of economic performance cannot be neglected.

2. The longer-term dynamics of infrastructure's role in spurring growth

Infrastructure may have a lifespan of more than 100 years - just think how old some of our water pipelines and trunk roads are. This observation points to two further considerations for policymakers. The first (addressed here) is how the role of infrastructure in promoting economic performance can change over time. The second (discussed in the next section) is the resilience of the infrastructure.

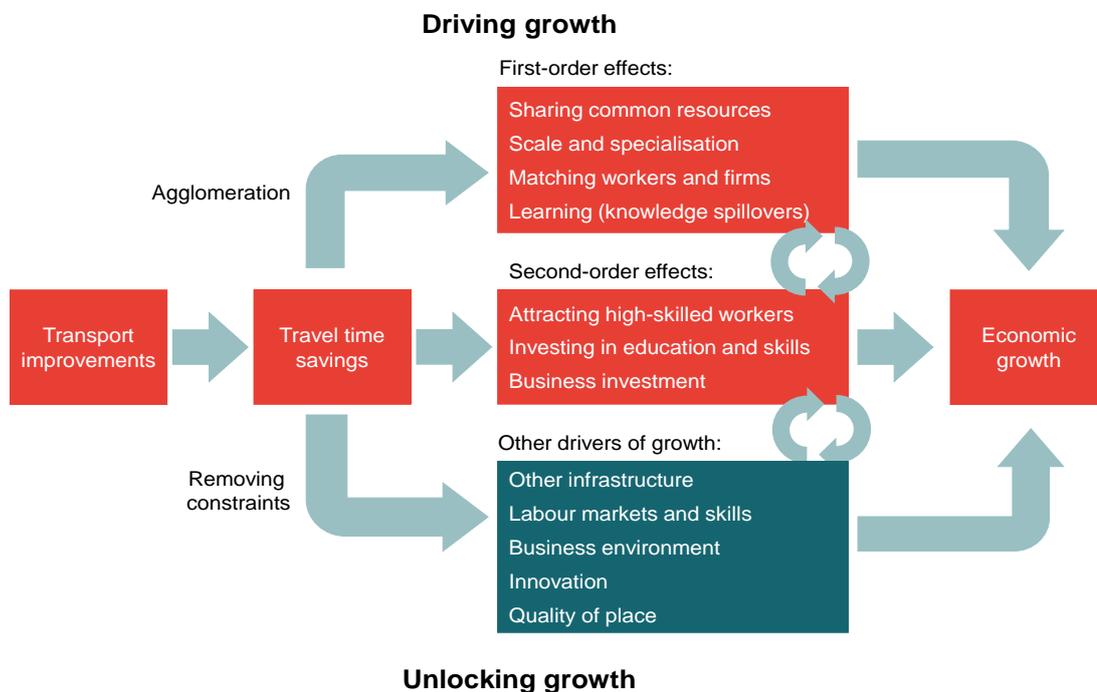
Transport is a good example of how the part played by an infrastructure system in boosting growth can change over the years and, hence, why policymakers need to keep checking whether they are investing enough in other, complementary areas to optimise its contribution to the economy.

From a UK perspective, two ways of looking at this issue suggest themselves:

- The first is to ensure that transport infrastructure responds to growing demand, so that congestion, travel times and travel costs do not act as constraints when other forces are generating growth. This is the traditional, enabling role of transport, **unlocking** the potential of other growth engines.
- The second is where transport has a role in stimulating local economies, **driving** growth rather than simply facilitating it. This can be further split into the following two effects:
 - By reducing travel times and connecting people, firms and places, transport improvements can produce agglomeration benefits that increase productivity (first-order effects). These include sharing common resources; increased specialisation; better matching of workers and firms; and knowledge spillovers which boost the productivity of a given stock of workers and firms (i.e. the current composition of the economy is held constant).
 - The reduction in travel times and the resulting rise in productivity increase wages and returns on investment, attracting more high-skilled workers and firms to the area over time (second-order effects). This may also provide an incentive for local people and businesses to invest in education and skills.

The scale of the benefits of transport enhancements, in particular the second-order effects, will depend on the extent to which they are **supported or constrained by other drivers of economic performance**, as shown below.

