



Productivity through Technology

How the infrastructure industry can thrive in the age of disruptive technology.

PRINTING.

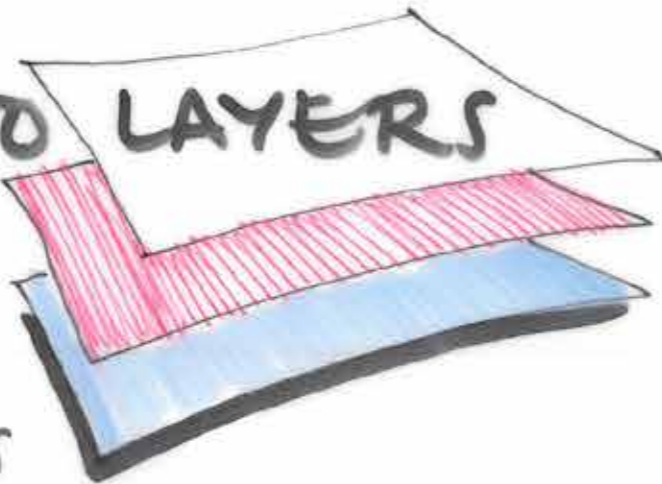
SIZE
CONSTRAINED...

RECENTLY ~ 8m³ BOX.
SHORTLY: INFINITY
PRINTING

SHIFTING SANDS

ICING INTO LAYERS

FLUID
SCULPTURE
COMPLEXITY
GEOMETRIES



RAPID PROTOTYPING
RAPID CONSTRUCTION
RAPID FABRICATION
(NOT IN TIME).

ENHANCED PERFORMANCE.



MICRO
TIMBER
STRENGTH

UTILISING WAS

DYNAMIC

Foreword

The infrastructure industry landscape is shifting rapidly as governments and private firms seek opportunities to spur growth and prosperity. New technologies are coming to fruition, with innovators devising methods to increase productivity and improve cost efficiency, without compromising reliability. Historically, the evolution of technology is not something that the infrastructure industry has adapted to readily, but futurists are now partnering with other like-minded forward thinkers to look beyond traditional techniques to create and implement ingenious new ways to achieve their goals. Put simply, we can do things better together, and the time to invest in our future is now. So where do the opportunities lie? What challenges await, and what do we need to do to prepare for this quantum shift in thinking?

As part of our Productivity through Technology Series, AECOM hosted a meeting of minds to discuss the future. The series provided a platform for industry leaders to air their thoughts on what might be the key technologies that shepherd the infrastructure industry into a bold new era, and how sweeping changes might shape our cities and the way we choose to work and live. Many questions were raised – What impact might technology have on our industry in the future and how do we best prepare for it now? What future demands might our society have of us that we need to start preparing for now? How can we educate our people? And, what considerations must be given to ensure there is good policy and governance around such rapid transformation?

It is my pleasure to share with you some collective thoughts gathered during the series. May these insights guide your own conversations around technology, and perhaps sow the seed that ultimately secures the future success of your business.

Todd Battley
Regional Managing Director - Northern and Western Australia
AECOM

Introduction

The Leaders in Infrastructure Technology Series was designed to provoke discussion around the impacts disruptive technology will have on our infrastructure industry. It involved key industry professionals and the following technology experts - Simon Eassom, IBM's Global Manager for Smarter Cities; Sandra Löschke, an authority in 3D printing from Sydney University; Steve Appleby, AECOM's national BIM Practice Lead; Andry Rakotonirainy, QUT's head Research Professor for driverless vehicles; Catherine Ball, Unmanned Aerial Systems specialist from Elemental Strategy; and Lena Kimenkowski, virtual reality General Manager for Jumbo Vision International.

Through bold vision, collaborative discussion and shared knowledge, this group of like-minded professionals not only provided a blueprint for the challenges that the infrastructure industry may face, but also zeroed in on the opportunities for new technology to change the way we do business. With tight budgets and strict timelines, infrastructure organisations are increasingly asking for more from less. To survive - and indeed thrive - in the highly competitive infrastructure environment, industry players must invest in new technology or be faced with the prospect of being reduced to a relic of times past. Insights will help uncover safer, more productive and cost-efficient ways to stay ahead of the game and to create transformative thinking, architecture and collaborations for a measurable improvement in adaptability and responsiveness.

