Rethinking Smart Futures

Focused on people, enabled by transport, powered by technology

pwc

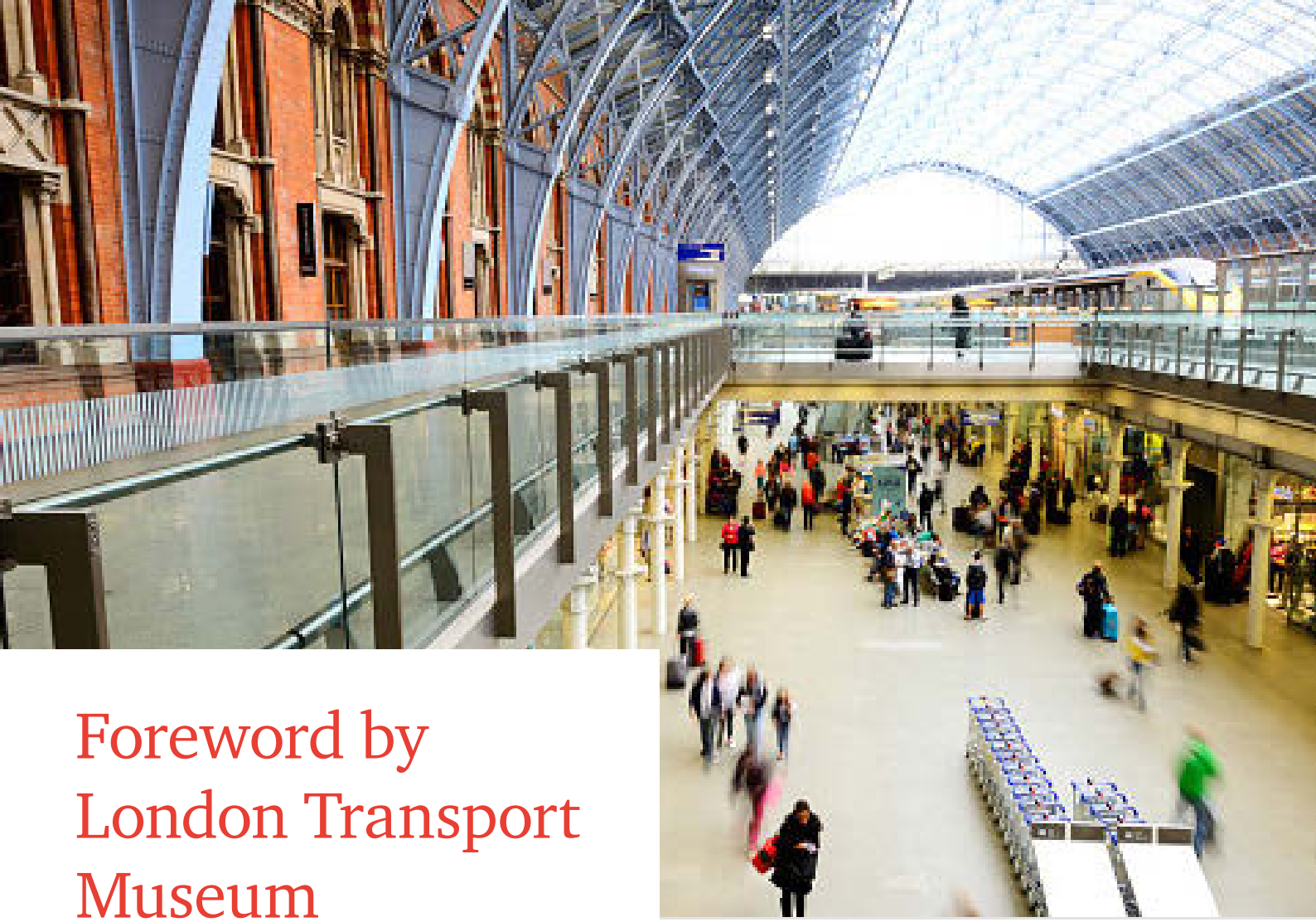
In collaboration with

london transport museum

THALES

GOWLING WLG

Contents



Foreword by London Transport Museum

As the influence of digital technologies on our lives continues to grow, our cities are at a crossroads. Rapid advances in technology are coinciding with sweeping changes in working patterns, social attitudes and therefore transport usage. And these trends are playing out amid growing concerns over privacy and security in a world where data is ever more abundant. Against this background, our cities and local communities must work out how to harness the power of technology for the good of all.

