Promoting InfraTech adoption across the Infrastructure lifecycle

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Global Infrastructure Facility

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Introduction

Infrastructure development is one of the great global challenges of our time, with vast investment needs, a multi-trillion-dollar financing gap, and a dearth of bankable projects. In an attempt to rapidly meet a growing demand for new infrastructure, technology-enabled solutions are often not proactively factored into infrastructure planning considerations. This can lead to a de-prioritisation of infrastructure technology—or InfraTech—since it may not be deemed critical to a project's success or to garnering private sector interest. In the long run, this may cause missed opportunities for maximizing the positive impact of infrastructure, maintaining technological competitiveness, and raising economic efficiency in view of life-cycle cost.

However, new technologies are constantly reshaping the operational models of the infrastructure industry, transforming the way infrastructure is being built and operated. This will only accelerate in the post-COVID-19 pandemic period, which is also marked by growing trends in technology disruption, aging assets, and climate change.

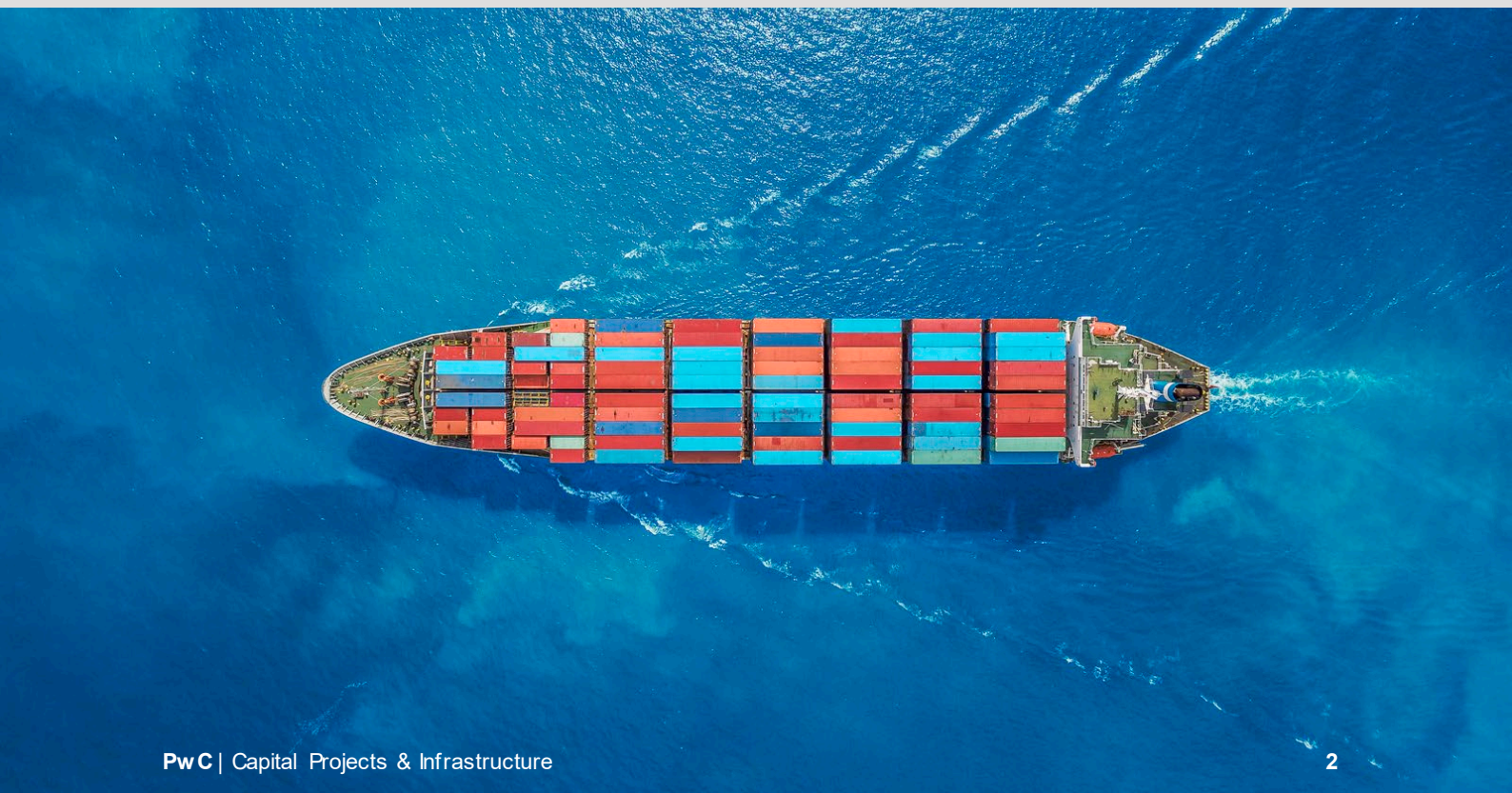
Infrastructure technology

InfraTech is a broad term that encompasses a number of widely different systems, processes, devices, and applications. According to the World Bank document InfraTech Value Drivers, InfraTech at its broadest can be defined as "any technology that significantly impacts the development, delivery, and ongoing operation of infrastructure."[1] It is best described through its application in infrastructure projects, and its overall purpose is to provide enhanced benefits—be they operational, economic, environmental, social, for security, or otherwise.

Although InfraTech can be used in infrastructure projects throughout the project life cycle—from the planning and development stage through to operations and maintenance (O&M)—the Global Infrastructure Hub's Stocktake of InfraTech Use Cases finds, for example, that more than 70 percent of the use cases they analysed (while not necessarily representative of the market as a whole) were in the O&M stage.[2] The brief below provides an overview of why it is beneficial to incorporate and use InfraTech starting from the earliest stages of project development. It lays out some of the issues faced by public sector planning authorities in integrating InfraTech into the design, procurement, and contracting of public–private partnership (PPP) projects.