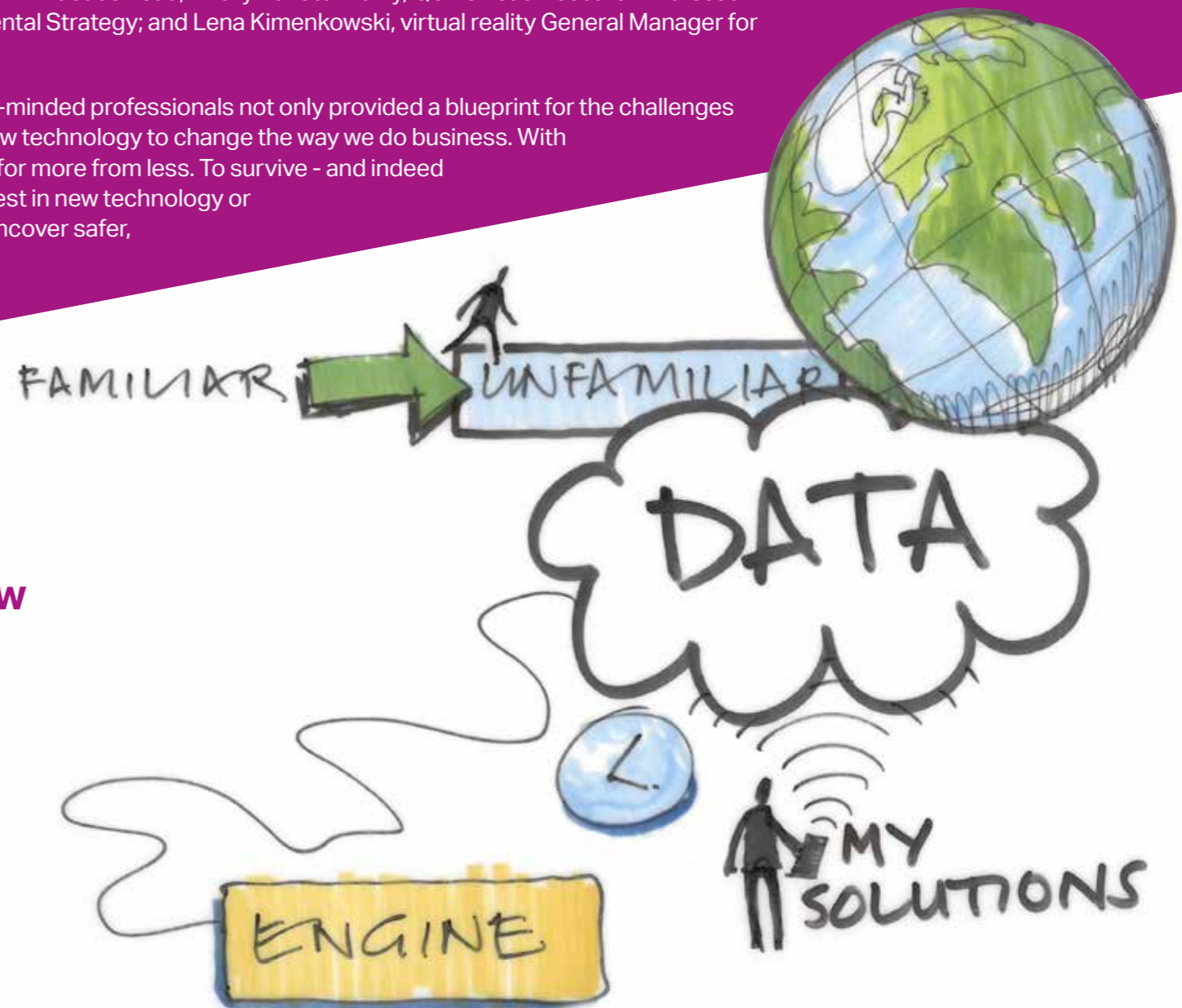
What key technologies will we see becoming more prominent as others fade away – and how can we capitalise?

