



G20 Infrastructure Working Group

G20 Riyadh InfraTech Agenda

BACKGROUND

BACKGROUND FOR THE INFRASTRUCTURE TECHNOLOGY (“INFRATECH”) AGENDA

CONTEXT

Previous G20 initiatives have highlighted the importance of infrastructure as a driver of economic prosperity and the basis for strong, sustainable, balanced, and inclusive growth and sustainable development. The Roadmap to Infrastructure as an Asset Class (Roadmap), endorsed by G20 Leaders in 2018, stressed the need to mobilize private capital to fill the infrastructure-financing gap. The importance of private-sector participation in infrastructure is even greater now because government fiscal space is severely constrained as a result of COVID-19. Recent technological advances have dramatically reduced the cost of gathering, storing, analyzing and using data, these advances can support the Roadmap by providing enhanced data, tools as well as facilitate investors’ ability to make informed decisions. Technology also presents new opportunities for infrastructure investors by creating new markets and business models and the potential for enhanced revenues. The rapid pace of technological advancement also creates new risks for investors and infrastructure end users— that can be mitigated by appropriate policy interventions.

More recently, continued work on the goal set out by the Roadmap has materialized through the G20 Principles for Quality Infrastructure Investment (QII) established in 2019, under Japan's G20 Presidency. The principles emphasize the need to focus on the quality of infrastructure investment. Emphasizing quality helps attain value for money and ensures that projects remain affordable by taking into account total life-cycle costs as well as economic, environmental, and social benefits. The quality dimensions of infrastructure include maximizing its positive impact to achieve sustainable growth and development, economic efficiency, environmental and social considerations, connectivity, local economic and social contribution, good governance, and resilience. Leveraging innovative technology solutions can play an important role in advancing Quality Infrastructure and in turn the Roadmap.

INFRATECH DEFINITION

Infrastructure technology, or InfraTech, can be described as the integration of material, machine, and digital technologies across the infrastructure life cycle. At its broadest definition, InfraTech can be considered any technology that impacts the development, delivery, and ongoing operation of infrastructure. This may include technologies used to define the strategic requirements of infrastructure or enable data-driven decision-making, innovations in finance and funding that support the commercial management of an asset, or technologies integral to the relationship a customer has with infrastructure services. From a policy perspective, it is important to make the distinction between the design of technologies in the operations of infrastructure planning and delivery versus the integration of technologies into the structures themselves, which changes the nature of infrastructure assets from simple inanimate objects to dynamic information systems.

There are six broad technology categories relevant to infrastructure, as shown below:

Connectivity & Communication	Analytic & Computation	Cloud & Data Storage	Devices & Automation	Platforms & interfaces	Materials, Energy & Construction
Wired or wireless technologies that connect people or devices and enable data transfer.	Advanced analysis that uses machine learning to process large amounts of unstructured data.	Tech solution that enables efficient mass movement and storage of large data sources.	Physical interfaces and components that perform specific tasks or enhance automation.	Complex systems that combine multiple technologies or have whole-system design thinking.	Applied science and engineering directly efficiency or quality for OPS and construction.

Some Examples of InfraTech use case includes:

- **Connectivity and communication:** Vehicle to Vehicle (V2V) connectivity can minimize traffic accidents and their associated costs as well as optimize traffic flows and reduce congestion
- **Analytic and computation:** Real-time collection and analysis of flooding data enables more targeted responses to disasters as well as predict future conditions to support more resilient infrastructure
- **Cloud and data storage:** Digital metering and data collection enables water operators to comply with water access regulations with built-in cybersecurity measures designed-in (encryption, data protocols, etc.)
- **Devices and automation:** Construction processes can utilize automated pre-fabrication to deliver infrastructure faster while reducing the cost
- **Platforms and interfaces:** Last-mile decentralized water systems use a combination of water supply kiosks, metering, and payment platforms to deliver inclusive water access to remote communities
- **Materials, energy, and construction:** On-demand 3D printing products use advanced materials for rapid response to maintenance requirements of critical infrastructure
(See Reference Notes for more examples.)

RATIONALE FOR FOCUSING ON INFRA TECH

The focus on InfraTech supports the G20 Infrastructure Working Group by highlighting the important role technology can play in helping countries make well-informed decisions and achieve more efficient financial outlays, by mobilizing private-sector investment, by enhancing service delivery and by achieving environmental, social and economic benefits.

