Improving critical infrastructure performance through advanced engineering and innovation

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Critical infrastructure systems: create value through diverse economic, social and environmental impacts; and make significant contributions to most countries' Gross Domestic Product (GDP), employment, health and quality of life. These systems provide: the road, rail and air transport networks that connect cities and urban areas; the power, water and sewage services required to run our homes and businesses; telecommunications including the internet to facilitate remote communications and create SMART cities; the structures that protect against flooding; schools, colleges and universities to educate; and hospitals and care homes to support health and social care delivery.

Although $2.5 trillion a year is spent throughout the world on economic infrastructure, this has declinedsincetheglobalfinancialcrisis. It is estimated that $3.3t needs to be invested worldwide each year until 2030 just to support expected growth rates withoutaddressing maintenancebacklogs or the UNSustainableDevelopmentGoals (SDGs).Investment shortfalls have: led to congestion, bottlenecks and queues; constrained economic performance; depressed productivity; and reduced living standards.

The planning, delivery and management of interconnected critical infrastructure systems require innovative solutions to meet future challenges; however, construction has been relatively slow to innovate and often pursues incremental change resulting in flat productivity. Given projected population growth, ageing and movement, critical infrastructure systems need greater integration, innovation, technological advancement and engineering excellence to improve performance.

This presentation explores how advanced engineering and innovation can contributeto the improvement ofthe following important determinants of critical infrastructure performance, productivity, capital effectiveness, sustainability and resilience:

- long-term strategic planning, project selection and portfolio optimisation through fact based, data-driven infrastructure portfolios;
- asset delivery and productivity through integrated project delivery and integrated supply chains taking due account of system interdependencies ;
- infrastructure intelligencethrough advanced technologies, e.g. sensing, digitalisation, big data and artificial intelligence; and
- interconnected and interdependent systems thinking.