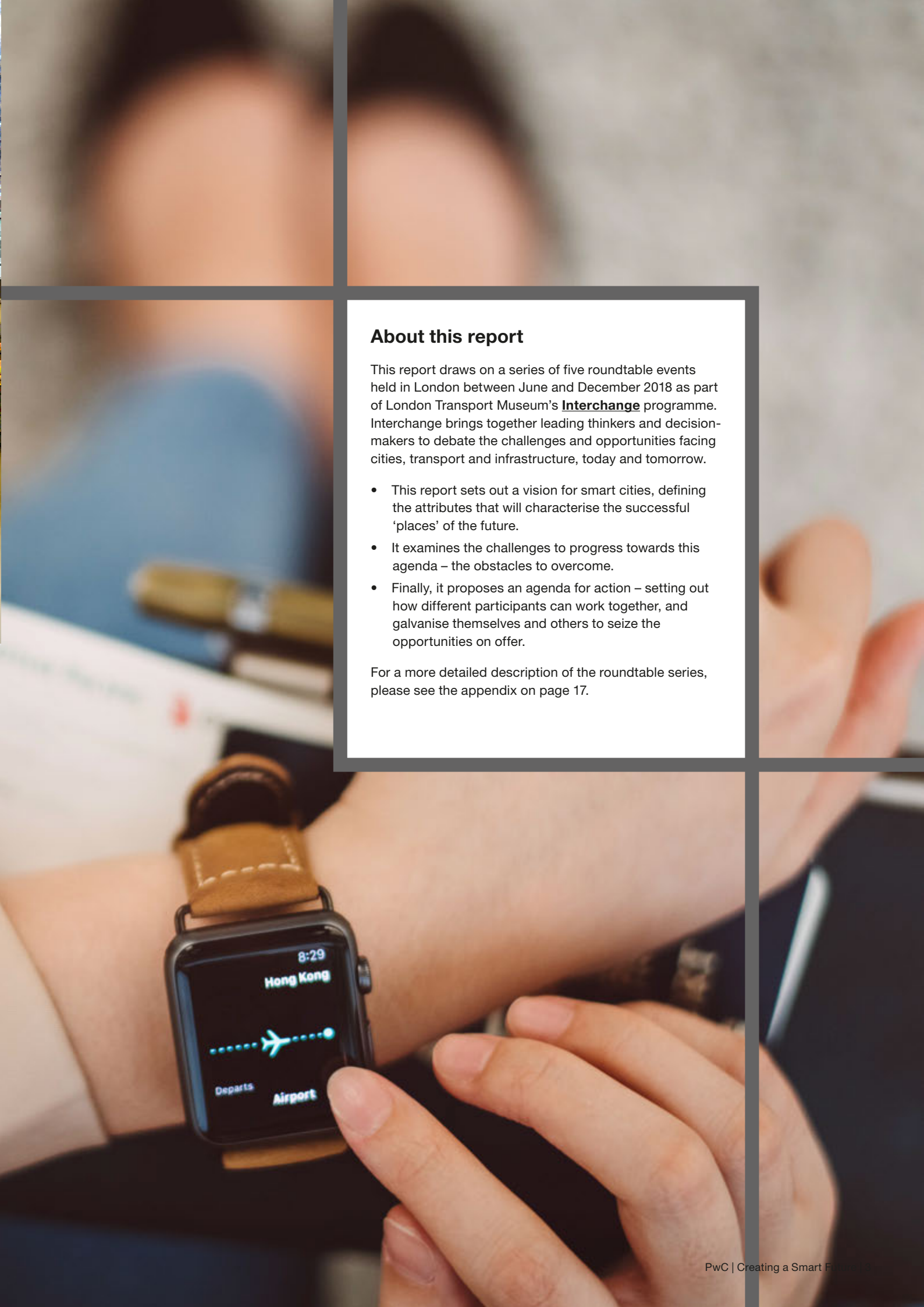
The result? While the aspiration of ever more tailored and responsive services is now achievable, it remains unclear how to make it a reality that works for everyone. But what is clear is that transport will remain the crucial bedrock underpinning the cities and communities of the future.

All of this means the question of how the transport networks serving our cities and local communities will develop is more urgent than ever. That's why, as part of our **Interchange** thought leadership programme, London Transport Museum has collaborated with PwC, Thales and Gowling WLG to host a series of roundtable discussions throughout 2018. This report represents a synthesis of the thinking, insights and debate from those sessions.

So, what messages come across? While much exciting progress is being made towards the creation of smart cities and communities, things are not happening quickly enough. Realising the opportunity on offer will require several challenges to be overcome – and the good news is that they are surmountable. This report examines what a smart future should look like, what the roadblocks are, and how these can be addressed. It then goes on to detail the specific steps that each stakeholder – central government, city and regional authorities, and private sector providers – must take to realise the vision.

Building on our 2017 research study **Rethinking Urban Mobility**, we believe this new report is a step forward in the debate on the future of our transport networks. We hope you find this report informative and thought-provoking.

Sam Mullins
Director, London Transport Museum



About this report

This report draws on a series of five roundtable events held in London between June and December 2018 as part of London Transport Museum's **Interchange** programme. Interchange brings together leading thinkers and decision-makers to debate the challenges and opportunities facing cities, transport and infrastructure, today and tomorrow.

- This report sets out a vision for smart cities, defining the attributes that will characterise the successful 'places' of the future.
- It examines the challenges to progress towards this agenda – the obstacles to overcome.
- Finally, it proposes an agenda for action – setting out how different participants can work together, and galvanise themselves and others to seize the opportunities on offer.

For a more detailed description of the roundtable series, please see the appendix on page 17.

Focusing on people: The vision for a smart future

Putting people at the heart of our future cities is critical for their success.

Steps to becoming a smart city will inevitably involve a combination of technologies – but these are the means rather than the end. The core purpose for any progressive city is to have a thriving population with an enhanced quality of life for all.

An agenda for the future of our cities.

In developing a world class smart city[1], a city authority must work out how technology, innovation and transport will fit together to help achieve a combination of the following:

1. **Develop a holistic strategy** – The keystone for success for a smart city is a shared vision and comprehensive growth strategy. This needs to incorporate the multiple stakeholders and organisations across the public, private and third sectors, and be underpinned by strong, clear governance.
2. **Tackle societal challenges** – It is important to address their citizens' needs to provide a high degree of livability. That covers employment opportunities, health, housing, leisure, education, mobility, connectivity and more. All while tackling challenges around environmental, social and economic sustainability.
3. **Include an underlying social inclusion agenda** – Social exclusion and inequality are among the biggest issues facing our cities. Whether the problems are related to financial exclusion, or access to employment, transport or digital connectivity, a successful smart future must help address them. Reducing inequality and deprivation can itself drive growth according to a report by the Inclusive Growth Commission.[2]
4. **Make it easy to embrace digital innovation** – Advances in technology are opening up opportunities to tackle social and environmental challenges. To capitalise on them, smart cities will actively embrace innovation, necessitating them working in new structures and business models.
5. **Develop an iconic brand** – Every successful place needs to have a distinctive offer for residents, business and investors, and a credible vision for why it's unique. This could be a keystone asset such as an educational institution or industry cluster. When this works well, a city attracts, trains and retains world class talent, as well as nurturing its own residents' talents, thereby encouraging aspiration.
6. **Prioritise transport as a vital enabler and underpinner** – While any smart future encompasses many areas of people's lives, the ability to move around easily and cost-effectively is a vital enabler of all the other benefits. That's why our debates – and this report – have focused particularly on transport.

