morphosis RICS

Crossing the Threshold

A primer for sustainable digitalisation in real estate and cities

Report by Morphosis and RICS

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Crossing the Threshold can be used in multiple ways:

Browse a Transformation chapter on a topic of interest to you

OP RL EB LD RS TM

Use the tools to take action on sustainable digitalisation

- *Map of Focal issues*
- *Framework for action*

Read from end-to-end

About Morphosis

Morphosis is a corporate sustainability strategy practice specialising in the real estate sector in Australia and internationally. Founded by Simon Carter in 2008, Morphosis works with companies and governments to build resilience over the long-term and be a core part of the global sustainability solution.

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About RICS

RICS promotes and enforces the highest professional qualifications and standards in the valuation, development, and management of land, real estate, construction, and infrastructure. Our name promises the consistent delivery of standards – bringing confidence to markets and effecting positive change in the built and natural environments.

www.rics.org

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Endorsements

Crossing the Threshold is endorsed by:

"We live in a fast changing world and real estate is subject to the winds of technological disruption as much as any other part of society. Congratulations to Morphosis and RICS for producing this timely roadmap to help guide the way."

Ken Morrison, Chief Executive, Property Council of Australia

"A catalyst for transformation, we can expect sustainable digitalisation to reshape the way our industry works. Crossing the Threshold outlines the opportunities and challenges emerging for the property industry, grappling with how best to take action to ensure digital innovations within our cities are sustainably implemented."

Romilly Madew, Chief Executive Officer, Green Building Council of Australia

"In preparing and responding to global megatrends like digitalisation, a sustainability lens is essential for enabling vibrant societies, efficient and productive workplaces and liveable cities and regions. This is a practical approach for responsible organisations to lead their own unique transformation agenda by matching capability and capacity to affect change across the value chain of infrastructure asset portfolios."

Ainsley Simpson, Chief Executive Officer, Infrastructure Sustainability Council of Australia

"Digitalisation is a strategic priority for the City of Sydney, with many implications for our communities and businesses. It is important that we pursue digitalisation in cities ethically and sustainably, and we encourage leadership on this by city stakeholder organisations and increased public discussion about the environmental, social and governance issues it raises."

Chris Derksema, Sustainability Director, City of Sydney

"Crossing the Threshold sets out key ingredients for a sustainable business in a technology enabled world. This is a great read for any organisation associated with real estate and cities, to understand this complex field, and also to retain and attract the future workforce."

Paul Edwards, General Manager Workplace Experiences, Mirvac

Foreword

Dr Sean Tompkins
CEO, RICS

Chris Nicholl FRICS
Managing Director for Southeast
Asia, Australasia and Japan, RICS

RICS came into being 150 years ago as a response to the unprecedented advances of the Industrial Revolution. New technology was driving such substantial change in real estate that more stringent checks and balances became essential to protect the public. Similarly, the technological transformation we are experiencing today also demands fresh approaches.

Digitalisation is inevitable. And as professionals our duty is to find ways to maximise the benefits while taking full account of the associated risks. How can we ensure that digitalisation is sustainable in environmental, social and governance terms? We can begin by asking difficult questions about the true purpose of the technology we use, and the future we want to create for society.

No professional can stand aside from this process. Each of us needs to better understand the changing needs of our stakeholders – clients, employees, government and the public – so that we can help them to seize the opportunities of digitalisation in a responsible manner.

This can never be a conversation amongst professionals alone; we have to engage tirelessly with our stakeholders as partners. The RICS World Built Environment Forum provides a platform for this and related debates, enabling us to collectively steer a future course. In this way we can be confident that our profession will remain as relevant as ever.

Crossing the Threshold is a tool for action in your organisation. It will help us all to provide leadership in an area fundamental to future success and prosperity. And it reminds us to put ethics at the heart of our decision-making. In so doing, we serve the interests of today's society and those of future generations in equal measure.

Executive summary

Digitalisation is a double-edged sword

'Digital disruption', innovation, proptech, cybersecurity, AI, Alexa, the Internet of Things, smart buildings, smart cities, driverless cars – these are all hot topics of discussion around real estate and cities today. Digitalisation is upon us.