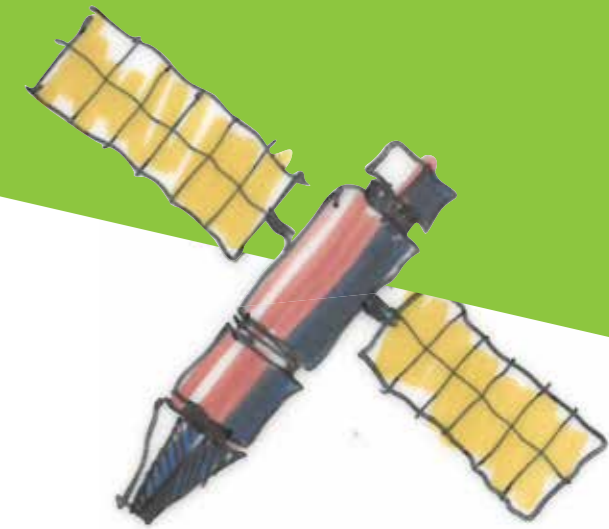
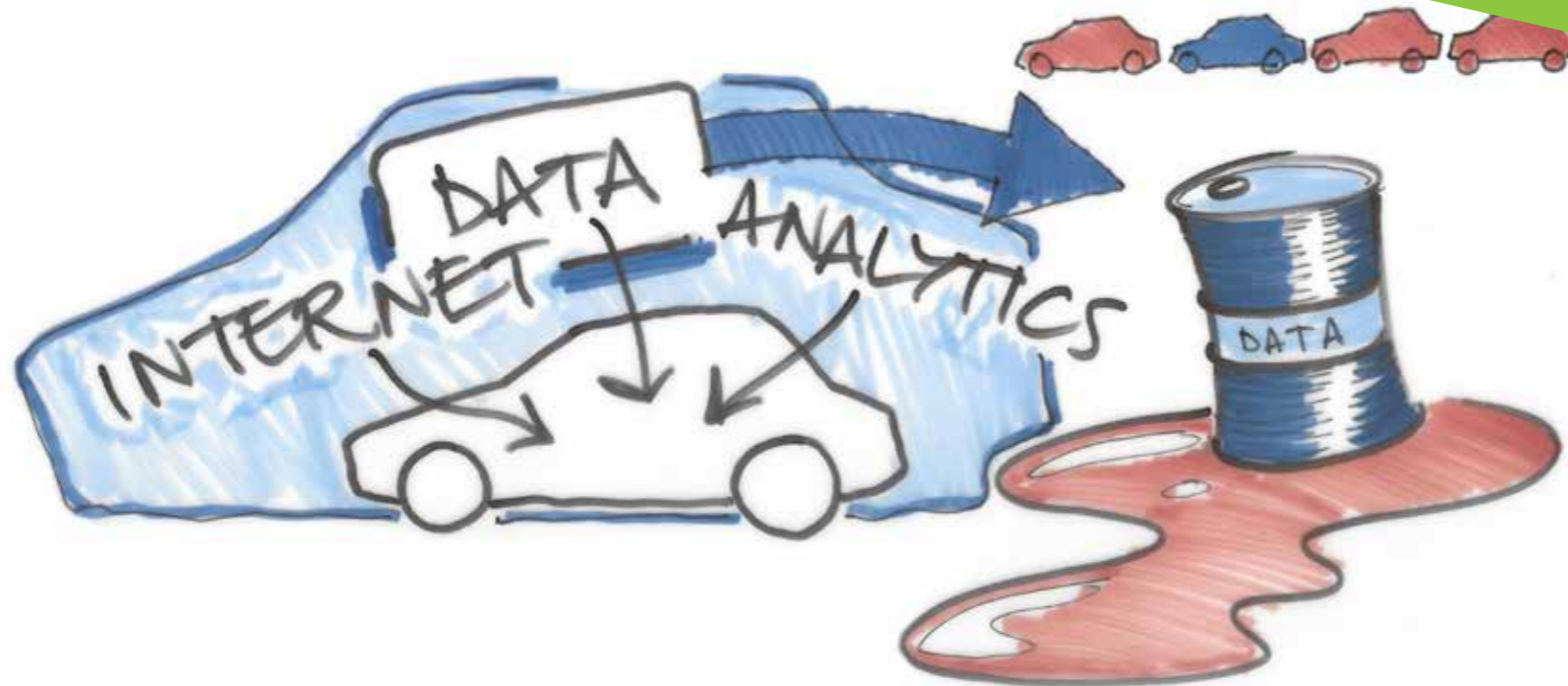
Internet of Things (IoT) Cloud Technology

The mass adoption of mobile devices as the primary source of connectivity and the emergence, growth and availability of mass data is creating real-time networks between citizens and the cities in which they live.