"Too often, people try to define what a smart city should look like from the technology point of view, rather than from a social or people perspective."

Claire Williamson, London Transport Museum

"We need to find new and creative ways to address the digital divide that will enable better education, improve employment opportunities and address the growing number of people living in isolation."

Julie Snell, Bristol is Open

[1] We use 'city' and 'place' as shorthand in this report, but they can include regions or even nations

[2] RSA, Inclusive Growth Commission: Making our economy work for everyone (2017)

Realising the opportunity…

PwC's **Cities of Opportunity** provides a useful aid to visualising the future of our cities and communities. It examines how cities work as an interconnected system of complex systems – from energy to education, transport to food supplies, healthcare to water. And it analyses how the world's leading cities keep all these moving parts meshing smoothly to create common wellbeing for citizens.

The report goes on to rank the performance of different cities globally against ten factors (see call-out box). The outcome? In the latest study, London has widened its lead – with Singapore, Toronto and Paris hot on its heels.

…by putting human values at the core

The overarching message from Cities of Opportunity is that human values constitute the cornerstone of urban life. A city's performance correlates with its ability to foster attributes like senior wellbeing, housing, workforce management, mobility and disaster responsiveness.

The future of transport relies on data

As we've highlighted, inclusive transport is the bedrock of the smart future. Once the core infrastructure – roads and railways – is in place, what matters then is understanding, anticipating and meeting users' needs.

Smart use of data is vital in shaping the system to do this. That starts from planning what services are available and how citizens access (and pay for) them, through to how they're used – including integrating multiple services and dealing with real-time changes.

So, the vision for the smart future is focused on people, enabled by transport and powered by technology and data. We'll now look at the barriers to realising this vision – and then how these can be overcome.

Ten measures of city performance

- Intellectual capital and innovation
- Technology readiness
- City gateway
- Transportation and infrastructure
- Health, safety and security
- Sustainability and the natural environment
- Demographics and livability
- Economic clout
- Ease of doing business
- Cost

"You'll never get a smart city if all the different elements haven't got their data in order. So, the starting point is establishing ownership of data and understanding its value as an asset. Without that, how can you hope to start sharing information?"

Peter Vale, Thames Tideway Tunnel

Challenges to realising the vision

To date, the progress of cities around the world towards a smart future has been both gradual and uneven. To understand more about the opportunities, roadblocks and what 'good' looks like, our Interchange workshops elicited views from a diverse array of experts. Three overarching challenges emerged.

1 Too hard to choose

This barrier boils down to indecision because of uncertainty over which innovations will win out – and are therefore worth investing in. It's evident that technologies like artificial intelligence (AI) and automation will play an increasing role. AI-enabled systems are expected to grow from $1.4 billion in annual revenue in 2016 to $59.8 billion by 2025, according to one research study.[3] But working out exactly how these should be applied to best effect in years to come is not easy.

Picking winners

Picking winning technologies is made harder by the need for the smart future to achieve two key goals: first, to be truly inclusive; and second, to be flexible enough to keep pace with people's fast-evolving behaviour and expectations. The risk-averse nature of public procurement can also add to the difficulty, by making it harder for government at all levels to collaborate and innovate with private sector partners.

What's more, focusing on innovating in just one dimension of the smart future – transport, say – won't do. In a smart environment everything is interconnected, meaning system-thinking is imperative. However, the fact that problems such as inclusivity and sustainability are also being tackled in areas such as healthcare and energy creates opportunities – and a need – to collaborate with those areas too.

Procuring – and protecting – innovation

A final barrier to technological innovation is fear of cyber-attacks. In Asia, over half a million Android accounts were breached between August and December 2016.[4] In the smart future – not least in transport – preventing disruption from hacking will be critical. Technology can enable citizens to travel in a flexible and personalised way across different modes of transport. But everyone will need to feel safe and confident that the systems and personal data flowing across them are secure.

"Since the 1980s, the public sector seems to have had less and less ability to do deals – to say things like, 'My policy aim is to get people to walk more, you want to develop IP for future sales, let's talk.' At the moment the public sector doesn't seem to be able to take the risk and do deals that create value-added collaboration."

Matthew Hudson, Transport for London

"There is a real tension in public procurement law – between the basic 'level playing field' principle and the fostering of new technologies and innovation. We cannot expect innovators to give their ideas away so there may need to be a bold re-assessment of the procurement law framework."

Giles Clifford, Gowling WLG

[3] Tractica [media release], "Artificial Intelligence Implementations Have Expanded to Encompass 215 Discrete Use Cases Across Virtually All Industries", 28 August 2017, available at: https://www.tractica.com/newsroom/pressreleases/artificial-intelligence-implementations-have-expanded-to-encompass-215-discrete-use-cases-acrossvirtually-all-industries/

[4] Future City Catapult (2017) Smart City Strategies: A global review

2 Too many cooks

Creating a smart future for cities demands participation and collaboration from multiple organisations across the public and private sectors. But they'll often have competing interests. In the public sector, national government will focus on economic growth and policy goals aligned to the national Industrial Strategy.[5] Regional government will likely pursue greater agglomeration, inter-regional connectivity and consistency. And local and city governments will often target brand differentiation, more jobs, a healthier environment and wellbeing for citizens.

Equally, there are differences that emerge among business stakeholders. Established providers of smart services will want to work with the public sector in ways that are profitable on a long-term basis. Innovative start-ups will be looking to prove their technologies in a smart environment and secure a new market. And local businesses will want good commuting and trade connections, and an attractive place for their employees to live.

What's more, the various agencies and providers will typically work together to develop strategies narrowly focused on an individual component. For example, transport planners – mindful of local economic ambitions – will focus on producing a transport plan. Similarly, local development plans will follow a relatively narrow path that doesn't consider the full breadth of issues relevant to their place's future trajectory. If left unaddressed, these 'strategy silos' can be a significant barrier and result in the duplication of effort.