Digital technologies that have been surfacing for some time are now integrating with each other, and their take-up is being driven hard by high levels of investment and public acceptance, and by geopolitical forces such as the quest for military power. Humankind is crossing a threshold into a digitalised way of life which will be transformational for our species, and highly consequential for real estate and our cities.
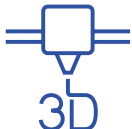
Digitalisation offers extraordinary benefits – but it is a double-edged sword. To date, innovators, implementers and users of digital technologies have largely focused on one edge of the sword – the benefits – without adequately considering the risks such technologies present to the environment, society and governance.

We find ourselves at a critical juncture, facing some big choices that will shape our future. We must recognise digitalisation for what it is: a megatrend that sits alongside other megatrends such as urbanisation, globalisation, climate change and resource security to define our global sustainability agenda. Digitalisation must now become sustainable.

'Sustainability' in Crossing the Threshold uses an environmental, social and governance (ESG) definition and encompasses corporate responsibility and responsible investment.

Digital technologies featured in *Crossing the Threshold*

Digitalisation is the expansive application of technologies such as these in our society, economy and environment.

3D printing	Artificial intelligence (AI)	Augmented reality (AR) and Virtual reality (VR)	Autonomous vehicles	Big data
Blockchain	Building information modelling (BIM)	The internet of things (IoT)	Robotics	Wearables and implantables

This is a point in the evolution of humankind's relationship with technology where we need to collectively make some crucial choices about the future of our society, and our species.

It is time to set a sustainable digitalisation agenda

Crossing the Threshold aims to advance 'sustainable digitalisation' in real estate and cities, and is a call for action and leadership. It is written with the creators, owners, occupiers and operators of real estate and cities in mind, and invites them to:

Understand digitalisation in a broader sustainability context

Start preparing their organisations to embrace sustainable digitalisation

Provide leadership on sustainable digitalisation in our sector and society.

Crossing the Threshold is structured as a practical tool. It includes a map of 24 environmental, social and governance (ESG) *Focal issues* driven by digitalisation in real estate and cities (*Map of Focal issues*, page 70). These represent both opportunities and risks, and can be used for the development of strategy. *Crossing the Threshold* also offers a *Framework for action* (page 71) to help organisations build capacity for sustainable digitalisation and provide industry leadership.

A map of ESG issues to focus on

The *Focal issues* are structured under six digitalisation-driven transformations, each with significant implications for sustainability in real estate and cities within the next ten years, if not already:

1. **Optimised performance (OP):** Transformation of the operation of buildings, cities and markets

2. **Reworked labour (RL):** Transformation of the labour force

3. **Exposed business (EB):** Transformation of the public exposure of organisations

4. **Liberated developments (LD):** Transformation of development and construction

5. **Reinvented streets (RS):** Transformation of urban mobility and form

6. **Troubled minds (TM):** Transformation of the human experience.

The list of *Focal issues* is not exhaustive, but focuses on those issues that will likely be of material consequence to real estate sector stakeholders in the short- to medium-term. While some may be familiar, and your organisation may already have relevant initiatives in place, we must consider them in the context of unfolding trends and what will be required in coming years.

Many have flipsides, where addressing a risk can also represent an opportunity, or failure to seize an opportunity can create a risk.

"In the coming decades, the technologies driving the fourth industrial revolution will fundamentally transform the entire structure of the world economy, our communities and our human identities. These profound changes highlight the great responsibilities we face as a civilisation."

Marc Benioff, Chairman and CEO, Salesforce[1]

A framework for action for your organisation

The simple *Framework for action* below is designed to help your organisation prepare for and navigate sustainable digitalisation. The first five actions focus on building internal capacity, while the final three are for those organisations seeking to provide industry leadership.

1. Develop digital literacy. Build understanding of digitalisation and digital technologies across your organisation through to the board level.

2. Expand strategy. Consider the *Focal issues* presented in this primer, along with others you may identify, in the development of sustainability and other strategies.

3. Embed ethics. Build a culture of ethics across your organisation from the board down, and be prepared to show your process for making ethical decisions about ESG issues that affect your stakeholders.

4. Maximise trustworthiness. Make sure your organisation maintains high levels of trust capital with its stakeholders. Ensure transparency around sustainability performance.

5. Pursue mindfulness. Slow down to get a strategic view of digitalisation. Support others in looking after their mental well-being as they spend more time in digital environments.

6. Champion sustainable digitalisation. Become a role model and advocate for the sustainable and ethical use of technology, and help lead a responsible professional and public discussion on digitalisation.

7. Build shared vision. Help industry and the community build shared vision of the digitalised and sustainable world they wish to create.

8. Drive smart policy. Be actively involved in setting public and industry policy on the use of digital technologies in business, cities, and society.

