

DOING MORE WITH LESS

With tight constraints on public and private finances, Britain must adopt a more cost-effective approach to innovation to create an infrastructure ready to meet 21st-century challenges, writes **Dan Lewis**

SNAPSHOT

- Infrastructure has become a panacea of late, with low interest rates leading to calls for a broad programme of infrastructure spending, but the IoD believes it remains as easy as ever to squander money and the cost of finance cannot be an excuse to embark upon projects without clear objectives and cost controls.
- The UK has spent the last six years struggling to bring down the budget deficit; if the cost of infrastructure were better controlled, the chancellor's problems would be eased.
- Many infrastructure projects are susceptible to the 80 per cent/20 per cent rule, where the vast majority of the benefits could be had for a fraction of the total costs. Given the state of the public finances, such an approach needs to be the default position of infrastructure spending.
- Frugal infrastructure is not so much about salami-slicing existing projects as to new ways of looking at projects' desired goals and seeing how such goals can be achieved as cost effectively as possible. Pretend it was your money you were spending!



Is now the time for Britain to splurge on infrastructure? Or do our limited and fragile finances – both public and private – make this impossible? Spending is always easier than saving, but generating returns is hard. Some argue that the stars are aligned for an infrastructure boom. Britain's historically low interest rates are leading many to call for the government to finance long-term infrastructure investment.

Permanence, however, is the illusion of every age. Despite the UK being close to full employment and reasonable economic growth, successive governments have had a long-running spending problem; even with the rosier forecasts, the level of national debt will not return to pre-crisis levels until 2029.

Perhaps we can't do it all and, really, we shouldn't try. If the cost of infrastructure – now at £46bn a year – was held to more stringent performance criteria, balancing the budget would be a lot easier. In their 2015 book, *Frugal Innovation*, Navi Radjou and Jaideep Prabhu argue that seeking value is not a short-term recession-driven phenomenon. They cite the example of how Renault discovered, with its low-priced Logan cars, that consumers were shifting to becoming "permanently value-sensitive".

There is no better time for taxpayers and the private sector to look at infrastructure the same way. By designing projects to be frugal from the start, frugal infrastructure promises a new way of looking at project goals and how to achieve

them as cost-effectively as possible. To do otherwise is a huge risk. It's not just the initial capital costs, but whole lifetimes of operating and maintenance costs just to keep an asset running are locked in too.

Many countries, including Brazil, Spain, Japan and China, have taken a "damn the costs, build it and they will come" approach to infrastructure and are faced often with underused airports and stadiums, expensive high-speed trains and a big financial hangover. A frugally driven approach that confronts the cold reality of choices, trade-offs and hard numbers is the way ahead. Even better, why not match the frugality with the IoD's proposed infrastructure Best Value Index, which ranks potential projects according to whole-life costs and the underlying yield?

How did we get here? Nothing drives infrastructure demand like population and the UK's is growing much faster than anticipated. In 2001, in London alone, there was great anxiety about how the city would fit in 700,000 more people by 2015. It ended up having 1.5 million more. Across the UK, population growth is the new normal with a further 9.7m people anticipated by 2039¹, taking the headcount to just under 75 million. And all of them will require power, transport, water and broadband as well as the social infrastructure for somewhere to live, be educated and receive healthcare. This is one driver for infrastructure that isn't going away.

Perhaps this population growth wouldn't be such a factor if the politics, rules and regulations of



Technicians laying solar panels – hardware that may need replacing after 15 years. An Infrastructure Best Value Index can check whether taxpayers' money is spent wisely

¹See <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2015-10-29>



A cradle lifts turbine blades for a windfarm project off the coast of Cumbria. The UK has under-appreciated the intermittent cost of switching to renewable energy

“Of particular concern to IoD members is the UK’s world ranking for broadband speeds – 23rd for download and 39th for upload, according to the Internet Society”

planning at national and local level didn’t always seem to lag behind demand – but they do. The endless delays by central government over south-east airport expansion are a case in point; the inability of local authorities to allow the building of new homes at a sufficient scale to keep house prices in line with incomes are another. And even when there is money and demand – as there is for faster broadband – the UK languishes in the global league tables for connectivity due to a lack of competition. A closer look at where infrastructure spending will be over the next five years portrays the scale of what is scheduled to happen [see Table 1]². Broken down further, it’s clear which projects will demand the highest contribution from the public purse – trains, followed by the Nuclear Decommissioning Authority (NDA) – until 2030 [Table 2].

All of this is not to say that the UK lacks infrastructure. According to the World Economic Forum’s *Global Competitiveness* report for 2015-16, Britain has a passable global ranking

of ninth for infrastructure but an overall quality ranking of 24th [see UK rankings in Table 3]. Quality, though, is no substitute for quantity.

It would be a mistake to assume, for example, that the UK would benefit from higher quality, smoother roads rather than more of them or even just more and freely shared real-time traffic information on an open-data basis that might eventually pave the way for hypothecated road-pricing. We are still very far from making the most of what we have. And within this figure, of course, are pockets of excellence, such as the availability of airline seats reflecting the UK’s highly successful model of distributed airports.