1. World Bank Group, "InfraTech Value Drivers," https://openknowledge.worldbank.org/bitstream/handle/10986/34320/Infratech-Value-Drivers.pdf?sequence=1&isAllowed=y.

2. Global Infrastructure Hub, "Stocktake of InfraTech Use Cases," https://www.gihub.org/infrastructure-technology-use-cases/



Why InfraTech to be considered at the earliest stage of the infrastructure life cycle: building the business case

Bringing the private sector onboard

When the public sector undertakes an infrastructure project, a key consideration should be integrating InfraTech into the early stages of the project's life cycle—that is, strategy, planning, and design phases—given the value InfraTech can bring to the various stakeholders in the development of the project. In particular, it is important to obtain "buy-in" from the private sector in this regard because they will ultimately be the ones who deploy InfraTech solutions.

Some key aspects assessed by private sector players when deciding whether to include InfraTech in a project include, in addition to what kind of Infratech would be most suitable for the project and how forward looking should they be, whether the InfraTech will

- help develop the project more quickly and make it more operationally efficient;
- place additional burdens—such as financial or operational—on the project developers;
- help streamline and better utilise resources; and
- provide financial benefits and, if so, of what sort and magnitude.

For both developers/operators and end users, incorporating InfraTech into infrastructure projects will be an indispensable part of the solution to today's infrastructure challenges. The expected effects of this include improving efficiency and transparency, unlocking more sustainable business models, building climate-resilient assets, and ultimately, transforming traditional ways of planning, financing, delivering, and maintaining infrastructure.

It is therefore critical to ensure that before it is included in a project's specification, the InfraTech business case is well defined, properly thought through, and beneficial to key stakeholders. Over time, such careful deliberation will substantially contribute to the successful implementation of high-quality bankable projects.

So how does including InfraTech at the project development stage add value?