These are just early steps

This is the beginning of a journey with making digitalisation responsible, ethical and sustainable. Digitalisation could play out in many ways, often unpredictably, and we should consider a variety of future scenarios and apply the precautionary principle in acknowledgement of the potential seriousness of some of them.

What will digitalisation ultimately mean for lifestyle, work, privacy, security, the economic system, democracy, military and global power, and the experience and essence of being human? What might it mean for your life, or your children's lives?

Morphosis and RICS hope that *Crossing the Threshold* motivates and supports your organisation and its stakeholders in getting the most out of what digitalisation offers, harnessing its potential for the betterment of humankind while mitigating the risks it presents.

"The changes are so profound that, from the perspective of human history, there has never been a time of greater promise or potential peril. My concern, however, is that decision makers are too often caught in traditional, linear (and non-disruptive) thinking or too absorbed by immediate concerns to think strategically about the forces of disruption and innovation shaping our future."

Klaus Schwab, founder and Executive Chairman, World Economic Forum[2]

Table 1: Summary of Focal issues

Opportunities

OP1	**E**	**Environmental optimisation**
		Optimised building, infrastructure and city environmental systems
OP2	**S**	**User experience**
		Enhanced experiences for building and city users
OP3	**S**	**Healthy spaces**
		Improved management of the healthiness of indoor and outdoor spaces
OP4	**E**	**Building utilisation**
		Reduced sustainability impacts of building materials through greater building utilisation
OP5	**S**	**Operational resilience**
		Enhanced resilience of buildings, businesses and communities
OP6	**G**	**Marketplace integrity**
		Improved governability of real estate-related marketplaces
RL3	**S**	**Job enhancement**
		Improved quality of work experiences
LD1	**E S**	**Materials sustainability**
		Improved management of the life-cycle sustainability impacts of building materials
LD2	**S**	**Stakeholder inclusion**
		Enhanced inclusion of stakeholders in development processes
LD3	**E S**	**Architectural quality**
		Enhanced quality of architecture and construction
LD4	**S**	**Site safety**
		Improved mitigation of injury and death risk on construction sites
LD5	**S**	**Affordable building**
		Reduced cost of building
RS1	**E S**	**Diverse mobility**
		Reinvented mobility systems in cities, including autonomous vehicles (AVs)
RS2	**E S**	**Urban uplift**
		Repurposed real estate currently used for automobiles

Risks

OP7	**S**	**Personal privacy**
		Increased responsibility for built environment data
OP8	**E**	**Electronic waste**
		Increased production of e-waste
RL1	**S**	**Workforce transitioning**
		Required transitioning of workers affected by job automation
RL2	**S**	**Community well-being**
		Reduced well-being of communities negatively affected by job automation
EB1	**G**	**Full transparency**
		Expanded transparency of sustainability performance
EB2	**G**	**Supply chain exposure**
		Exposed links to ESG issues in supply chains
EB3	**S G**	**Cybersecurity**
		Amplified data security risks
TM1	**S**	**Digital exposure**
		Managed exposure of people to virtual and digital experiences
TM2	**S**	**Grounding places**
		Increased provision of peaceful places that help to psychologically ground people
TM3	**S G**	**Factual information**
		Increased responsibility for the honesty and factuality of information in digital media

Key

OP	Optimised performance		**E**	Environmental
RL	Reworked labour		**S**	Social
EB	Exposed business		**G**	Governance
LD	Liberated developments			
RS	Reinvented streets			
TM	Troubled minds			

Introduction

Humankind is entering a whole new world

Throughout our history, humans have inhabited one world – the physical world, which includes the natural and built environments. Today, we are stepping into a new world – a digitalised world – representing a major upheaval for humankind.

Digital technologies that have been emerging over time are now converging and receiving the computing power, financial investment, political commitment, and public acceptance they need to take off. Humankind is currently crossing a threshold where digital technology will irreversibly change society, the economy, and the environment.

How will we adapt to a digitalised world; living and working in augmented and virtual realities, forming relationships with machines driven by artificial intelligence (AI), being monitored in the built environment, having the information we consume shaped by algorithms, and being heavily dependent on – even addicted to – technology?

When we consider the way some governments are developing AI technology as they pursue global power, we get a sense of the strength of the drivers pushing digitalisation forward. Russia, China, and many other countries have made AI a top strategic priority, as have a number of large, monopolistic corporations. There should be no doubt about how serious a poorly-managed path with digitalisation could be for humanity.