Elements of the built environment are expected to become more interactive with one another and those responsible for their operation and maintenance. This connection of digital assets will allow trends to be identified and meaningful information passed on to decision-makers, helping extend the lifecycle and utility of an asset.

The current functionality of storing and accessing data over the internet will evolve to become the primary access point for shared resources and information that can be accessed on demand. This easier access to big data will facilitate better planning of infrastructure developments, which in turn will make our cities safer and more liveable. Of course, the availability of massive amounts of real-time data will come with both challenges and opportunities. Security systems are being compromised and sensitive data breached in this era of cyber-vulnerability, driving the need for data more complex efficacy, protocols, legislative and legal considerations.





Smart Machines

Driverless cars and robotics are no longer restricted to the realms of science fiction books and Hollywood movies. The advent of autonomous vehicles is swiftly becoming a reality and for infrastructure firms, a successful piloting of this technology will require a fundamental shift in the way cities and their transport systems are designed and built. We will no longer need traffic lights or speed limits, and with no requirement for household garages or commercial parking allotments, valuable real estate can be allocated or repurposed for other communal uses. Advanced robotics, already making an impact on the globe's mass factories and production lines, can deliver benefits in terms of safety and increased efficiency as the unpredictability of human involvement is removed from many processes. Automated heavy machinery is already being used on mining sites and many manufacturers are trailing unmanned earthwork and site preparation equipment to make sites safer during infrastructure construction.

Global Navigation Satellite Systems (GNSS)

Over the next decade, experts predict a sharp improvement in global positioning technologies, with advanced Global Navigation Satellite Systems (GNSS) being integrated into existing devices. For the infrastructure industry, detailed location intelligence plays a vital part in every aspect of its workflows. Location based information gives greater insights into city trends or environmental challenges, improving the decision-making process and ability to deliver services across both private and public sectors. This technology will feature strongly in the development of health and education infrastructure, emergency services, crime prevention and housing as our cities move into the future. Smaller, wearable units could combine real-time performance and precision detail.

Building Information Modelling (BIM)

BIM technology is set to revolutionise the infrastructure industry, allowing firms to create, manage and share structured information about an asset throughout its lifecycle – from inception until it is retired from service. By modelling an asset before committing to its physical construction, industry participants will be able to create risk profiles for sizeable projects and employ a mitigation strategy that brings benefits in terms of safety, material savings and productivity. It is anticipated that a full life cycle multi-disciplinary virtualisation of a project will become standard practice preceding any construction in the near future.





CONFIDENCE

TIME
SAVED

"We've developed a new approach – we're taking people away from their technology and putting them right in the middle of it."

Lena Kimenkowski (Jumbo Vision International) on the value of augmented reality.

What are the biggest challenges for infrastructure?

Change Management

With the introduction of new technology comes a raft of challenges as we strive to find the right balance between unbridled innovation and good governance and risk management. Resistance to change is not a new phenomenon, and when that change arrives rapidly, it is natural that there will be a portion of the industry longing for a past they know and take comfort in. Change management could be problematic, with the reactive nature of humans to new technologies being a hurdle many firms will struggle to overcome.

Education

The human element of our industry will always influence the decision-making process, with safety, security and acceptance of a changing infrastructure landscape becoming key to our future. Upskilling existing teams and maintaining an agile workforce that can capitalise on opportunities swiftly shapes as an important consideration. Educating society to cope with change also appears a wise and necessary investment to mitigate the challenges that fear of the unknown can bring.

Data standards

Standardising data formats and structures to increase collaborative opportunities and ensure operability between best-in-class packages will further enable global firms to harness the potential of any new technological developments.