The answer to this may initially seem relatively straightforward—incorporating InfraTech at an earlier stage of a project means that value is being created earlier, and for longer—but there is more to it than that. Taking steps to ensure that InfraTech is considered in the development and procurement stages of a project can lead to clearer specification of what the project is designed to deliver—that is, an outcome-based procurement framework. For example, it can compel the stipulation of specifically required CO_2 emissions reduction targets, or provide relevant InfraTech examples in a technology/vendor neutral manner in the project tender documentation. The project can then be built-for-purpose from the very beginning, increasing the likelihood of achieving the planning authority's objectives. There can also be supplementary benefits such as more optimised capital expenditure planning, environmental benefits generated earlier in the project implementation, and less resistance against incorporating InfraTech into the project retrospectively in a later stage.

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The table below highlights four key areas where InfraTech can add value when considered in the early stages of a project, along with examples of key performance indicators (KPIs) and specific technologies which may help in achieving these KPIs.

Project Outcome	Example KPIs	InfraTech Examples
Improved effectiveness & efficiency of the project	• Increased efficiency and productivity (e.g., decreased construction timeline) • Increased reliability of assets / service • Increased longevity of assets • Enhanced quality of product / service	• **Drones** – Using drones for surveillance requires less time to cover an area compared to human surveillance. • **Digital twins** – Efficiently monitors physical assets, generating data in real-time which results in more informed and faster decision making (e.g., for maintenance requirements). • **Building Information Modelling** – Quick development of 3D digital models of new/existing buildings to seamlessly integrate building data, sustainable building design and enable better space utilisation. • **Smart Analytics Solutions** – Data analytics is utilised for multiple purposes: improved design of transport infrastructure, asset management, more convenient service provision to the public, and more efficient logistics.

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Project Outcome	Example KPIs	InfraTech Examples
Improved safety & security	• Improved safety processes / procedures • Enhanced physical security • Improved cybersecurity measures	• **E-Navigation** – Reduces human error using automatic indicators, warnings and fail-safe mechanisms, ensuring safe transit of vessels in and out of ports and terminals. • **Geographical Information System** –Supports remote engineering with geospatial planning tools which allows greater enhancements to monitoring and planning & forecasting for potential security threats, both from physical and cyber threats.
Environmental & social benefits	• Reduction of pollution and waste • Source sustainable financing for the project • Use of sustainable materials • Improved resilience of asset / services (e.g., from natural disasters, pandemics etc.) • Improved governance structures (e.g., diverse and inclusive)	• **Flood warning / forecasting solutions** – Using Internet of Things (IoT) technology and remote sensing data for this helps minimise the potential damage to infrastructure due to early warning systems and actionable insights provided. • **Smart pedestrian management** – Reduces pollution via efficient traffic management and improves service productivity by reducing time spent in signals.