Professor Toby Walsh, a leading AI expert and author, reminds us that the Industrial Revolution led to many structural changes to protect the community from the adverse effects of technology: labour laws, unions, universal education, the welfare state, and pensions.[4] We must go through similar changes in response to the current step change in technology, but much more proactively if we want the best it has to offer at the lowest social and environmental cost.

Digitalisation could be humankind's greatest tool – or its Achilles heel. We might use it to help build a sustainable society, or we might become slaves to it. We must have our eyes wide open to its benefits and consequences, and it must be pursued with responsible stewardship and wisdom.

Sustainable digitalisation for real estate and cities must be our goal

Real estate and cities are digitalising fast. The internet of things (IoT) is being rapidly deployed to monitor and control numerous systems; jobs are being automated with robotic brick-layers or online property services platforms; design and development professionals are beginning to use augmented and virtual reality devices; drones are being deployed on construction sites; buildings are being 3D printed.

"Artificial intelligence is the future, not only for Russia, but for all humankind. It comes with colossal opportunities, but also threats that are difficult to predict. Whoever becomes the leader in this sphere will become the ruler of the world."

Vladimir Putin, President of Russia[3]

This is just the tip of the iceberg. Automated valuation models are being used to value assets and land titles are being recorded in blockchains. Autonomous vehicles are appearing on the roads and we are beginning to rethink our cities in advance of the reinvention of our mobility systems.

Digitalisation is a megatrend, alongside urbanisation, globalisation, climate change, resource security and the others that are reshaping our world and defining our global sustainability agenda. It is driving many environmental, social, and governance (ESG) issues for real estate stakeholders, both opportunities and risks. Some of these issues, such as cybersecurity, already have some profile in the sector, but we are only in the early stages of responding to the broader set.

By our very nature, humankind will almost certainly chase technology. We must therefore adopt sustainable digitalisation – the sustainable, responsible and ethical pursuit of digitalisation – as a goal. We need to redefine sustainability to respond to the ESG opportunities and risks that digitalisation presents and include its potential impacts in our longer-term thinking and planning.

Professionals in real estate and related fields should provide leadership in promoting this expanded sustainability agenda. The sustainability discipline must evolve to help us navigate digitalisation with the skills, ways of thinking, and wisdom that it has successfully applied to other ESG issues.

We need a new discourse about digitalisation

A critical first step towards sustainable digitalisation is to reshape the professional and public discourse around digitalisation. The public, for the most part, does not yet comprehend what is unfolding. Many people implicitly put trust in the technology companies that use their data, but are frightened by stories about businesses making unscrupulous use of that data. At the same time, they are not meaningfully engaged in a conversation about the kind of future they want.

Digital technologies can be difficult to understand, and the conversation about digitalisation in business and the media is often lacking in serious reflection on the issues. It can be very dominated by technologists and heavily focused on just the upside benefits. Enthusiasts for technology, or those with interests vested in it, often downplay risks or polarise debate through strategies such as painting those who raise social concerns around digitalisation as blockers of progress or Luddites.

The required approach needs to be informed by some of the basic principles of corporate sustainability. It needs to start with the engagement of key stakeholders, such as the community, and understanding their concerns. It needs to identify ESG issues that are materially consequential, and to implement strategy by taking stakeholders on a change journey shaped by a positive and motivating vision, while also openly acknowledging the risks.

Virtual reality may become a commonplace work tool

Crossing the Threshold is a call for action and leadership

Morphosis and RICS want to help set the real estate sector and cities on a path leading the urgent cause of sustainable digitalisation while skilfully negotiating this transformation themselves.

Crossing the Threshold is a primer for this mission. It helps us understand the broader implications of digitalisation, identifying many of the ESG issues we need to address, and explores how you can prepare your organisation in response.

In Crossing the Threshold, the term 'sustainability' is broadly defined to encompass all relevant environmental, social and governance (ESG) factors and includes corporate responsibility and responsible investment.

'Real estate' is also broadly defined to include design, construction, development, investment, facility operation and occupation, and extends into cities operations, infrastructure and places. It primarily focuses on non-residential real estate.

Crossing the Threshold is written for any stakeholder organisation in and around the commercial real estate sector, including:

owners, investors, and investment managers

developers, designers, and builders

tenants of buildings

city administrations

services and technology providers.