InfraTech is also essential in responding to the COVID-19 health and economic crisis through

- enabling the data collection and advanced analytics needed for evidence-based public health and economic policy decision-making;
- maintaining economic and social activities (e.g., education) during social distancing through connectivity and digital solutions;
- helping ensure continuity of essential energy, utilities, transport, and telecommunication services by better targeting maintenance interventions, extending the life of existing assets and developing new modes of service delivery;
- enabling effective monitoring of and support to food and production supply chains; and
- upgrading the safety and resilience of logistics and transport lines to maintain an unobstructed flow of goods and to ensure that global supply chains and transport corridors remain efficient.;
- reshaping the healthcare system with technology during social distancing in a shorter period and at a lower cost; (e.g., drones can transport blood samples, e-health/Telehealth services and remote consultation reducing visitors load to hospitals).

Accelerating the adoption of InfraTech will help countries more effectively respond to the current crisis if done sustainably and transparently. It will also help close the infrastructure-financing gap, strengthen resilience, and spur economic growth.

OBJECTIVE OF THE INFRA TECH AGENDA

The InfraTech Agenda provides high-level policy guidance for national authorities and the international community, including MDBs and IOs, to advance the adoption of new and existing technologies in infrastructure. The Agenda aims to harness technology to deliver quality infrastructure investment; promote inclusive, accessible, sustainable, and affordable infrastructure in view of lifecycle costs; mobilize private-sector financing; and support the development of infrastructure as an asset class. This guidance includes a set of voluntary, non-binding elements. Reference notes (separate documents described in the supporting reference note, provided by the World Bank Group and The Global Infrastructure Hub) are provided to support the adoption of these elements; they provide InfraTech stocktake, analysis of InfraTech value case, and InfraTech toolkit that are useful for countries at all levels of InfraTech-adoption readiness.

OPPORTUNITIES AND CHALLENGES OF INFRA TECH

Recent-use cases are demonstrating the potential value of InfraTech throughout the infrastructure life cycle and across sectors. Realizing the value of InfraTech is also an increasingly important consideration for private-sector investors; widespread adoption may help to mobilize further investment. These include benefits in three main areas:

- **Improving efficiencies and reducing costs across the project life-cycle:** Enhanced analytical functions, data management, communications, and automation have significant financial benefits. Better planning and decision making through InfraTech not only reduce costs but also extends the life of assets. In addition, the costs of maintenance can be significantly reduced through advanced analytics, reduced transit and monitoring costs, remote interventions, and on-demand 3D printed parts.
- **Enhancing economic, social, and environmental value:** InfraTech can help create jobs and economic opportunities by using new mobility solutions to connect people to jobs and also create new technology-driven areas. It can also broaden access to essential social services (e.g., health, education) by ensuring safer and more reliable services for users. InfraTech as well improves resilience by enabling faster and more targeted response to disasters, including the current COVID-19 pandemic. Finally, InfraTech can improve air quality, reduce emissions, and enhance sustainability.
- **Creating new markets through technology and infrastructure:** Disruptive technologies are enabling new markets by changing the underlying mechanics of infrastructure demand models. This offers opportunities for new domestic and global industries to emerge.

The potential benefits of InfraTech options will need to be weighed against the upfront capital investment or recurring costs, long-term returns, and societal benefits in a balanced way. The occurrence of global emergencies (e.g. health) and natural disasters may also increase upfront or recurring costs. While some InfraTech opportunities may come with relatively low upfront costs, other investments come with upfront costs that may be prohibitive for some countries or regions. However, costs and benefits of InfraTech options are rapidly evolving given changes in technology maturity curves and the context in which the technology is applied. Pandemics such as COVID-19 demonstrate that investments in connectivity and data-related technologies are even more essential.

