Connected, Collaborative and Cool: How technology and governance could transform the impact, efficiency and image of the construction industry.

Part 1: The construction and infrastructure revolution, and why it matters.

Slide 2

The world is on the cusp of a construction and infrastructure revolution.

- The world will build more infrastructure in the next 40 years than it has in the past 4000 years.
- Total spend on infrastructure will rise from around $3 trillion per annum to up to $9 trillion per annum
- More than 50% of the value of new build infrastructure will be in ASPAC and Emerging Markets
- Technology is disrupting and transforming the transport, energy and digital sectors
- Data and analytics is giving us the power to build, maintain, and operate infrastructure more efficiently than ever before.

These seismic trends create a huge opportunity. Let us take a recent example.

Slide 3

On the evening of Friday 28 September the 7.5 Richter scale earthquake off the coast of Sulawesi, and the resulting tsunami wave hitting the city of Palu, caused the most terrible and still ongoing death and destruction. Natural disasters are not something we can control. But the devastation of Sulawesi was much worse than it might have been because the population was weakly protected. The Economist wrote, "the death toll this time is particularly high [because] the province which was struck was relatively poor [and] infrastructure is ropy".

So I have a question for you that comes from this wonderful book Factfulness by Hans Rosling: "How did the number of deaths per year from natural disasters change over the last hundred years".

a) More than doubled
b) Remained about the same
c) Decreased to less than half

The answer which may surprise you is that the number of deaths is now one-quarter of the level that it was a hundred years ago. And if we take into account the population increase, deaths per capita are 6% of what they were a hundred years ago.

As we eliminate poverty we set societies on a virtuous path to better education, better health and life expectancy, reduced crime and conflict, and fewer deaths when natural disaster strikes.

We have seen huge strides in our lifetimes in what is good in the world. Today, to draw from Factfulness again:

A 88% of the population have access to safe water

B 85% have access to electricity

C Average life expectancy is more than 70 years

D. Even in the lowest income countries, more than 60% of girls go to school.

At the point some of you may be wondering if you have stumbled into the wrong lecture. What on earth has girls going to school got to do with construction, unless this is about them studying STEM subjects?

The link is as follows. If we can build, maintain and operate the world's infrastructure more efficiently, we can build more of it and quicker, and it can serve societies more effectively. And that is the route to stronger societies, saving more lives, educating more children, even taking more holidays. We can improve the quality of life everywhere by being better at construction.

So it really matters.

So how are we going to do it?

We are going to do it by moving to a world where construction is connected, collaborative and cool.

Slide 4

Part 2: Connected

Slide 5

Technology is impacting every stage of the asset lifecycle.
It is revolutionising the way we plan and prioritise our infrastructure investments; how we build and maintain assets, and how we operate them. It is transforming whole industries.

I would like to take each stage in turn and talk through what I see as the implications of that with some examples:

Slide 6

First technology is changing the way we plan our infrastructure. All over the world we are starting to see a more analytical, data-driven, evidential, technocratic approach to infrastructure development.

Can anyone identify the city on this slide?

It is not a photograph from the air. It is a still from the Melbourne Activity and Agent Based Model, developed by KPMG, which collates hundreds of data sources to produce a minute-by-minute spatial representation of movements in the city. Through simulations and scenarios it allows planners to, for example, predict loadings on bus routes, or understand the pattern of travel to schools and the airport. It was used this summer to produce three reports for Infrastructure Victoria, looking at future transport, fiscal and energy market impacts in a world of autonomous and electric vehicles.

One of the best examples of the technocratic approach to infrastructure planning is here in the UK with the creation of the National Infrastructure Commission. I campaigned for many years for it to be established and was delighted when the Government agreed and followed through, even if they have not yet put it on the statutory basis that I believe it should have.

Despite my enthusiasm for it, I was always worried. That it would either be too theoretical and be ignored, or would be too controversial and would be abolished. Somehow under the leadership first of Andrew Adonis and now Sir John Armitt, but also particularly Phil Graham, it has managed to land some seriously challenges to public policy, for example questioning new nuclear and exhorting the Government to embrace road pricing and full fibre roll-out, but without any apparent backlash. Why? Because its approach is so academic, well-evidenced and well-reasoned that it is hard to attack it. And as a result it is wielding serious public policy influence.