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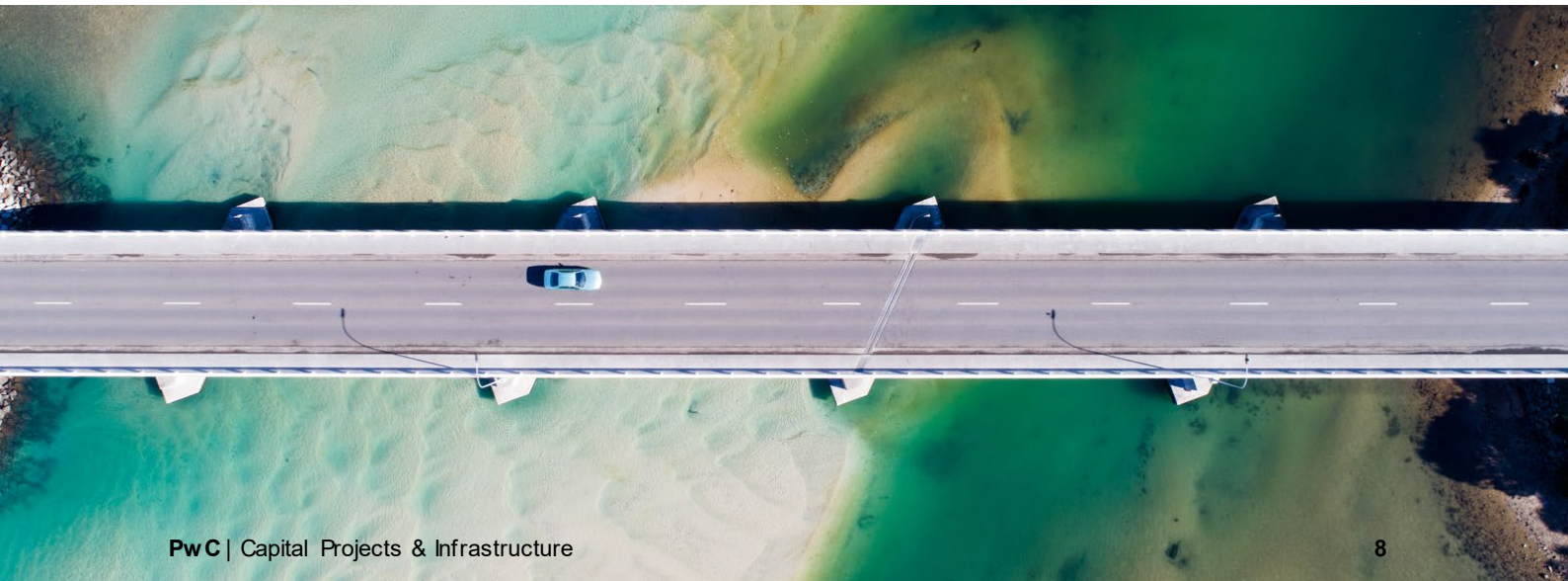
Project Outcome	Example KPIs	InfraTech Examples
Financial benefits	• Enhancement of revenues • Improved cost management • Direct and indirect economic benefits	• **Digital substations** – Improves the asset's life reducing the need for additional CAPEX (as well as improving asset utilisation and reducing downtime). • **Smart grids** – Active network management reduces grid integration costs and facilitates the use of energy storage to help balance the network, making it more reliable and efficient. • **Demand response management system** – Innovative way to conserve energy and balance consumer requirements, reduce investment requirement for peaking generation capacity, and reduce cost of expensive peak-time electricity, based on in-depth data analysis.



So how does including InfraTech at the project development stage add value?

Effectively capturing value from InfraTech requires a disciplined, ongoing, and managed process that starts at the early project-development stage and continues through operational delivery. It is important to keep in mind that if these project outcomes are not considered and planned for through the use of InfraTech at the project development stage, it gets much harder to address the shortcomings later in the project life cycle, and value may therefore be lost. There are tangible ways to ensure the inclusion of InfraTech, such as

- Including an assessment of the potential use of InfraTech in the project's feasibility study;
- Holding early consultations with the private sector party players (for example, during the market-sounding stage of the project) to discuss how InfraTech could add value; and
- Incorporating within the tender documentation and project agreements the InfraTech that the planning authorities choose to use.

Including InfraTech in Project Planning: Some Key Considerations

Although there is a strong business case for InfraTech to be included in the early stages of the project life cycle, there are various other matters that public sector planning authorities need to consider in this regard as well. This is especially true under PPP frameworks where there are often trade-offs to be made with the private sector with regard to affordability, quality, certainty of delivery, and environmental and social outcomes. With this in mind, it is important to strike a balance between which InfraTech features are “a must have” versus those which are “nice to have.”

Some key considerations for public sector planning authorities include

1. **The cost of InfraTech** – Including InfraTech in a project undoubtedly increases overall project costs (for example, initial CAPEX). Under a PPP arrangement, these costs would normally be factored into any private sector bid and passed back to the planning authorities (which impacts the overall affordability of the project). This makes it necessary for alternative funding/financing structures to be explored by both the planning authorities and the private investors (for example, leasing models, stand-alone business cases for the InfraTech), because otherwise it gives rise to the "who pays for it" question.

> As an example of innovative financing structures that create cost savings through the use of InfraTech, in 2016, Signature Healthcare, an integrated healthcare delivery network in the United States, partnered with Siemens on a Guaranteed Energy Performance Contract that included an US$8.9 million investment in infrastructure improvements, with expected savings of more than US$10.5 million over a 12-year period (over US$9.7 million of that was fully guaranteed by Siemens).