It is for professionals leading sustainability, corporate responsibility or responsible investment strategies; steering the strategic direction of organisations; innovating with new technologies; creating smart buildings, precincts or cities; investing in proptech; procuring technology-enabled buildings or spaces; serving the needs of city citizens and communities; or providing technology-related services and products in the built environment. *Crossing the Threshold* is ultimately for anyone and any organisation engaging with digital technologies in real estate or cities.

Each of us will navigate sustainable digitalisation in different ways appropriate to our specific contexts and *Crossing the Threshold* has been designed to accommodate many different pathways.

How to use this primer

Crossing the Threshold is designed to be used in a variety of different ways. You might choose a chapter on a digitalisation-driven transformation of most relevance to you; read the primer end-to-end for a deeper immersion in the topic; or use the two following practical tools to develop strategy or the sustainable digitalisation capacity of your organisation.

Two tools for working with sustainable digitalisation

Map of Focal issues

OP1	OP2	OP3	OP4
OP5	OP6	OP7	OP8
RL1	RL2	RL3	TM1
EB1	EB2	EB3	TM2
LD1	LD2	LD3	TM3
LD4	LD5	RS1	RS2

Materiality to your organisation and key stakeholders; short-, medium- and long-term
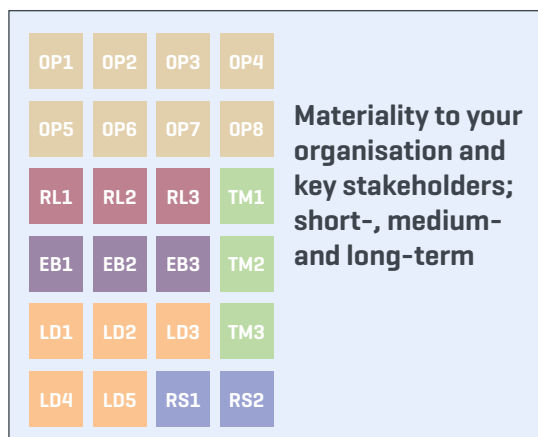
Framework for action

For building organisational capacity

1. Develop digital literacy
2. Expand strategy
3. Embed ethics
4. Maximise trustworthiness
5. Pursue mindfulness

For providing industry leadership

6. Champion sustainable digitalisation
7. Build shared vision
8. Drive smart policy

1. Map of Focal issues

A map of the digitalisation-driven ESG issues for real estate and cities (page 70)

To examine the strategic implications of sustainable digitalisation for your organisation and its stakeholders, *Crossing the Threshold* provides sets of digitalisation-driven ESG issues, *Focal issues*, under each of six transformations.

The six transformations are all driven by technology and represent a shift in thinking and operating that will be highly consequential for real estate, cities and sustainability. They will unfold at different speeds, but are all expected to be impactful within the next ten years, if not already.

You can use the *Focal issues* as a starting point in developing strategy in the areas of sustainability, corporate responsibility and responsible investment, or with technology, innovation or general corporate strategy.

Consider the materiality of each *Focal issue* to your organisation and key stakeholders today and in coming years, and prioritise. You may determine your own definition for materiality, but one definition you could use is that a material ESG issue is one that has a significant impact on your organisation or key stakeholders, or substantively influences their assessments or decisions.[5]

Each *Focal issue* comes with a question that will act as a starting point to consider the issue's relevance for your organisation and stakeholders. Some of these questions might not be easy to quickly answer, but are intended as the start of a deeper inquiry.

The six transformations

1	**OP**	**Optimised performance**
	Transformation of the operation of buildings, cities and markets	
2	**RL**	**Reworked labour**
	Transformation of the labour force	
3	**EB**	**Exposed business**
	Transformation of the public exposure of organisations	
4	**LD**	**Liberated developments**
	Transformation of development and construction	
5	**RS**	**Reinvented streets**
	Transformation of urban mobility and form	
6	**TM**	**Troubled minds**
	Transformation of the human experience	

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2. Framework for action

A framework for action and leadership by your organisation (page 71)

To give your organisation the capacity it needs to best pursue sustainable digitalisation, *Crossing the Threshold* presents a *Framework for action*. The first five actions in this framework are for all organisations, while the last three are for those organisations prepared to provide industry leadership.

In addition, the *Menu of technologies* on page 16 offers a quick summary of the key digital technologies currently being applied in real estate, and the *Glossary* on page 77 will help you navigate new terminology and acronyms.