Security and other commercial considerations

The hunger for more data and greater connectivity could place enormous pressure on IT infrastructure, and also unlock a world of risks in terms of cybersecurity and data ownership. Challenges lie in developing appropriate commercial and legal frameworks that encourage integrated working practices and cut through the bureaucracy that can hurt the infrastructure industry in terms of time, quality and cost. A data strategy that identifies and secures data assets, using them effectively throughout the business whilst protecting them from outside interference, is central to success in a world that, through technology, will defy the notion of borders and the difficulties typically encountered through geographical distance and other artificial barriers.



“The product we design is not the thing we are going to sell. We sell the individual, social and cultural experience that the technology provides. There may be resistance, because some will see this (driverless cars) as excessive technology intervention on what they see as the last bastions of their freedom.”

Professor Andry Rakotonirainy (QUT) on the impact of driverless cars.

What are the biggest opportunities for infrastructure?

Collaboration

Smart alliancing and intelligent community engagement will lead to more valuable infrastructure, designed and built under more extensive consultation with the very citizens who commission it. Aligning with Universities and engaging education centres is a pro-active strategy, giving access to academics on the front line of technological development and research. There is enormous commercial potential in co-developing or investing in new technologies at the grass roots level.

Early adoption

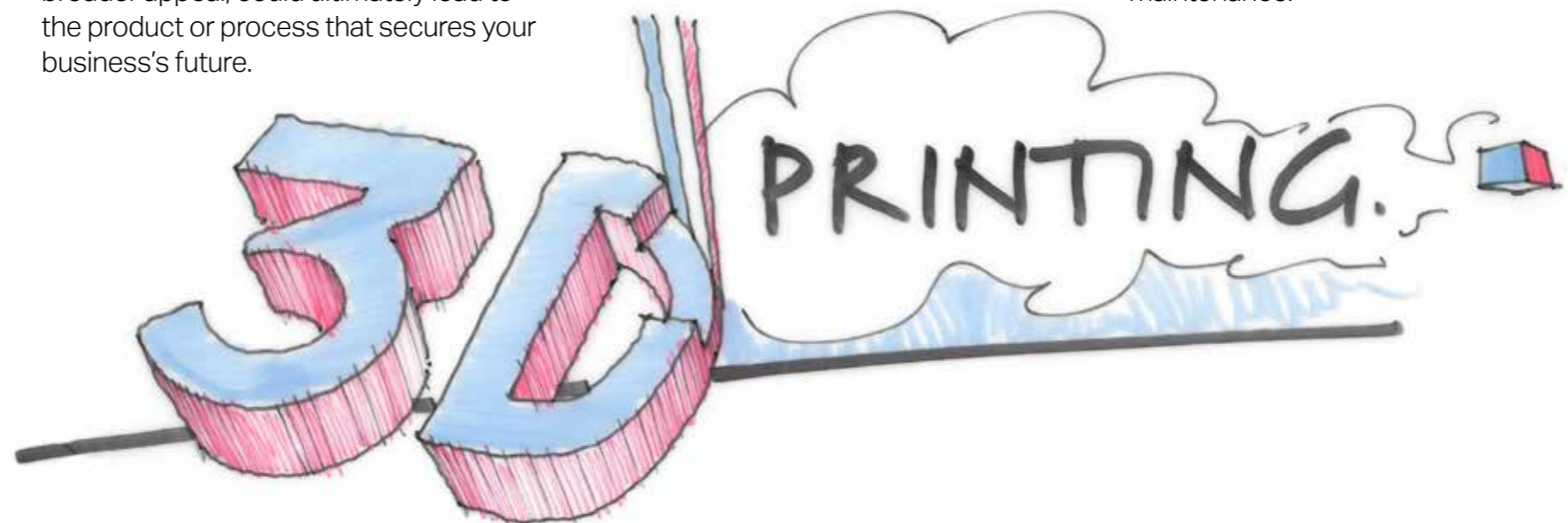
Firms should strive to get involved in emerging technologies on the ground floor, so they can influence their direction as they mature and tailor outcomes to best suit businesses and end-users. Those who invest in innovation and build a culture around technical excellence will be the first to capitalise. Communicating the company vision from a technological perspective will get the whole business engaged in the conversation, discussing and sharing the best ways to move forward. Bold ideas, and the implementation of software that captures them and helps identify niche market opportunities or those with much broader appeal, could ultimately lead to the product or process that secures your business's future.