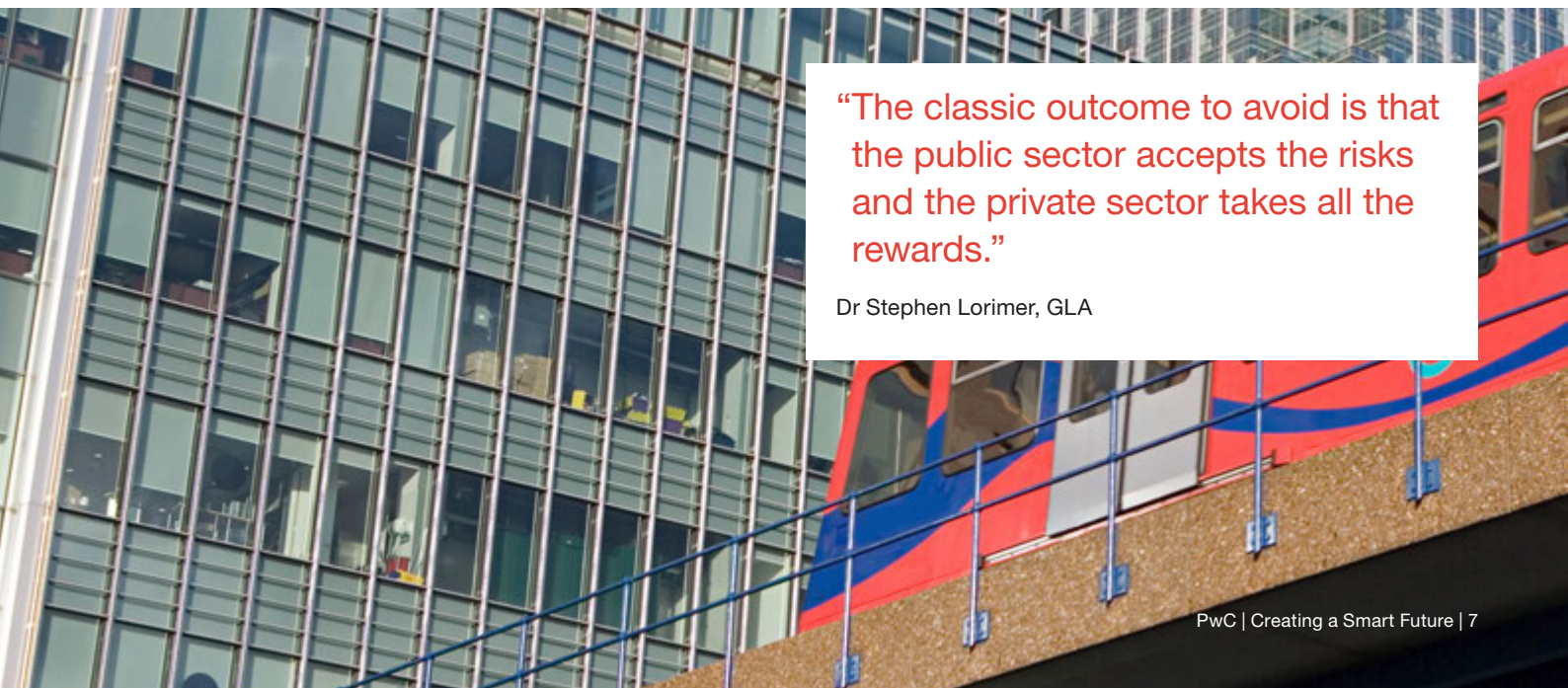
Mistrust of the 'profit motive'

Differing interests within the public and private sectors are compounded by differences between those sectors. There's often concern in the public sector that private sector providers are seeking a quick return on investment. The worry is that they'll select the most profitable opportunities – and wealthiest demographic – leaving the public sector to pick up most of the risk and cost of new development, and to address the inclusivity agenda. Yet the private sector can only be involved if it makes a return. All of this calls for a new type of public/private collaboration, with the public sector investing for the public good and the private sector still getting a fair return on investment.

Avoiding dislocation

The disconnects between the agendas on both sides can make it harder to provide seamless services, particularly when data is distributed across multiple entities. The public sector has access to a wealth of personal information that can be very valuable in personalising and monetising smart services. But partly because of the public debate on data privacy, it's often reluctant or unable to share this data with the private sector. It's clear that joined-up, integrated smart services have implications for personal data privacy – a fact that should be made clear to citizens.

[5] HMG Government, National Industrial Strategy (November 2017)



"The classic outcome to avoid is that the public sector accepts the risks and the private sector takes all the rewards."

Dr Stephen Lorimer, GLA

3 One size does not fit all

Variations in wealth, infrastructure and funding…

Developing a shared vision and comprehensive strategy for a city is important. Each place has its own set of priorities and timescales reflecting its specific needs and circumstances. These are partly determined by the needs, expectations and socioeconomic makeup of its populace, and partly by the existing infrastructure on which it must build its smart future.

Tier-one cities like London benefit from a long history of investment in transport infrastructure. This legacy can give a robust platform on which to innovate. But it can be a double-edged sword. Designed before digital connectivity and the Internet of Things (IoT), legacy infrastructure can be costly to repurpose for and protect in a digital era.

The availability of funding also varies. Local factors shape how new transport infrastructure and services will be financed, including the degree of government involvement and the business models used. Examples include the different roles that city or combined authorities play in public transport provision, from light touch to taking on operation either directly or via contracted services. Road pricing and congestion charging open further potential differences here including the vehicles that are charged and what happens to the net revenues.

…mean every place's smart future is unique

Such variations make it impossible to develop a catch-all, out-of-the-box 'smart solution' for use in all cities and regions. Many tools and technologies may be common – but each place's vision and approach will be unique.