Figure 2 The role of transport in driving economic performance



Source: Frontier Economics (2016) *Assessing the productivity benefits of improving inter-city connectivity in Northern England*

3. Thinking ahead: the resilience of infrastructure

As the UK Treasury notes, "...individual infrastructure assets and networks are dependent upon each other in order to function effectively as part of an infrastructure system. In turn the infrastructure systems interact with other systems that support our

society and economy, such as health, education, justice and defence systems.” (HM Treasury, 2015¹)

It is therefore important for policymakers to take interdependency into account. On the one hand, interdependency creates an opportunity to improve the value of infrastructure spending by generating additional benefits and reducing costs. Infrastructure can be shared – a tunnel can house both electricity and telecoms connections - while coordinated planning can cut both costs and disruptions to existing services, for example by minimising road works. On the other hand, however, interdependency potentially increases vulnerability and reduces resilience: if one part of an infrastructure system is affected, others are too.

The Treasury identifies different forms of interdependency. These include:

- “Physical interdependence. A transfer of physical resources, where the output of one element - either a good or service - becomes the input to another (e.g. electrified rail lines requiring a secure supply of power). A shared physical dependence by the two elements on a third resource (e.g. both consume the same fuel).
- Information interdependence. A transfer of information, potentially relating to the condition, operation or use of infrastructure and related services. This is increasingly via telecommunications systems, making digital transfer and storage more important (e.g. information about electricity usage by transport systems is required to determine generation needs).
- Geographic interdependence. If the components are located in the same place or close to each other (e.g. utility connections under the same road).
- Organisational interdependence. Shared ownership, governance or oversight links infrastructure together (e.g. an organisation requires access rights from a third party before going ahead with a project). The mechanism may be financial (e.g. elements of a system rely on the same sources of finance).” (HMT, 2015, page 12)

A further, very topical issue is the resilience of infrastructure to a changing climate and more frequent episodes of extreme weather. The Environment Agency estimates the cost to road and rail from flood-related disruptions and damage in 2015-2016 alone at £220m and £121m respectively². The high price of vulnerability has implications for:

- The *infrastructure options* considered. Solutions to particular challenges may call for innovative options, and decisions to be taken at particular times to allow time for learning and information to be generated where there are uncertainties, so that challenges can be addressed while also ensuring resilience.
- the *design* of infrastructure. There could be a case for investing in spare capacity so services can return to normal more rapidly after an interruption; alternatively, more demanding specifications might be in order to increase resilience against storms, droughts or floods.
- the *materials* used. Should the materials used be more weather-resistant?

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/417822/PU1798_Valuing_Infrastructure_Spend_-_latest_draft.pdf

2

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672087/Estimating_the_economic_costs_of_the_winter_floods_2015_to_2016.pdf

- the *location* of the infrastructure – Building on a flood plain, for example, carries risks.
- *operational standards* – How quickly can service interruptions be identified and addressed?

Each of these aspects has implications for both the lifetime costs and the benefits of the investments.

4. What could all this mean in practice?

If policymakers can design infrastructure so that it is resilient to floods and storms in particular, well-targeted investment, such as in inter-city transport, can add significant value to local economies.

Work we have carried out for the National Infrastructure Commission³ explored changes in access to workers ('accessibility') associated with improving train times between the travel-to-work areas (TTWAs) around major northern cities⁵. We considered four city pairs: Leeds to Manchester; Manchester to Sheffield; Liverpool to Manchester; and Leeds to Hull.

We found:

- Shortening the rail travel time between the largest cities (Leeds and Manchester) from 49 to 30 minutes increases the number of workers to whom cities have access for all six of the largest city regions. Accessibility could increase by around 2.8% for Leeds, by 1.5% for Hull and by 1.3% for Manchester (whose gain is smaller as it starts from a higher base). This translates into an increase in total earnings for the six northern TTWAs in the order of £30m a year or £62m nationally.
- Improving other city connections could also lead to earnings increases, though of a lesser magnitude. For example, cutting the rail journey time between Manchester and Sheffield from 48 to 30 minutes could yield a gain in earnings to the six TTWAs of £18m a year or £41m nationally.

These estimated gains in annual earnings are **additional**, as they are not captured by the standard approaches to assessing the user benefits of a transport intervention. (These methods chiefly measure whether the intervention will unlock growth and are largely based on time savings, reductions in collisions or accidents and reduced overcrowding.) Investment decisions should be informed by an assessment of all anticipated costs and benefits of a transport intervention. Agglomeration effects would be expected to form **just one part of such an assessment**.

5. Conclusion

Infrastructure works are the sinews of today's society. Public investment in everything from hospitals to transport networks is essential to the performance of the economy. Yet choosing where and when to invest for the future is becoming more complex. This is because infrastructure systems are increasingly interdependent while extreme weather events linked to climate change are occurring more frequently, testing the resilience of assorted infrastructure. Still, if policymakers bear these wider considerations in mind in

³ Frontier Economics (2016) Assessing the productivity benefits of improving inter city connectivity in Northern England

their decision-making, the returns on public investment in infrastructure can become stronger than ever.

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