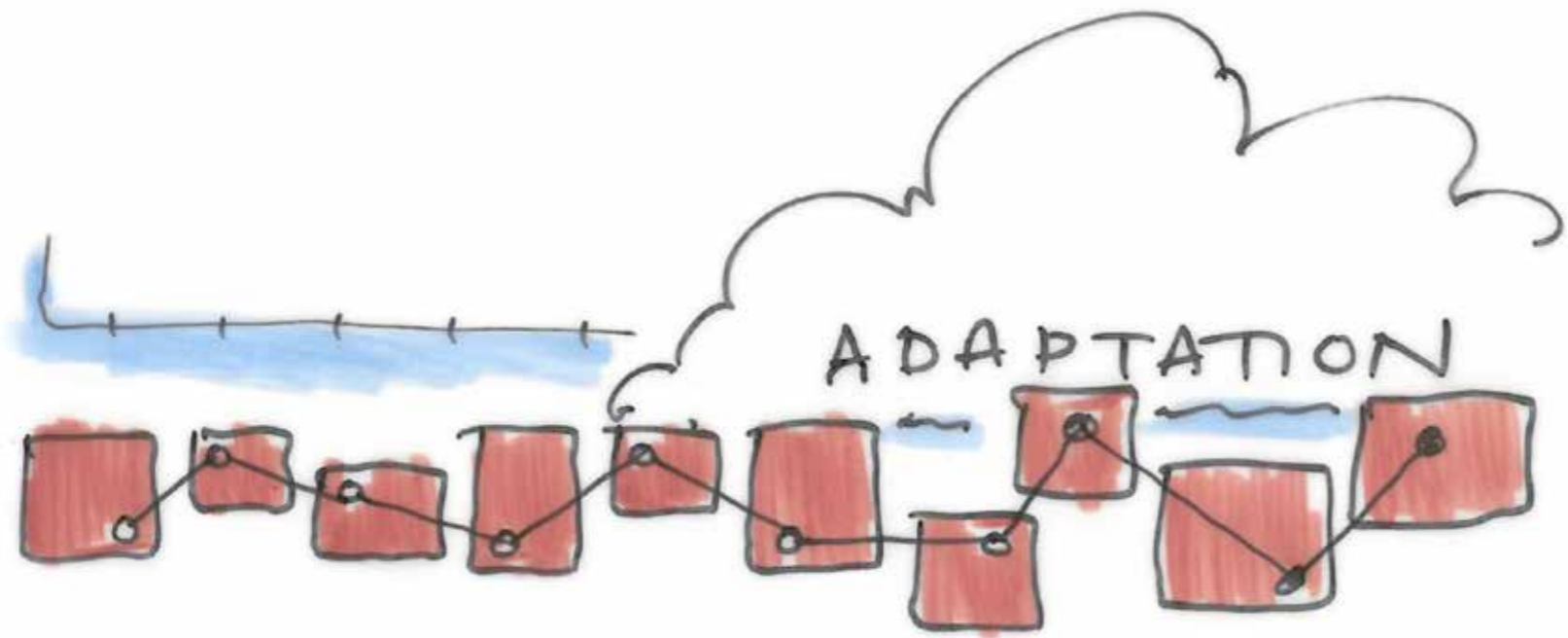
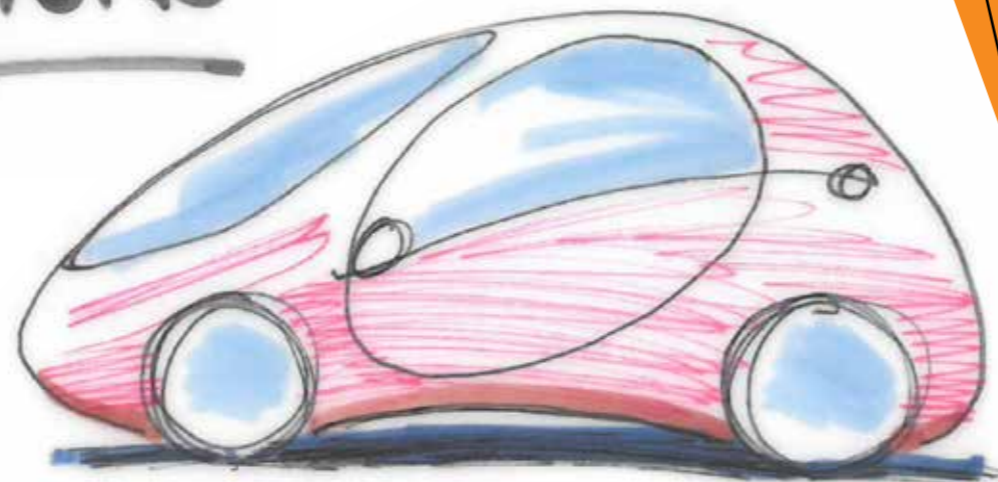
Organisational efficiencies