Other examples of the growing use of data in infrastructure planning are the Virtual Singapore project, which aims to create a digital twin of the entire City state, and Canada's Core Public Infrastructure Survey, the first ever comprehensive study which collates both the extent and condition of the country's assets.

But the rate of change in technology is also creating one big challenge, which is uncertainty. So we are seeing more scenario planning, and that in turn is driving the need for more flexibility in our infrastructure.

Slide 7

Second technology is changing the way we build in particular through offsite construction and additive manufacturing, but also through Building Information Modelling and data-driven approaches to worksite optimisation.

This graphic, from last year's Transforming Infrastructure Performance report by the Infrastructure and Project's Authority, envisages a 40% efficiency gain if we can move construction into a largely manufacturing environment.

That number interestingly is consistent with the view of McKinsey a few years back that technology could reduce the cost of construction by around 40%.

KPMG's 11th Global Construction Survey, released in 2017, showed that an overwhelming 93 percent of respondents think technology/innovation will significantly change their business, but a mere five percent view their organizations as 'cutting edge' in terms of their technological maturity. And, fewer than one in 10 are routinely using innovations like mobile platforms, advanced data analytics, and robotics and digital labour.

What is the barrier? It is the structure of the industry. The disconnect between the financial interest of end users, owners and the supply chain, and the fragmented, low margin, position of the supply chain, which means most of the players have little incentive to invest. I welcome the Construction Sector Deal because it opens the way to co-investment by the industry and Government in cutting edge technology, which is the key to making that investment happen.

To take an example, a 2005 study by the NAO concluded that offsite construction provided financial benefits of up to £90 per square meter. But offsite remains around 7% of industry output, and has been at that level for years. In 2016 KPMG set out to understand the barriers, and what it would take to really shift the dial. We looked at a specific case study – the Leadenhall building – which was a substantively offsite construction, and used standard industry metrics to build an onsite comparison. We estimated that the cost of the offsite build was £18m, or 6% higher, than onsite. But the offsite build was estimated to be 6 months quicker, resulting in £36m of additional rental value in the London rental market. Creating an overall saving of 7% to the client. We also went on to look at portfolio and whole-life savings, which were potentially many magnitudes larger. Only with a whole industry, whole-life view do we recognise the savings.

One of my favourite examples is Glaxo Smithklein's Factory in a Box, which was developed by Brydon Wood. It was built by 8 Gurkhas, costs 10% more but was built in 4 weeks instead of 12 to a known standard, 86% productivity on site rather than 60%. It arrives in shipping containers and bolts together with all parts colour coded, and with all services, ventilation and hygienic services built in. It is capable of being sent and assembled in any country.

Slide 8

Third technology is changing the way we maintain assets. We obsess as an industry with asset creation. But only 30% at most of the cost and value of an asset lies in the period of its creation. The rest lies in its maintenance and operation over time. Technology is helping us to understand and take decisions on a whole-life basis.

Today most asset maintenance and renewal decisions are taken on the basis of engineering judgement, and often rely on outdated or non-existent records. The following is an actual quote from a client of KPMG in the US:

"Our water system mapping is a bit of a mess, done in 1966. Some water system changes were done by Barney, our DPW guy back in the day, and he knew where everything was, but then he died, and everything he knew went with him."

This reliance on human memory and judgement is rapidly changing. Geospatial mapping of infrastructure is gathering pace, in particular deploying drones. Sensors on assets are allowing us to harvest vast quantities of real time information on asset condition. Data analytics allow us to use that information to understand how assets perform over time and under particular conditions. Then we can apply artificial intelligence to undertake predictive analytics.

We are starting to see best in class clients, in all sectors, adopt customer outcome and whole life value approaches to asset management.

Orange the mobile telecommunications business, is now using predictive Artificial Intelligence to anticipate network failures up to 7 days in advance. They are able to anticipate congestion on the network, allowing them to resize network elements in advance.

KPMG is working with a major highstreet retailer to embed whole life value into the approach to the maintenance of its huge network of stores and warehouses.