"London has inherited a powerful transport network – and whatever is going on elsewhere in the economy, society or technology, that's an embedded reality. If you live in Blackhorse Road, you'll continue to use the Victoria Line: no other type of transport could move so many people so quickly to Oxford Circus."

Tony Travers, London School of Economics

"Cities like London, Paris and Milan are generally able to access and build the knowledge and capabilities needed to understand how to become a 'smart' city. Others might struggle to build internal expertise – so it is important they can get support from somewhere else – including the private sector."

Jo Dally, BP

Removing the roadblocks

Our recommendations for overcoming the roadblocks we've described fall into three main phases. **Setting up for success** comes first, followed by activities to **create a data-rich environment**, which can progress in parallel with encouraging **collaboration, innovation and investment**.

We'll now specify the key actions in each of these three phases. We identify what needs to happen, and then who needs to do it.

1
Setting up for Success

Start with the why

What needs to happen?

To guide its journey, each place must develop a shared purpose. This will become the strapline encapsulating why we should be collectively pushing for the smart future at that location. A generalised version would be along the lines of: **'The smart future is about creating places where all citizens thrive through ever-increasing quality of life, enabled by smart technology.'**

Who needs to do it?

This needs to be led by the local government entity – be that the city, local or combined authority. But crucially, it cannot be something the public sector does on its own. It has to be developed in consort with representation from critical local businesses, for example in using the Local Enterprise Partnership (LEP) network.

"At the moment we're often bound by the ambition that we want cities to be smart without really knowing why. If we look to make cities more sustainable and liveable, then becoming smart is really just a way to achieve these things."

Daniel Dowling, PwC

Determine the place-based vision for your smart future

What needs to happen?

The place-based vision will set out what the future will be like in each location. Every place has its own unique challenges and traits. So it's vital that cities take ownership of what the smart future should look like for them, how to ensure integration between services, and how it will improve citizens' lives.

Who needs to do it?

As with the purpose, developing plans for what needs to happen should be led by the local authority, supported by key private sector and business stakeholders.

"Most housing developments now have a proportion of affordable housing. You could apply the same principle to mobility. You could also see who's used the transport network, who has not, and target those people who are excluded from the system."

Claire Williamson, London Transport Museum

You get what you measure

What needs to happen?

This activity should include exploring and developing alternatives to the traditional metrics of GDP or GDP per capita growth. Since the mid-1970s the link between GDP per capita growth and living standards of the average worker has been broken in the US and more recently this also seems to have been the case in the UK. Between 2010 and 2017, for example, UK GDP per capita grew by around 12% but, over the same period, real wages fell by 4.2%. So while GDP and GDP per capita are still useful as timely measures of economic activity, alternative measures of living standards need to be developed that also capture distributional effects – a shift that global policy influencers, including the World Economic Forum, have already noted.[7]

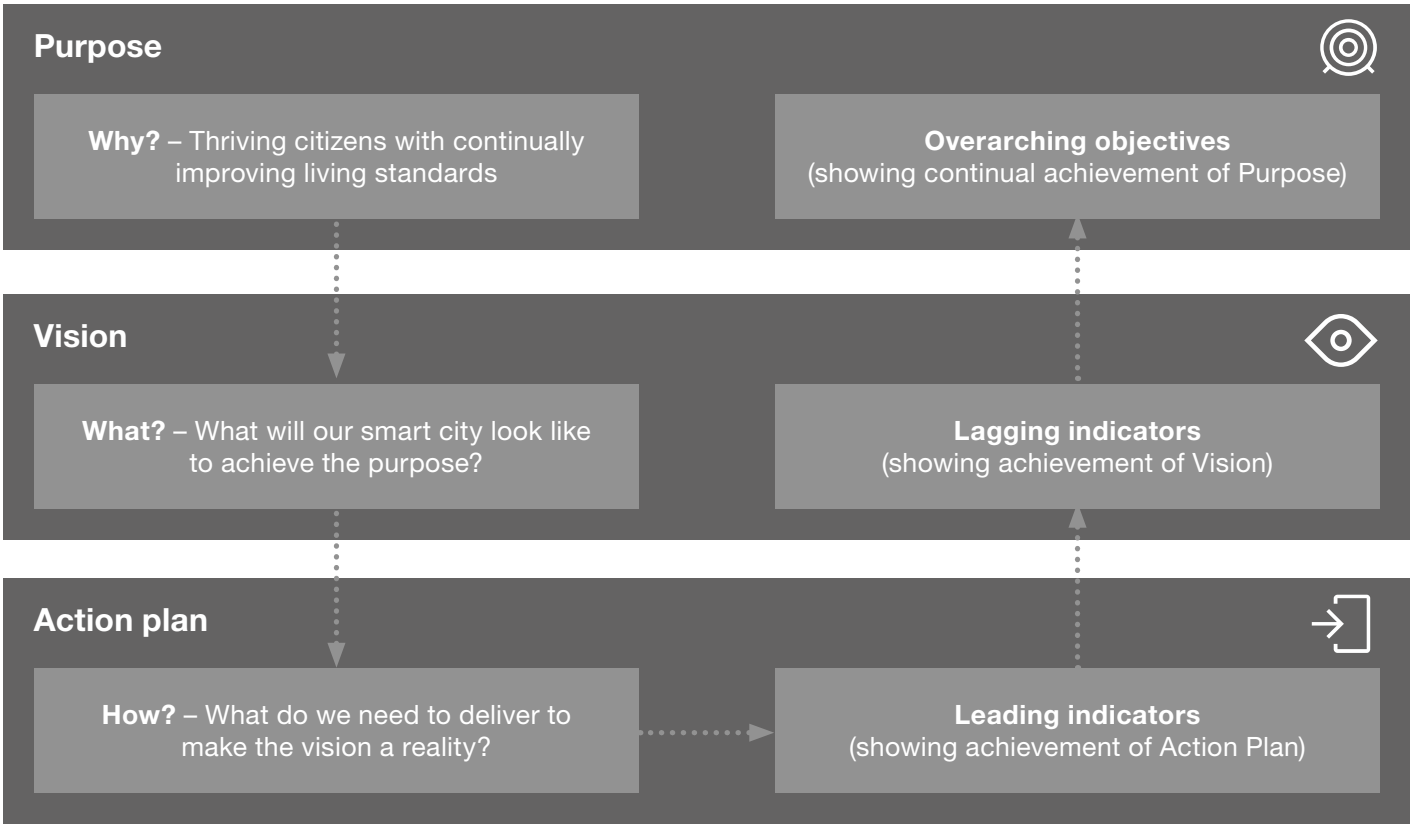
Other options include 'well-being indices' such as the OECD's **Better Life Index**, or the Demos-PwC **Good Growth for Cities Index.** The New Zealand government announced in January 2019 that it will use the **Living Standards Framework** to guide investment decisions and measure its own effectiveness. Frameworks like these can be used as success measures for smart future initiatives, possibly supplemented by locally-developed metrics for areas that incorporate social inclusion, health impacts and ease of access to transport.