2. **Policy and regulatory frameworks** – Policies and relevant strategies in areas such as planning, procurement, intellectual property protection, cybersecurity, and data protection are not always well formulated in many countries. Also, suitable regulatory and compliance frameworks may not be available to facilitate the introduction of InfraTech on a large scale in the early stages of project development. This could make investors and planning authorities uncomfortable with implementing certain InfraTech in their projects because they might not be properly governed. Furthermore, key InfraTech-related standards, such as specification standards, terminology standards, data standards (to support data sharing), or standards of devices and equipment (to support interoperability and avoid vendor lock-in), preferably in compliance with international or industry de-facto standards) should be established to help create and sustain an ecosystem that is easy to understand and navigate. However, this can take time, especially in certain jurisdictions. In the interim, planning authorities should take a "start small and safe" approach that employs more "proven" technologies and build up as many use cases, while taking comprehensive steps to enhance the effectiveness and accountability of the frameworks and obviate regulatory failures by learning from precedents in developed countries.

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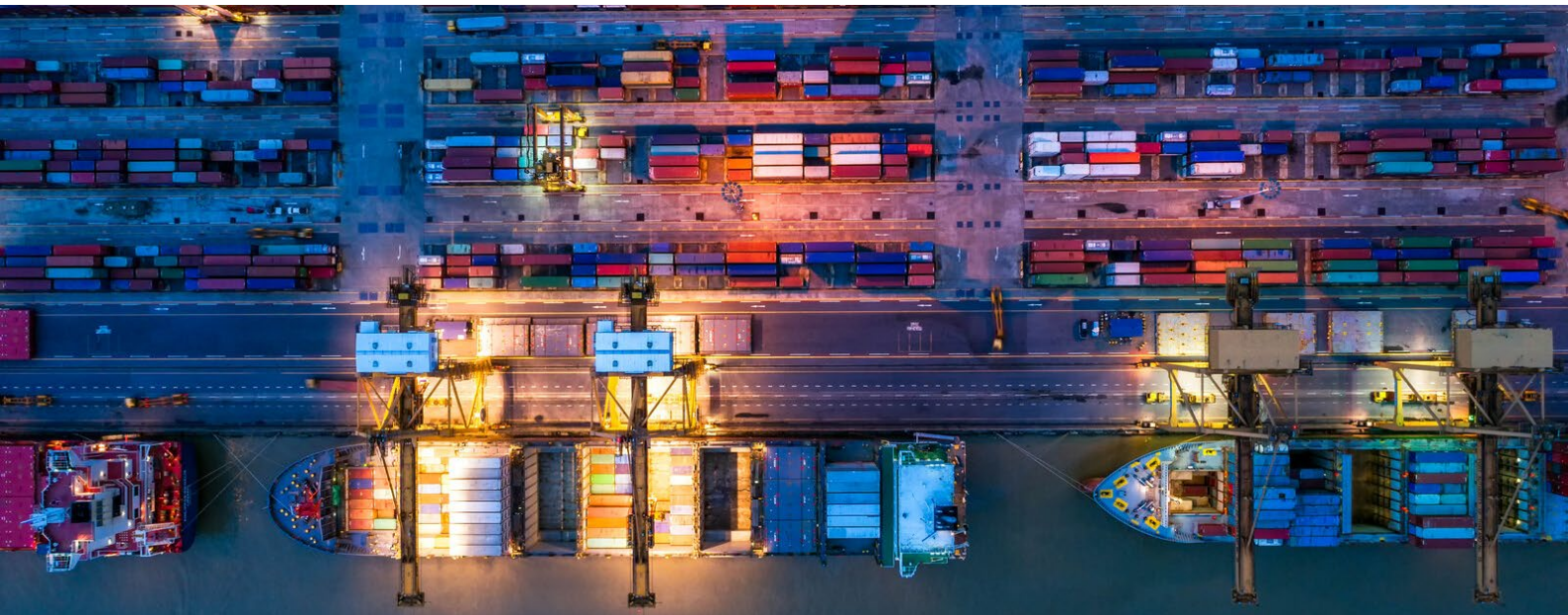
3. **Cybersecurity.** – Cybersecurity has emerged as an essential topic across all industries and on the list of InfraTech project "must haves," given the interconnectedness and interdependency of the constituents of cyberspace. The prospect of cyberthreats to infrastructure projects via their IT systems is no exception. The increased digitalisation of projects and assets, and the high level of dependency on reliable data flow through the incorporation of InfraTech, naturally allow for more security vulnerabilities and increases the need for cybersecurity systems and processes at the project level. The strategic nature of infrastructure projects (for example, power generation or water plants) makes it necessary for all project stakeholders to make a concerted effort to guard against data security breaches and hacking attempts.