The implications are immense. Decisions taken on the basis of whole-life by a public authority provides best long-run value for the taxpayer. For a private asset owner it maximises shareholder return.

Slide 9

Fourth technology is changing the way we operate assets. At the core of this is recognising that value is now less in the physical asset and more in the data. Which is why blockchain is of such interest to the industry as it provides a way for us to create an immutable and auditable history of the data related to an asset and its service.

For us to realise the benefits, however, data must be transparent, shared and publicly owned. I have been arguing this for a few years, but I was both delighted and astonished when the National Infrastructure Commission published "Data for the public good" late last year, arguing that there should be a presumption of data sharing for all except personal data.

Entur, on the right hand side of the slide, is an example of where this new world takes us. It is a body established by the Norwegian government with a remit to become the customer interface, on-line and in-person, for all transport providers in Norway.

But the big data sharing opportunity relates to driverless vehicles. I believe the future is driverless vehicles connected into publicly-controlled mobility management systems. Those systems will allow a city or country to optimise the use of road space, recognising that capacity is the key constraint. It will also crucially allow the introduction of road pricing, which is essential to fill the fiscal black hole gradually opening up globally as the vehicle fleet switches to battery electric, and fuel-duty income falls off a cliff.

All this is closer than you may think. Transport for London opened a dialogue with suppliers two years ago for the so-called Surface Intelligent Transport System, which aims to provide real time visibility of all movements in London; real-time ability to intervene and influence or direct those movements, and predictive analytics to allow optimised response to planned or unplanned disruptions.

And in Adelaide, Australia, the 10 GB Adelaide project has wired up the entirety of the central square kilometre of the city with super-fast fibre optics, with reserved capacity for the city to run a smart transport system.

Slide 10

Last but not all least, technology is driving transformational change that is revolutionising whole industries. As the cost of battery technology collapses, from $1,000 / kWh in 2010 to less than $200 today, and expected to be below $100 by 2025, users will switch on-mass to electric vehicles, which KPMG predict will be cheaper to own on a whole-life basis than a petrol or diesel vehicle as early as 2021. That in turn will crash the second-hand market for petrol and diesel vehicles. We will recharge those batteries using renewable energy and decarbonise the planet at the same time. We will overlay universal 5G coverage and full-fibre coverage and we will be able to operate all those cars as Level 5 autonomous pods. Which is why the roll-out of those two technologies is so important for the UK, together with electric vehicle charging, as the NIC has so rightly said.

In a world of electric, autonomous vehicles and mobility as a service, where I can push a button on my phone and get from where I am to where-ever I want to be without consulting a map or a timetable, buying a ticket or looking for where I left my car or my bike, the way we live and work will be transformed, as will the entire logistics industry globally, given 70% of the cost of the trucking industry lies in the cost of the labour.

The potential benefits are enormous. But there are downsides too. There will be a profound employment disruption with jobs being lost simultaneously in the low-skill, high employment, industries of driving and construction replaced by much higher skilled jobs.

Public authorities are also having to rethink their role. Technology increases obsolesce risk and as governments are reluctant to waste taxpayers money, they must move more to regulation than delivery. After a period of city authorities allowing the free market to innovate in transport technologies, we have recently seen the reassertion of city regulatory power in New York, limiting the number of ride-hailing cars in the city; London taking on Uber, and Vienna ejecting the unauthorised dockless bike sharing schemes Ofo (Chinese) and oBike (Singaporean) in in favour of their own licensed CityBike.

Slide 11

Part 3: Collaborative

Slide 12: Project 13

Turning to collaboration, I am going to talk to you about Project 13. It sounds like it ought to be the name of an Edinburgh fringe festival movie, or a top secret government initiative. It is actually more ambitious, more exciting, more far-reaching than anything like that. It is nothing less than an attempt to finally take the UK's infrastructure and construction industry and blast it into the modern age.

Project 13 is not an idea. It is not a publication that is too thick to read and everyone has forgotten about it shortly after it is published. It is a campaign and it will run until we actually see change happen. It is powerful because it is led by the largest infrastructure clients in the UK. It will succeed because the main thrust of Project 13 is that change is needed by those same clients. And four of the UK's biggest infrastructure owners – Anglian Water, the Environment Agency, Heathrow and National Grid have agreed to become early adopters and put the Project 13 concepts into action.