Who needs to do it?

Central government must set a framework for allocating money based on a purpose that goes beyond just GDP. Civic and regional authorities can then take the lead in developing their place-based visions and metrics, in collaboration with wider public sector, private sector, academia and citizens. Local authorities will need to ensure all these views are captured and used to guide policy on purpose, vision and metrics. One mechanism could be 'citizens' assemblies' including representation from all these groups.

"Building a wider range of metrics into contracts is important. You don't just want to measure against GDP growth; you need to know that the benefits are being spread in an equitable way."

Ryan Charteris, PwC



[6] Statistics from Office for National Statistics

[7] https://www.weforum.org/agenda/2018/12/how-gdp-distorts-our-view-on-what-is-important

2
Creating a data-rich Environment

Engage with all users on data and its use

What needs to happen?

Data underpins all systems and services that make up a smart city. More data will be collected from everything from a digital railway or road to an autonomous vehicle or e-scooter. This data is most valuable to those providing services directly to citizens or maintaining key assets. The next generation of mobility-as-a-service will enable service integrators to offer citizens a choice between a dozen or more modes – but this will only work if the information on availability, journey time and conditions is reliable and timely. However, many organisations may feel reluctant to share data. And individuals will only agree to their data being shared if they're confident it's safe. So the first step here is to gather insights into the motivations of those involved in providing transport services to inform the requirements for a future service.

Several initiatives are underway across the UK to generate value from data with smart infrastructure and services. For example, **ODI Leeds** is a 'pioneer' node of the Open Data Institute, created to explore and deliver the potential of open data at city scale. Birmingham City Council's **Digital Birmingham** has helped the West Midlands to be named the UK's first 'Future Mobility Area', with a total of £20m set to be invested in transport innovation across the region. And the **Manchester Smarter City Programme** is working with universities, business and public sector to explore how technologies in transport, health, environment and energy efficiency can help improve how the city operates.

Who needs to do it?

Each city or region will need to develop a view of its key citizen or customer segments, and understand their needs and issues around data. The same exercise for organisations involved in providing transport services should be carried out at a national level, given the commonality of many providers.

Develop data use rules – leading to a 'broker of trust'

What needs to happen?

This activity begins with reaching agreement on the principles of data sharing – which in turn can enable the creation of protocols specifying how data will be accessed and exchanged. For this to work, there will inevitably need to be a trusted third-party who can act as a guardian of the data; they may not hold all the data, but they would need to be the 'broker of trust' and be on point to ensure the rules are applied consistently. The rules need to define what information will be shared, how and with whom, and what protections are in place. However, demonstrating the value that sharing creates for organisations and citizens is also critical – as is clearly allocating responsibility and accountability for data.

Who needs to do it?

This will need to be led by service providers, but with engagement and agreement from local and national government. All parties involved in creating the smart future must have a say in defining the data use regime – central and local government, private sector providers, local businesses and citizens.

"Public good, we need to build in the trust perspective that it's being protected. We need to establish how to get value from it, and then individuals can make a choice about their own data."

Peter Vale, Thames Tideway Tunnel

Design services with cyber security incorporated from the outset

What needs to happen?

The UK National Security Strategy ranks cyber security alongside international terrorism as one of four 'tier one' risks to the UK's security and prosperity. The frequency and severity of cyber-attacks on UK transport infrastructure are rising. And with the move to hyperconnectivity and automation, this trend is set to increase further. In a world of digitally-operated railways, autonomous vehicles and automated payments for transport services from multiple providers, the risks from cyber threats are clear. So, for passengers to trust the resilience and safety of transport systems in the smart future, cyber security must be an integral design consideration from the start.

Who needs to do it?