> For example, countries that are considering applying IoT/Infratech to core infrastructure assets need to determine how to make their internet networks more resilient so that disruptions (physical or otherwise) do not result in a major failure of the assets.
>
> In 2018, PwC developed the Cyber Security Experience Centre (CSEC) in Israel, a 1,000-square-meter lab that simulates cyberattacks on scale models of actual infrastructure control systems for critical services, including oil & gas facilities, electric power stations, and water systems. CSEC offers a safe, "sandbox" testing environment in which the Israeli government can analyse potential cyberthreats against core infrastructure assets.



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4. **Data privacy and protection.** – InfraTech is often combined with data analytics to offer more efficient services. This requires privacy norms to be established to protect personal data from misuse and ensure individual privacy. In addition, ethical analysis has become an additional tool within Artificial Intelligence (AI) applications to protect fundamental human rights. Planning authorities can refer to Data Privacy, Ethics and Protection: Guidance Note on Big Data for Achievement of the 2030 Agenda[1], a document endorsed by the United Nations Development Group (UNDG) in 2017. It presents the UNDG with nine general guidelines on data privacy, data protection, and data ethics regarding the use of big data[2].
5. **Complexity of technology adoption** – Although some InfraTechs are more developed than others, there are various complexities that tend to be found generally. They include dealing with legacy issues from previous systems and solutions (that is, change management and process reengineering), integration/interface issues between new InfraTechs and infrastructure projects, and mobilising the right human resources with the expertise to operate the InfraTechs. Due to the limited supply of locally available talent, this creates a strong need for capacity building. Furthermore, planning authorities need to ensure that an adequate budget is allocated to addressing obsolescence and periodic upgrading of InfraTech, and that tender documents include the details of these arrangements. It should also be noted that technologies may not have life cycles that match the assets to which they are attached.
6. **Procurement process in a complex ecosystem** – The procurement process with regards to incorporating InfraTech into projects has generally been underdeveloped and/or unstructured. When the scope for InfraTech projects is not adequately defined, private sector developers and operators tend to be left with a large amount of autonomy over what technologies they implement. Although this might possibly encourage innovation, in practice the likelihood is that they are incentivised to include only those InfraTechs that offer them direct benefits—specifically, cost-saving and revenue-enhancing technologies. This reinforces the

1. United Nations Sustainable Development Group, Data Privacy, Ethics and Protection: Guidance Note on Big Data for Achievement of the 2030 Agenda (2017), https://unsdg.un.org/resources/data-privacy-ethics-and-protection-guidance-note-big-data-achievement-2030-agenda.

2. The nine principles are (1) lawful, legitimate and fair use; (2) purpose specification, use limitation and purpose compatibility; (3) risk mitigation and risks, harms, and benefits assessment; (4) sensitive data and sensitive contexts; (5) data security; (6) data retention and data minimisation; (7) data quality; (8) open data, transparency and accountability; and (9) due diligence for third-party collaborators.