So let me tell you about it.

Slide 13: Construction Productivity is Woeful

Project 13 is seeking to address the industry's woeful productively. Over the last 20 years UK construction productivity has been flat. Actually that is not strictly true. It rose by a breath-taking 0.8% over that period. Project 13 was framed for the particular woes of the UK industry. But the same challenge is seen all over the world. I was in Hong Kong last week and they were bemoaning the fact that construction productivity is actually declining. As a result the Hong Kong government has just published a manifesto for change, similar to Project 13, called Construction 2.0.

Why is productivity so bad in construction? Because it is an industry that neither invests in skills nor technology.

Slide 14: Because margins are vanishingly small

So we can blame the construction industry then.

Actually Project 13 says it is largely not the construction industry's fault, that they do not invest. Project 13 carries forward the themes of the Latham and Egan and Wolstenholme reports, but with one crucial difference. It places the onus on action on the owners and procurers of infrastructure. Because it recognises that the reason the construction industry doesn't invest, is because it is a near perfectly competitive market, and as a result is it a perfect mess.

There is almost no market power in the supply chain. So margins are nearly always pushed through the floor in a price shoot-out. 59 of the UK's top 100 contractors made a less than 2.5% profit in results available in January 2017. And 17 were loss making. The result is a construction industry that is inherently and perpetually unstable. The focus is always to survive the next few years, rather than invest for the long-term.

But infrastructure is about long-term investment. I think we might have put our finger on the problem.

Just a bit of history. Project 13 was the brainchild of the Infrastructure Client Group – a body established in 2010 to bring together senior representatives of the UK's largest infrastructure owners, to swap good ideas. Guess what, Project 13 was their 13th good idea. It was too big for the ICG to handle on its own, so the ICE stepped in to drive it. An executive group was put together and 5 workstreams. I led the governance workstream.

Slide 15: A shift in our thinking

Project 13 takes us from a focus on doing things to a focus on delivering outcomes It encompasses the way we invest in individuals throughout the supply chain; the way we manage risk; and the way we invest in technology.

Slide 16: Embedded through governance reform

How do we make this happen and make it stick?

Our objective in the Governance workstream was to get industry clients to embed the Project 13 principles in the very heart of their boardroom governance, and then cascade it through their organisation. We recognised that the investors in an organisation – whether that is private investors in a private utility, or Treasury and Government departments in a public organisation, have to enable their organisations to act in that way. And we recognised the potential for regulators to force, or frustrate, that approach.

We have developed an infrastructure sector-specific interpretation of the UK Corporate Code which we are asking infrastructure organisations to adopt. And we are in discussion with the Treasury and the National Audit Office, both of who were represented on my group, to more explicitly focus on value rather than cost.

Slide 17: Measured through three stages of maturity

To help organisations step through this change Project 13 sets out in detail a Maturity Matrix covering three stages of maturity, so organisations can benchmark themselves and see what they need to do to progress to the next level of maturity.

All the materials are freely available to download from the Project 13 website.

Slide 18: Focussed on whole system performance

But Project 13 is not a campaign in isolation. There is across the UK a groundswell of determination to reform the way our industry works.

This slide is from the Treasury's Transforming Infrastructure Performance report, published last November. It shows how the Infrastructure and Projects Authority within Treasury, and in particular Keith Waller, has been driving a relentless focus on aligning reform at project level to reform at a whole system level.

Slide 19: Aligning System, Network, Asset and Project

Keith calls it SNAP. System, Network, Asset and Project. It is the alignment of objectives and measures from an individual project, through its associated asset, through the network of which it is a part to the operation of the whole system. This brings together what matters to a board in terms of delivering operational efficiency with what matters to users of infrastructure, and the economic and social vitality of a society as a whole.

Slide 20

Part 4: Cool

Technology and governance systems are also a route to helping address the other Achilles heel of our industry – its reputation for being all about mud, delays, overspends and adversarial relations.

The more we build offsite, using technology, the less the industry has to wade in mud.

The more we plan well in advance using Building Information Modelling, and use digital project scheduling and site management and predictive analytics for weather and other external risks, the less we will see projects delayed and overspent.