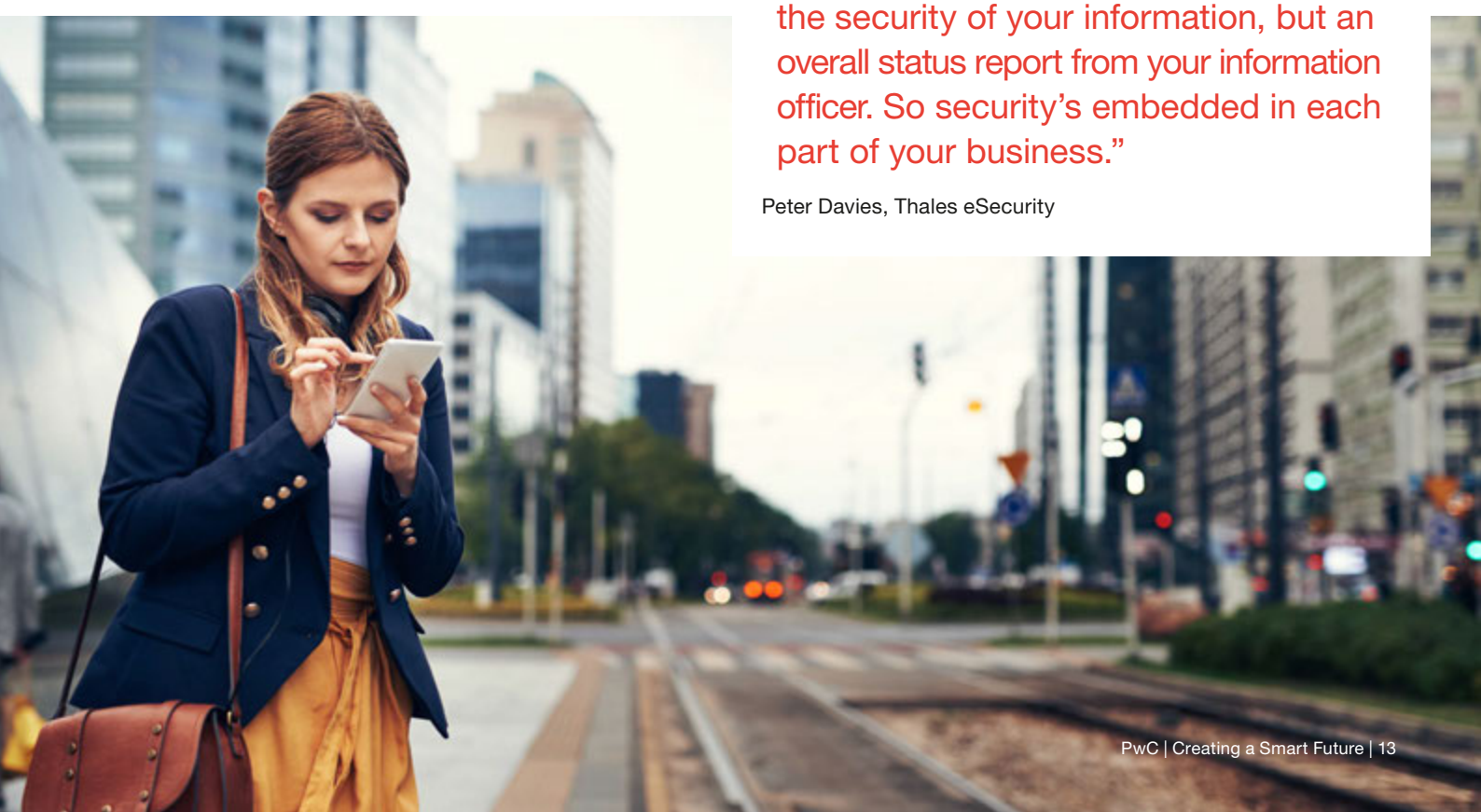
Every organisation operating in the smart future will need to demonstrate its cyber security credentials. The 'Directive on security of network and information systems' (NIS Directive) enshrines this imperative into UK legislation, making compliance with it a baseline requirement. The local authority's role will then be to confirm this is in place and to engage with citizens so they understand what steps are being taken to protect them against cyber threats.

"If you look at financial services, the chances of someone being hurt or killed are low. But in transport, with people travelling at speed, you are looking at real harm and even loss of life. That makes the stakes considerably higher for this sector."

Robert Hannigan, BlueVoyant

"What does 'embedding security' mean? It means you don't get a report just on cyber security, but on safety as a whole. And you don't get a report on the security of your information, but an overall status report from your information officer. So security's embedded in each part of your business."

Peter Davies, Thales eSecurity



3
Collaborate, innovate and invest

Create a regulatory framework for safety, data and interoperability

What needs to happen?

Regulations are required to underpin a number of aspects of how a smart city will operate. They are needed to ensure two key things: first, the safety of users; and second, a level playing field for fair competition. The level playing field is created by ensuring all operators in the market meet acceptable:

- Safety standards,
- Data use standards, and
- Standards of interoperability to enable system-wide connectivity.

Data plays a vital role in underpinning smart, personalised services in transport and other areas of people's lives. And people need to feel confident that their data is not open to misuse or unauthorised access. Together, these point to regulation around the ownership, use and security of data being imperative.

Who needs to do it?

Creating the regulatory framework for smart services will be a task for central government – albeit in consultation with city/regional authorities, service providers and citizens' groups to establish what's desirable and achievable.

"With technological change moving at such a fast pace a clear structure is required at the outset to enable those involved with smart cities to understand what the starting point is and what deliverables are required."

Sarah Rock, Gowling WLG

"Innovation across the public sector demands collaboration. Outside of the police, emergency, ambulance services and so on in London, there's no single body that has the budget to keep innovating and then test and scale that innovation. So collaboration is needed that cuts across those silos."

Dr Stephen Lorimer, GLA

Focus public procurement on enabling the vision and collaboration

What needs to happen?

The creation of a smart city or region demands innovation in public services. Public spending accounts for a large share of the overall economy. It's vital that this spending is well-directed to shape the right responses from business. Public procurement needs to encourage delivery of the smart futures vision. This means it must evaluate proposals based on the 'beyond GDP' metrics. It also needs to encourage collaboration and innovation, as these will deliver better services for citizens. This will include running pilots of new technology and then investing further in those that deliver the biggest benefits to citizens. Achieving this means procurements that are more focused on outcomes rather than specifications, that have more flexibility upfront and therefore involve more dialogue as learnings emerge.

It will also mean breaking down 'strategy silos'. So rather than different agencies focusing on specific components of the smart future, they work together to take a holistic view across, say, employment, housing and transport. Successful smart places will find a way to cut across and integrate these silos. And they'll have the courage to work on the edges of regulatory frameworks to develop a single strategy across all components that addresses their critical issues and works for their citizens.

Who needs to do it?

Central government must lay down the ground rules for procurement of innovative services, with the baton then passing to city and regional authorities to put relationships and agreements in place.

Invest in and around the technologies required to realise the smart vision

What needs to happen?