InfraTech also poses a set of technology-specific challenges that must be managed. They include the following:

- **Implementation risks:** Given the complexity of the underlying technologies, there is potential for unintended adverse impacts on safety and reliability. Nascent technologies also carry additional risks due to greater technological uncertainty. Existing policy approaches and institutions may not be ready to manage the complexity of procurement and roll-out of new technologies.
- **Economic and labor force risks:** As demonstrated by the impact of automation in manufacturing, the adoption of new technologies in infrastructure sectors may result in labor-skill mismatches and job market disruption associated with their implementation. In addition, new skills are needed to effectively use new technologies and manage InfraTech operations.
- **Social risks:** Uneven roll-out of InfraTech may exacerbate inequality in access to technologies and infrastructure services. In addition, the exponential increase in data generated through InfraTech poses societal and technical challenges, including heightened cybersecurity risks and issues related to data privacy, protection, and confidentiality.
- **Environmental risks:** The increased data storage requirements of many InfraTech solutions will result in increased energy consumption (e.g. data centers, cooling). In addition, some InfraTech solutions currently rely on scarce natural resources (e.g. lithium) where there may be environmental and social issues in the supply chain.
- **Obsolescence risk:** The rapid and constant evolution of technology often runs counter to the long-term investment horizons of capital projects and can lock investors into InfraTech projects that become outdated or no longer fit for purpose. Replacement or upgrading of assets may cause significant disruption on project parameters or large capital expenditures.

INFRA TECH ELEMENTS



1. Leverage InfraTech to enhance economic efficiencies and mobilize private-sector investment to promote growth and sustainability

Governments can leverage technology to improve the productivity, efficiency, value-for-money, and affordability of infrastructure projects with respect to life-cycle costs and efficiency. Leveraging technology to reduce upfront costs and recurring financial outlays supports project level financial and fiscal sustainability, and macro level debt sustainability.

- 1.1. Reduce financial outlays by capturing economic efficiencies across the asset life-cycle stages.** In the strategy and planning stage, improved data analytics, and advanced modeling techniques can optimize investment and financing decisions. The use of new material and process technologies (e.g., 3D printing) can reduce costs during the construction stage as well as upgrade existing assets. During the operations and maintenance stage, new modes of data collection (e.g., drones, integrated sensors) and analysis allow more targeted and less costly interventions and improved operations. New materials, processes, and analytics can also prolong the life of infrastructure assets.
- 1.2. Update procurement processes to realize economic efficiencies.** The use of new technology is expected to deliver between 5 and 10 percent cost savings on project delivery and maintenance costs.¹ Reforming government internal procurement processes is essential to achieving these potential savings. Procurement approaches should be technology-neutral and solution agnostic, focusing on standards and outcomes. Governments can employ collaborative procurement and contracting approaches that work closely with technology experts to encourage innovative approaches. An emphasis on value for money and lifecycle costs will allow for new technologies that may save significant operations or maintenance budgets over time. This includes competitive dialogue models for procurement which allow bidders to prepare alternative proposals, the two envelope system which separates technical and pricing aspects of bids and new clauses to allow for innovation while defining issues surrounding liability and risks. Evaluation models based on outcomes and a focus on life-cycle costs in determining overall value-for-money will allow greater adoption of InfraTech during the procurement process. Incorporation of real-time data and consistent data management will allow us to better track progress on outcomes and improve governance.
- 1.3. Prioritize interventions that enhance the mobilization of private capital and promote innovative financial solutions.** InfraTech can benefit investors by improving the returns of existing projects and creating new investment opportunities. Governments that put into place a strategic policy response to the shifting technology landscape help foster a strong investment climate. This includes implementing policy tools that both encourage innovation and put in place adequate safeguards for new and emerging risks posed by InfraTech. In addition, because InfraTech enables faster and more accurate monitoring of infrastructure outputs, efficiencies, and other key metrics, including risk-return profiles and performance against environmental, sustainability, and governance (ESG) standards, investors can better assess infrastructure-investment opportunities and manage existing investments. This will help to bridge the data gap needed to promote infrastructure as an asset class. InfraTech also enables innovative financial solutions, such as dynamic pricing mechanisms or pay-as-you go models, to improve the financial sustainability and end-user base of many infrastructure projects.

¹ Deloitte Analytics, Predictive Maintenance: Taking proactive measures based on advanced data analytics to predict and avoid machine failure.



2. Promote technologies that foster inclusivity, sustainability, resilience, and good governance

InfraTech solutions support environmental, social, and governance (ESG) performance, consistent with the 2030 Agenda for Sustainable Development, and in line with the G20 Principles for Quality Infrastructure Investment (QII). Appropriate technologies to achieve these goals will vary based on country context and needs.