Of particular concern to IoD members is the UK’s world ranking for broadband speeds. In spite of the strength of Britain’s digital economy – now 12.4 per cent of national GDP according to the Boston Consulting Group – the UK has a paltry ranking of 23rd for download and 39th for upload. Without upgrading to optical fibre and other next-generation solutions, Britain will fall further behind and miss out on the next wave of technologies requiring ultrafast broadband – 5G, self-driving cars, drones, and virtual reality.

The rise of mandated spending
Infrastructure spending can broadly be divided as sourced from public, private and hybrid public/private finance. There is, though, a further category – mandated spending – where the private sector is compelled by government legislation to spend on specific infrastructure projects – a kind of ersatz taxation.

Table 3: WEF Global Competitiveness, 2015-16 (UK rankings)

Infrastructure	World ranking out of 140 nations
Mobile telephone subscriptions/100 pop*	53
Quality of roads	29
Quality of air transport infrastructure	19
Quality of railroad infrastructure	18
Quality of port infrastructure	11
Quality of electricity supply	9
Fixed-telephone lines/100 pop*	8
Available airline seat km/week, millions*	3

As Table 4 overleaf shows, mandated private sector spending is at its strongest over the next few years for the energy sector – far beyond the natural replacement rate due to stringent decarbonisation targets and related technology induced primarily by the Climate Change Act and the Smart Meters programme. Without mandated spending, future expenditure would probably come in at around a third of what’s due.

So far, the data on smart meters is poor with consumers left mostly out of pocket. The projected headline costs for the programme are £10.9bn with benefits split between primarily the suppliers at £8.2bn and £5.6bn in hypothetical energy savings for the consumers. According to British Gas, the actual average yield so far to consumers in energy savings that have smart meters is a miserly two per cent or £26 out of a cost per household of just over £400. With dramatic falls in gas and electricity tariffs over the last year, no wonder the government is conducting a new impact assessment that should hopefully lead to a review of the programme on how to lower costs and shift the benefits to consumers who are footing the bill.

On nuclear power, the endless prevarication around Hinkley Point C shows us that it was a mistake to prioritise a 2020 target (that will now not even be met) over waiting for enough nuclear designs to go through the Generic Design Assessment (GDA) to enable a cost-lowering competition between players. The United Arab Emirates, which held an open, global competition in 2009, is now building several nuclear plants on budget and to deadline at a third of the

Table 1: Total projected infrastructure spending 2016-2021

Sector	Total (£m)	Percentage share
Energy	£255,728	60%
Transport	£134,493	32%
Water	£19,322	5%
Communications	£6,026	1%
Science and research	£5,455	1%
Flood	£4,070	1%
Waste	£484	0%
Investment total	£425,582	100%

Table 2: How taxpayers will fund major infrastructure projects

Project	Description	Expected taxpayer contribution up to and beyond 2021 in £m
High Speed 2	HS2 – National high-speed rail network (phases one and two)	55,700
Network Rail	Enhancements	16,648
Network Rail	Maintenance and renewals	14,662
NDA	Waste management: disposal facility for UK legacy radioactive waste	11,438
NDA	Other NDA capex – new construction spending	10,783
Network Rail	Maintenance and renewals	7,755
Crossrail	Crossrail	7,500
DfT	Intercity Express Programme (infrastructure)	6,380
BIS	Other Grand Challenges Fund and world-class labs projects	5,657
Network Rail	Enhancements	4,996

² See National Infrastructure Pipeline Spring 2016

expected cost per installed megawatt as Hinkley Point C.

Short-term targets and long-term construction have been a poor match in Britain's energy landscape, raising the cost of finance and the overall project risk. There is huge scope for delaying decarbonisation so that it can be done at a price and a timescale within which the economy can stay competitive.

So what should the UK do?

Infrastructure Best Value Index

To great fanfare last October, George Osborne launched the National Infrastructure Commission (NIC) led by Lord Adonis with a remit to take politics out of big infrastructure decisions and, where possible, help to push them through with dispassionate analysis. Osborne believes that the failure of successive governments in infrastructure meant that Britons "...spend longer than they should getting to work; pay more than they should in energy bills (and) can't buy the homes they want".

Since then the NIC has been busy running consultations and producing upbeat and voluminous reports on northern connectivity, London's transport infrastructure and energy. But we cannot be blind to the cost of some of the larger projects in the pipeline. Crossrail 2, a trans-Pennine tunnel and HS3 together would cost just under £50bn. Add these to funds allocated to HS2 and the sum is over £100bn on public financing of big transport projects alone. These projects may well have varying levels of benefits, but they are expensive, and in a world of limited resources they inevitably have opportunity costs.

A further worry is that the government appears to be betting the farm on a continued modal shift from road to rail and other forms of tax-subsidised public transport, just as we acknowledge that driverless vehicles will become widespread at the end of the 2020s. The promise of autonomous cars is enormous. Studies suggest a six-fold rise in traffic on the road with increased speeds, zero accidents and the end of car ownership, replaced by a pick-up and drop-off service, undermining large swathes of public transport.