The more we embrace the collaborative, alliancing principles of Project 13 the less projects will end up in court, which I am hoping will be welcome in this room in particular.

But rather than just rely on these developments, there are some simple things we should be doing to make construction attractive as a career, to develop the skills of those who work in the industry and improve the image of our industry.

Slide 22: Inspiring Construction

If you have read my opinion piece published in Building Magazine last week you will recognise that this photo comes from the Little Britain sailing race held in early September where I joined Suzannah Nicole and others and sailed under the bright yellow colours of Inspiring Construction. Inspiring Construction is an industry campaign led by Build UK and the Construction Industry Training Board, putting construction and STEM ambassadors into schools, supporting appropriate college courses, and opening projects to visitors in Open Doors week each year.

Many other organisations do great work to bring young people into construction. The Construction Youth Trust is just one example - a charity with which KPMG has had long association. But what sort of industry relies on charities to recruit its future workforce?

The problem is the industry is still too fragmented. We need a co-ordinated approach across the whole industry. We should aim to make it as easy to apply for a job in construction as it is to apply to university. To that end I am calling on the Construction Leadership Council to take responsibility for establishing a single apprenticeship application process for the industry and a formal cross-industry work experience and skills record.

We also need an industry-led view of anticipated future industry skills need, translated into systematic provision of appropriate training courses, a bespoke application of the Apprenticeship Levy and a single online portal which allows individuals contemplating or entering the industry to understand the range of organisations providing networks for particular communities within the industry, for example to support women in the industry, or the disabled, and easily get in touch with the ones which most appeal.

None of this is conceptually hard. And the technology that could support it already exists and is being employed by many other industries, and trialled by some brave start-ups in the sector. But without proper co-ordination by the CLC, and the industry agreeing to fall in line, we will continue to muddle along as we have done for decades if not centuries.

Slide 22: Sustainability is becoming mainstream

Turning to the image of the industry, first we need to address the stereotypical view that our industry is bad for the environment. That whilst there may be an economic good from infrastructure, it blights our landscapes and pollutes our skies.

What is really encouraging is that I would observe that over the last year, sustainability has become mainstream in our industry.

There is a rallying around the UN's Sustainable Development Goals. I was in Bali two weeks ago for the World Bank's annual meeting at which they announced a radical shift in policy, to embrace private sector co-investment in the world's infrastructure needs, recognising that donor funding is nowhere near enough to achieve the Sustainable Development Goals in any reasonable timeframe.

At the same time private sector organisations involved in infrastructure are rapidly recognising that they need to be motivated by more than profit. And only just in time, because we are seeing a growing social backlash against private profiteering in the provision of public services.

It is true of infrastructure owners. Samsung earlier this year announced that they would have all their factories and offices in Europe, the US and China powered 100% by renewable energy by 2020.

And investors. Two weeks ago Andy Matthews, CEO of Infracapital, said that increasingly the infrastructure investors with which he is dealing want to know that their investments will meet ESG (Environmental, Social and Governance) principles.

And regulators. Guernsey's Financial Services Commission has recently launched the world's first regulated green investment fund certification, the Guernsey Green Fund.

But the image of our industry is more than about sustainability. It is about focussing on the ultimate outcomes of what we achieve, and about sharing those stories on social and conventional media.

The general public's involvement with the construction industry is characterised by roadworks, delays on the railways due to engineering works, and emotional rows over the location of new housing estates or waste to energy plants.

Crossrail's "The Fifteen Billion Pound Railway" and Thames Tideway's "The Five Billion Pound Super Sewer" help brilliantly to offset those negative experiences and put them in perspective.

But let's be bolder still. Infrastructure is the foundation of our civilisation – from Roman Roads to sub-sea internet cables; from oil and gas pipelines to cutting edge medical centres. And construction is the industry that designs, builds and maintains our infrastructure.

So what we do has real impact in society. The following slide is the vision statement of KPMG's Global Infrastructure business. But it applies to everyone who is involved in construction and everyone therefore in this room.

Slide 23

We connect the world. We build prosperity. We reduce poverty. We create sustainable quality of life.

Ultimately we make the world a better place for everyone, everywhere.