- 2.1 **Support solutions that help achieve inclusivity by increasing accessibility.** InfraTech can make essential services more affordable to end-users by reducing the life-cycle costs of infrastructure projects. It can also enhance access to opportunities, including for youth, women, elderly people, and those who experience particular vulnerabilities. These solutions include smart-city approaches that enhance urban economic growth, mobility, and workforce participation. Other people-centered technology-enabled solutions can enhance service-delivery outcomes; connect people, infrastructure, and networks to improved economic opportunities, enhance connectivity with rural and remote communities; and better integrate economic and social services.
- 2.2 **Scale-up new and existing sustainable solutions.** These include advances in green transport; water reuse; new approaches to energy efficiency; innovation in energy generation, storage and distribution; landfill and recycling efficiency; and reduced material use in construction. Such technologies can play a crucial role in promoting sustainable, resilient, shared, and inclusive growth, including integrating environmental considerations and improving ESG impact of infrastructure investments.
- 2.3 **Adopt new and existing technologies that improve resilience, adaptability, and response times in cases of natural disasters and pandemics.** The better use of new technologies enables governments and policymakers to more rapidly target appropriate resources before, during, and after disasters. For example, geospatial data can facilitate real-time monitoring and predictive modeling to help forecast and prepare for disasters in advance or assess real-time damage and the infrastructure needs of affected people. InfraTech can also ensure continuity of essential infrastructure services during a pandemic. For example, the safety of transport and logistics lines can be improved using technology that enhances automated processes or makes detection of pathogens or infectious travelers more effective.
- 2.4 **Adopt InfraTech solutions that enhance governance by reducing corruption, ensuring high standards, strengthening project preparation, and enhancing transparency.** Inefficiencies due to poor governance significantly erode the potential returns to their infrastructure investments. Enhanced data collection, tracking, and access enabled by InfraTech can strengthen accountability by public or private stakeholders. Better data will also support sound fiscal planning for major public infrastructure investments.



3. Accelerate innovation and economic dynamism in InfraTech related industries to support economic recovery and growth

Long planning, procurement, and development cycles, combined with the long life of infrastructure assets, are intrinsic to infrastructure. While these features are necessary for many types of infrastructure assets, they may also have an unintended negative impact on innovation. Governments can drive innovation through appropriate public-private partnerships and other procurement models, as well as through direct investment as needed. Governments can also promote innovation by ensuring fair competition and a non-discriminatory business environment for public and private technology providers, and by reducing risks that innovators encounter in the initial phases of new technology implementation.

- 3.1 Foster an innovation ecosystem for existing and early-stage technologies.** The development of a broad innovation ecosystem will help realize positive spillover effects within infrastructure sectors. A robust innovation ecosystem includes supportive policy frameworks, venture capital financing, public-private industry collaboration, academics, entrepreneurs, technology hubs, and cross-sectoral industry collaboration.
- 3.2 Foster domestic InfraTech industries that create jobs, new sources of growth, and dynamism in the economy.** To promote local innovation, governments can play an important role in facilitating a testing ground for technology providers, including small and medium-sized enterprises and small incubators. Infrastructure investors and operators can also work closely with these technology providers to develop commercial-use cases and support these industries.



4. Foster a robust data ecosystem to improve resilience and better inform infrastructure planning, operation, maintenance, and investment decisions

Effectively capturing and managing increasingly large pools of data, consistent with the country specific laws and regulations, combined with the continued development of big-data analytics tools, is foundational to many InfraTech solutions and much of the digital economy. In addition to improving economic efficiencies, advanced data analytics on big-data sets can facilitate informed decisions and track and maximize the social and environmental effects of projects for sustainable development. A robust data ecosystem will also help to bridge the data gap needed to promote infrastructure as an asset class.