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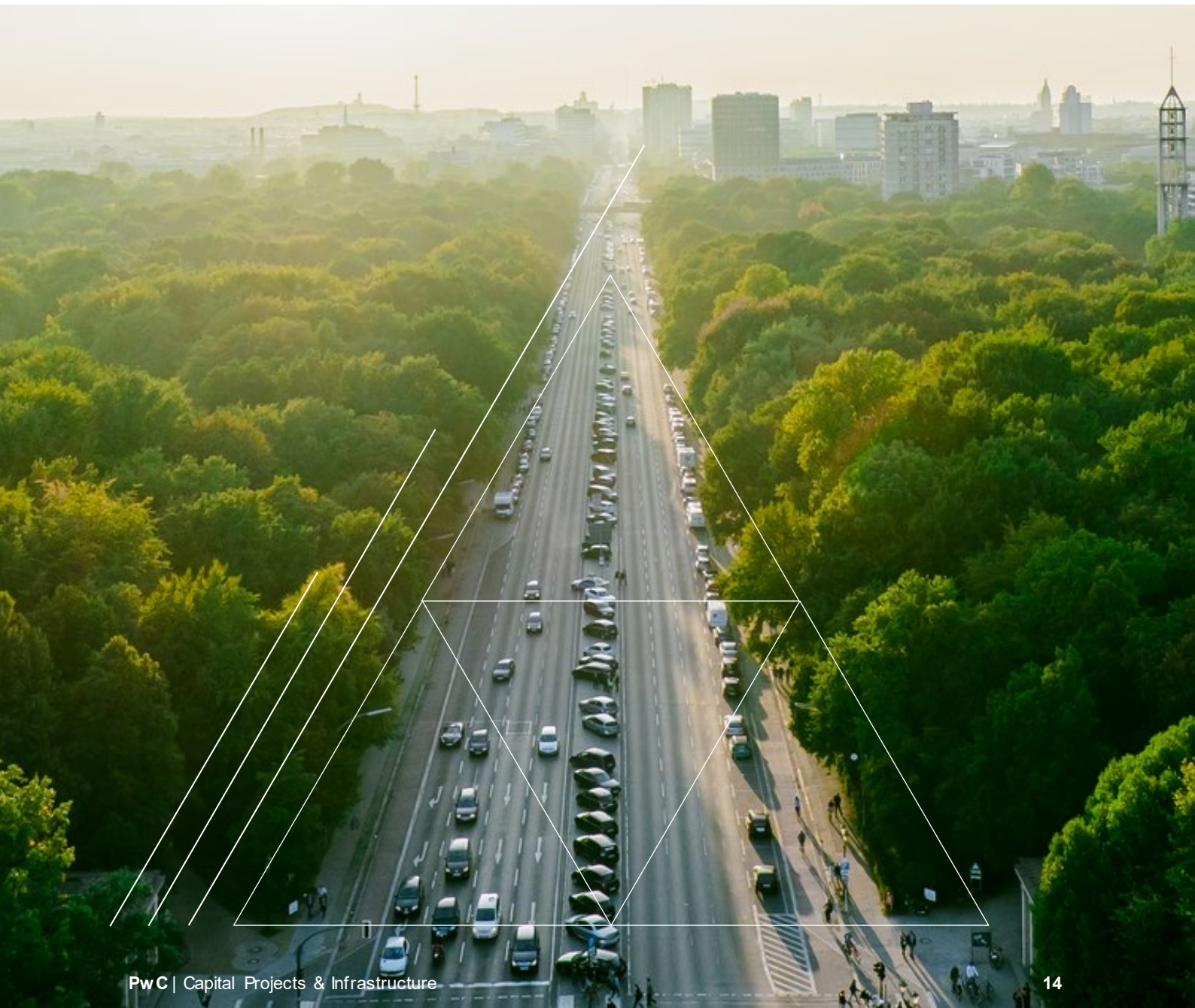
need for planning authorities to adopt an outcome-based procurement framework to align the objectives of both the planning authorities and the private sector organisations, and to ensure the achievement of other benefits envisaged by the public sector, such as delivery of environmental and social impacts.

> A good example is the UK government's new policy requiring the mandatory inclusion of a social value score in public procurement contracts, and that this score must be a minimum of 10 percent of the total scoring. The policy, expected to be in effect by June 2022, will apply to service contracts valued above £123,000 and construction contracts valued above £4.7million.



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