Some of the technology developments that are required to enable the smart future will progress through a typical lifecycle development funnel, starting with 'blue sky' innovation and moving through to applications to meet specific needs. This has its place but can create a disconnect with the innovation funding process, since the ultimate value of a piece of innovation may not become clear until it's gone through the funnel. Take the technologies that have made the smartphone so revolutionary, like GPS, touch-screens and the Internet. These innovations weren't invented by companies in response to market demand; instead, they sprang from strategic government investments in potentially game-changing technologies. Technologies that were then harnessed by the private sector to create products that change our lives. In short, for smart cities to realise their potential, they need to take some risks in investing in technologies for which the application is not entirely clear at the outset.

Who needs to do it?

This is a task for central and city and regional government who need to set the vision and agenda and lead, in cooperation with private sector partners who are carrying out the innovation.

Conclusion: An agenda for action

A prize worth going for

Successful smart places—be they cities or regions—will be about much more than new technologies. They'll help to address societal issues in areas like health and education. They'll promote inclusion. They'll embrace digital innovation, so they become places people want to live and work.

All this will be underpinned by smart enhancements to transport services as a vital enabler of all the other benefits. Indeed, we've made the case in this report that the vision for the smart future is focused on people, enabled by transport and powered by technology and data. Achieving these goals requires an approach that puts improving people's lives at the heart of every decision. And it requires an understanding of the critical importance of data – not least in shaping and running the transport systems of the future.

The message that came through loud and clear during our series of roundtables on creating the smart future was two-fold: there are hurdles and risks along the way to the smart future, but the scale of the benefits on offer to all stakeholders more than justifies the effort of tackling them. That's what we've sought to make clear in this report. It leads to a series of actions we have identified for each stakeholder group to take in creating the smart future.

Roadblocks along the way

Delivering the smart vision for a city or region is not easy. Three overarching challenges emerged from our roundtable debates:

- First, it is often **too hard to choose** the right innovations: with so much innovation going on, it's difficult to tell which new ideas or offerings will win out – and are therefore worth investing in for the future. True, AI and automation will be important. But how will they be applied?
- Second, there are **too many cooks** involved in creating the smart future. It demands collaboration from multiple organisations across the public and private sectors, often with competing interests or siloed areas of focus.
- Third, **one size does not fit all**. Every place has its own unique vision, priorities and timescales for its smart future, reflecting its specific circumstances. So it's impossible to develop a catch-all, out-of-the-box 'smart solution' application for all places.

Removing the roadblocks

The actions to overcome these three challenges fall into three main phases.

1. **Setting up for success** begins with deciding 'why' the smart future is the way forward – and then defining the place-based vision and relevant metrics to measure its success. Central government will set the lead by devising a funding framework that looks beyond traditional performance measures like GDP, providing a basis for places to press ahead with their own visions and metrics.
2. **Creating a data-rich environment** to support the smart future is critical but requires engagement and consultation across a region or city's stakeholders on what data will be used, how, and to what benefit. The outputs of such an exercise will enable agreement on rules for data use, including a 'broker of trust'. A critical step for building public trust is ensuring that cyber security is designed into all smart city systems from the start, which will also fall to city authorities to lead.
3. The third phase – **collaborating, innovating and investing** – is where delivery of the vision really gets under way. It begins with central government creating a regulatory framework for safety, data and interoperability to enable a market for smart future services in places across the nation. And it requires all levels of government to cooperate in refocusing public procurement to support collaboration and innovation – before pressing on to invest in vision-enabling schemes, including pilots and 'grand challenges' supported by grant funding.

By taking these three steps, places across the UK – and indeed globally – can navigate through the challenges we've highlighted. The stage for the smart future is set. The technologies are available and their potential is increasingly clear. The recommendations in this report will help harness the shared vision to make it happen, and establish the right approach to deliver it. Now it's time to collaborate to turn the vision into reality.

Appendix: The Smart Futures Roundtable Series

This report draws on the insights from five roundtable events held in the second half of 2018, as part of London Transport Museum's **Interchange** thought leadership programme.. Each event was attended by around 25 experts and decision-makers with an interest in smart futures, and featured an open debate led by two expert speakers.

The five Interchange sessions were:

Smart travel: how will technological change reshape how we travel?

This session explored technological change and its impact on the journeys we make and how make them. Key questions debated included:

- How will technology affect transport infrastructure and services in the future?
- How can we make the most of new technology while keeping passengers (and their data) safe?
- How will digitally enabled vehicles change the trips we make and how we make them?

Smart cities: how will technological change reshape our cities?

This roundtable examined how technological change will reshape the cities we live in. Key questions included:

- What do we really mean by a smart city, and how will these be developed?
- How do we best harness the power of the public and private sectors to create them?
- In what ways can technology help make cities better places in which to live and work?

Smart working: how will technological change reshape how we work?

This event looked at how technology will impact work in the future. Key questions discussed included:

- How will technology change the work that we carry out, where we work and how?
- What will be the key drivers of, and constraints for, this change?
- How can technology help us plan and reshape the workforce of tomorrow?

Smart security: how to protect smart environments from cyber adversaries

This session examined the cyber risks facing smart infrastructure and services. Key questions discussed included:

- What are the cyber security threats and developing trends facing transportation?
- What's the best response to dynamically evolving cyber threats?
- What do organisations have to consider in mounting digital defences?

Smart futures: what does a smart city look like?

Taking the three key themes of data, collaboration and inclusivity that had emerged from the other sessions, this roundtable debated questions such as:

- What are the considerations and blockers that need to be thought through with respect to each of these three themes?
- What are the recommendations for organisations making the smart cities happen, particularly with respect to transport?

To read summaries of the Interchange sessions, please click **here.**

pwc.co.uk

This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors.

© 2019 PricewaterhouseCoopers LLP. All rights reserved. PwC refers to the UK member firm, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see www.pwc.com/structure for further details.

190228-090820-AL-OS