- 4.1 Put in place a robust asset performance data ecosystem suited to national objectives.** This includes a user- and rights-centered approach with data protection and privacy standards, early stakeholder engagement, clearly defined data objectives, data security standards, data privacy and protection measures, and data governance regimes. It also includes an environment that enables effective data capture, secure storage, protection, management, sharing, and use. A secure and transparent data ecosystem also helps attract private-sector investment by catalyzing new business models and mitigating data security risks. Any such measures should comply with existing data security and privacy regulations to secure and protect personal data.
- 4.2 Improved data governance and transparency can also mobilize additional private capital in infrastructure projects.** InfraTech can provide investors with more accurate and timely information to help reduce investors perceived risk of infrastructure investment projects. Enabling the standardization and formation of benchmarks for financial and ESG performance needed to support evidence-based investment decisions, reducing perceived and real investment risks. This will help to bridge the data gap needed to promote infrastructure as an asset class.
- 4.3 Capture data across infrastructure sectors to support effective public health and economic response to pandemics and other disasters.** Using sensors, drones, and other remote technologies, infrastructure can generate mobility data and other data essential to tracking disease outbreaks and designing effective public health interventions. This data also provides a detailed view of economic activity that can be used by governments and policymakers to design fiscal packages that best promote economic recovery, as they continue maintaining debt sustainability and transparency.
- 4.4 Promote interoperability across technology providers, projects, and sectors to better harness data for improved investment decision-making.** Interoperability also supports innovation by allowing new market entrants and business models. Policymakers should work across government agencies and with the private sector to promote interoperable standards that facilitate analysis of amalgamated data sets for new insights and avoid duplication of data-collection efforts.²



5. Develop agile and flexible policy tools that promote potential growth, productivity and innovation while mitigating risks

Legislative, policy and regulatory frameworks and economic and non-economic incentives all have a significant impact on the rate of InfraTech adoption within a country. The national policies governing InfraTech should aim to maximize positive outcomes and mitigate risks along fiscal, financial, economic, social, and environmental dimensions.

- 5.1 **Ensure forward technological compatibility of infrastructure assets.** Given the relatively long project cycle of infrastructure assets, keeping pace with rapidly evolving technologies is particularly difficult in most infrastructure sectors. Policymakers should aim to mitigate the risk of investing in assets through appropriate choice of technology, scenario planning, and adaptable project design or flexible procurement approaches.
- 5.2 **Adopt forward-looking risk-management frameworks encompassing environmental, social, and technological risks.** Rapidly evolving technologies require forward-looking and evolving risk frameworks to manage both project-level and other spillover risks. Robust stakeholder engagement, which can include strengthened dialogue with the private sector, technology experts, local authorities, affected communities, and environmental specialists, is central to identifying and mitigating risks across the infrastructure life cycle.
- 5.3 **Improve skills and capabilities foundational to adopting InfraTech.** Adequate human capital across both public and private sectors can be promoted through new tech-enabled capacity-building activities and enhancing the curriculum of formal and informal education providers. Governments should also adapt their existing institutions, so they provide appropriate accountability and oversight given the pace of change and emerging risks.



6. Promote national and international cooperation in R&D and knowledge-sharing

Since new technologies often operate across borders, international cooperation is essential to accelerating the development of InfraTech and managing cross-border risks.

- 6.1 **Enhance cooperation in R&D among global public, private, and academic stakeholders to promote innovation in key technologies.** New InfraTech solutions that enhance safety in transport, ensure continuity of essential services and safeguard supply chains can be more rapidly developed and implemented with better international cooperation, as it still maintains the proper protection for intellectual property rights. In addition to sharing or co-sponsoring research, an open, non-discriminatory environment for R&D and application of new InfraTech, and collaboration on the development of technology-neutral international standards and interoperable systems can play a role in promoting innovation and solutions across regions and sectors.
- 6.2 **Share global best practices, lessons, data, and use cases, particularly in responding to the COVID-19 health and economic crisis.** Supporting developing economies in the use of Infratech can help improve resilience and accelerate growth, particularly in countries where access to essential services is limited. International cooperation can also promote the sharing of key global economic data on critical infrastructure services to support a conducive global infrastructure-investment environment and coordinated economic action by policymakers.
- 6.3 **Implement national policies aimed at spurring InfraTech research and development (R&D) to support scaling up of key technologies across the asset life cycle.** Collaborating with the private sector will also spur new and emerging InfraTech markets, particularly those that have strong environmental and social benefits. This is particularly important in InfraTech, where R&D has been relatively limited in scope given risks related to technology adoption and payback timeline.



G20

SAUDI ARABIA 2020
Finance Track