A final issue is to do with estimating

Infrastructure sector and project	Description	Cost in £m
Electricity generation	Post-2020 spend	60,223.2
Oil and gas	Oil and gas	45,600
Electricity generation	Nuclear – Hinkley Point C	16,000
Electricity generation	Nuclear – Wylfa B	15,000.0
Electricity generation	Nuclear – Moorside	14,767.5
Electricity generation	Other generation investment 2020	10,662.0
Electricity transmission	Other investment	8,624.1
Smart meters	Smart metering implementation programme	6,228
Water and sewerage	Projects over £50m – Thames Tideway Tunnel Main (Thames Water)	4,163.8
Electricity transmission	Interconnector investment	3,710.0

future urban and inter-urban scaling benefits. Cities grow successfully because the demands for energy and transport are sublinear to the growth of the overall population. By living at higher density, serendipitous opportunities are created for social and economic interaction while more people can be moved over shorter distances to and from work. That's why most planners hate urban sprawl, preferring concentration.

The future growth of Britain's most successful cities is limited by the green belt, which drives up the cost of property and economic activity. So the last few governments have seen fit to focus on inter-urban agglomeration with grand schemes such as HS2. But the amount of people you can move and economic opportunities you may be able to create with faster transport between two cities is a poor second to what you can do by improving transport in an existing city. London's Crossrail, for example, is expected to fill up right away when it opens fully in 2019.

The second – not far away now – will be the rise of virtual reality, or more precisely, virtual telepresence. Within the next 10 years, with multigigabit-speed, ultrafast broadband coming online, the rise of the virtual economy could begin to make actual presence redundant, leading to the rebirth of a dynamic rural and suburban economy. Urban scaling may start to reverse while the ultimate networking scale play will arrive with four billion more people using the internet globally.

With so much poised to happen that can turn received orthodoxy upside down, we must have an

infrastructure Best Value Index to ensure that scarce resources are allocated carefully and to negate the opportunity costs of squandered capital. It's essential because the true cost of infrastructure is not in the upfront capital expenditure to make it turn-key ready, but in the annual operations and maintenance that over the lifetime of the asset could be five or six times the total capital cost.

No one knows when, or even if, HS2 will make a profit. If publicly financed infrastructure is not expected to achieve 'capital deepening' – adding value in excess of costs with that value not just measured in profit – it should not be built and the taxpayers' cash saved. In 2016, we still know little about the internal rate of return of our existing infrastructure assets. Billions could be saved and successfully reinvested if we were to build a national database of our infrastructure – roads, bridges, sewers, mobile-phone masts, railway stations, gas pipelines – and answer some basic questions such as:

- What does it cost each year to run in operations and maintenance?
- Does it make a profit in excess of those costs?
- Does it crowd out existing privately financed infrastructure?

In cases such as rural and suburban railway stations, you may find that many are loss-making. But their value is that they make up part of the network and serve distant commuters who have valuable homes with high-paying jobs that serve the local economy. But it is clear that we cannot move on to having a debate about



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Torness nuclear power station in Scotland. Not all low-carbon technologies have long lifespans

how to turn this around by changing the terms of station ownership and turning them into commercial hubs without the underlying numbers. For future infrastructure, we need to set a lower ceiling on future spending that dares to be pessimistic about resources and ask:

- How long will it take to build?
- When will it make a profit?
- What is the estimated lifetime?
- Does it add networking and land value gain?

All of these can be scored and added to a public-facing infrastructure Best Value Index that would be a way for taxpayers to hold the government and the NIC to account by ranking proposed projects against each other.

This is necessary because the UK has under-appreciated the transition cost to intermittent renewable electricity that such an approach would have considered. The hardware – primarily wind turbines and solar panels as well as the requisite balance of systems – will need wholesale replacement after just 15 years, meaning you will have to spend

three times over 50 years. Other low-carbon technologies with longer lifespans, such as nuclear power plants and hydro-electric stations, could last up to 60 and even 200 years.

When fully amortised, perhaps after 20 years, they are cheap assets to run and can give us much cheaper power. On the other hand, because wind and solar are small and modular, they have been easier to finance and add incrementally to the system, albeit with subsidies.

Value for money

You can, of course, go too far down the cost-saving route. Occasionally, the UK will require a really big infrastructure project and it will pay for itself. The construction of the National Grid in the 1920s and 1930s was successful. The creation of the motorway network from the late 1950s – and particularly the M25 in 1986 – have paid for themselves many times over. And the digitisation of the telecoms backbone network in the 1980s paved the way for the explosion in communications technology. Taken to extremes, if you only ever build on the basis of pre-existing demand, then it is

highly unlikely that Apple would have ever made the iPhone.

Similarly, the UK has no spaceplane operators planning immediate launches from Britain, but the government is right to plan ahead and anticipate the need for a regulated spaceport or two for vertical and horizontal launch. Like business-driven consumer products, there is room for financing infrastructure that people want, rather than just what they need or didn't even know they wanted. Yet there is no escaping that finances are tight and, if another recession happens, will become much more constrained. Only with a shift to permanently value-sensitive, frugal infrastructure, driven by numbers taxpayers can understand through democratic discourse, are we able to meet the clear challenges of our age. **10**

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