Improvements in systems and processes through the use of technology based solutions can foster more flexible and collaborative working arrangements, allowing ideas to be shared more freely and widely, or large amounts of data to be collected and analysed to facilitate the creation of solutions that are not only cost effective, but customised to suit society's demands. Safety performance could be improved, which in turn builds client confidence, and could lead to more opportunities on larger, generational projects.

Internet of Things (IoT)

Through the IoT, our educational and communal areas could become collaborative hubs where knowledge is held and shared. City space can be used optimally to rebuild the very fabric of our society, providing ready access to information and effectively shaping the way we live and interact with our cities and the people who reside within. With greater connectivity comes access to a higher level of information, which can be translated into cost efficiencies, more sustainable performance, less misunderstanding in communication and faster, more pertinent decision-making when it comes to operation and maintenance.





*"We are going to move towards a future where the human moves further and further away from a combination of all technologies in the form of artificial intelligence within an intelligent, built environment – and we'll reach the end of the information age. **The acceleration of change on this planet is going to be so exponential that we are not going to be able to keep up.**"*

Simon Eassom (IBM) on our society's future.

*“In terms of infrastructure we are actually going to be looking at airspace - rather than just roads and rail – as ways to get parcels, information, medical samples, mobile phones... **infrastructure and transport isn’t just about the terrestrial anymore.**”*

Dr Catherine Ball (Elemental Strategy) on the potential for UAV technology.

So, what are the next steps?

Creating a new technology-driven, collaborative and innovative landscape in an industry that is historically conservative and dictated by government policy, economic conditions and social expectation is a hard sell.

Sure, the industry has been ground-breaking in the past in regards to design approaches and delivery frameworks, but the coming era will feature a different type of innovation and varied sources of inspiration. No longer will it be simply the engineers driving change in the infrastructure industry, but technology specialists who interpret data in a very different way are set to play a stronger hand.

To take the next steps towards a more productive, more efficient future, it is important to focus on identifying the people with the right attitude, right skillset and credible reputation to become the champions of change. These subject matter experts will drive the business’s technology focus in a measured and achievable way, avoiding a Big Bang style impact where employees are left paralysed or isolated by the rapid nature of change. Strong leaders who engage the wider team will ensure solutions are familiar and well tested before implementation. Investing in relationships with the providers of the technology and internal technology focused teams will guide the customisation of new technologies to specific stakeholder needs.

Finally, it is important to be clear on why your business needs to embrace change. Identify your motivations and be true to these principles as your technological solutions unfold. Good communication – to your teams, clients and other stakeholders – will also help you manage expectations around what your new technology will, and will not, deliver. Keep your own commitment to change strong, and ensure your champions are visible and their actions explained. New technology is coming - preparation begins now!

BUILDING INFORMATION MODELLING.

TECHNOLOGY: TO BUILD OR TO BUY?

COMMON PLATFORM

CO-ORDINATION

3D VIS.

PERSPECTIVES

INTERROGATION

DATA + PRODUCTIVITY.



SKILLS GAP

BUILDING ASSET

DIGITAL ASSET.

- DESIGN
- BUILD
- MAINTAIN

CHALLENGES...