Finally, as you work with *Crossing the Threshold*, we encourage you to monitor the assumptions you bring to the process. We all have many preconceptions related to digital technologies and sustainability and these can impact our ability to see what is really happening. For example, it might be easy to feel your organisation has 'ticked the box' on cybersecurity if you already have a related program in place; but, applying greater scrutiny, you might ask if that program really meets the demands of a rapidly digitalising world where cybercriminals are increasingly sophisticated, the internet of things provides enormous connectivity in the built environment, and data security and privacy is increasingly regulated.

The research behind *Crossing the Threshold*
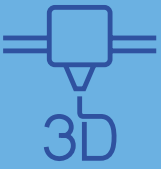
This publication is an outcome of a Morphosis-led research program, from late 2016 to mid-2018, into the sustainability of digitalisation in real estate and cities. The map of *Focal issues*, as a central product of the program, was developed, tested and refined with the help of dozens of technology, real estate and sustainability experts and thought leaders, including through individual interviews and roundtable forums. *Crossing the Threshold* has been reviewed by seven experts on sustainability and the application of digital technology in real estate and cities.

"We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten."

Bill Gates, co-founder, Microsoft

Menu of technologies

Beyond the technologies that we are all very familiar with, such as mobile devices, social media and cloud computing, the key technologies referenced in *Crossing the Threshold* are as follows.

Technology		Example applications
3D printing	Printing of 3D objects from computer models, commonly by laying down layers of materials (additive layer manufacturing), but also by cutting forms from blocks of material.	The printing of: – building components, off-site or on-site – whole buildings – consumer items, from kitchen equipment to furniture – vehicles – human body parts for medical procedures
artificial intelligence (AI)	Intelligence exhibited by machines, often associated with the replication of human functions such as learning or problem-solving. Machine learning is an important subset of AI and relates to many of the examples to the right.	– complex analysis and diagnosis, such as in medicine or science – automation of professional tasks, such as in accountancy or law – intelligent digital assistants (IDAs) and chatbots – writing or producing music, images or film – robots and autonomous vehicles – surveillance, including with facial recognition – predictive law enforcement – autonomous military weapons
augmented reality (AR) and virtual reality (VR)	**AR:** data overlaid on a view of the real world through a device such as a tablet or pair of glasses. **VR:** virtual-world experience that fully immerses the viewer using a device such as a headset.	– experiencing architectural designs ahead of construction – stakeholder engagement in developments – design aids – viewing aids for marketing – urban navigation aids – education – entertainment
autonomous vehicles (AVs)	Vehicles capable of driving without human input by sensing and analysing their environments. Also known as driverless or self-driving vehicles.	– driverless private or taxi cars (taxi-bot) – driverless shared vehicles – driverless logistics, utility, construction, and mining vehicles – delivery drones
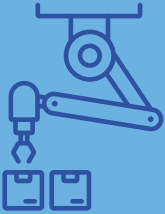
Technology		Example applications
big data	Large data sets analysed to inform decision-making.	– transport and infrastructure system optimisation – building performance optimisation – shopping centre customer trend analysis and planning – marketing – financial services – regulation compliance management
blockchain	Highly secure digital ledgers in which records (blocks) are secured with cryptography and distributed across networks. Reduces the need for intermediaries in a transaction.	– cryptocurrencies – real estate transactions and legal titles – online markets, including real estate and electricity – supply-chain management, including product sustainability provenance
building information modelling (BIM)	3D computer model-based process for the design, construction and operation of buildings and infrastructure. Can include cost, project schedule timing and material life-cycle impacts data.	– architectural and engineering design – building operation and refurbishment – building environmental performance modelling and life-cycle environmental footprint analytics – 3D printing and robotic fabrication – AR and VR presentations
the internet of things (IoT)	A huge network of physical devices (things), including cars, home appliances, elevators, rubbish bins and lights, among others, connected to the internet for monitoring and control.	– increased control and amenity to device users – management of energy, water and waste systems – parking monitoring and traffic-flow optimisation – fire detection – monitoring the safety and maintenance needs of infrastructure
robotics	Machinery capable of performing increasingly complex and intelligent tasks.	– faster and safer construction – operation of manufacturing and logistics facilities – garbage collection – mobile surveillance units – military equipment and weaponry
wearables and implantables	Devices worn on or in the human body, including watches, glasses, cameras and radio-frequency identification (RFID) chips.	– monitoring personal behaviour, health and exercise habits – managing health and safety behaviour on construction sites – access control for services such as public transport – streamlined security checks and surveillance

Image source: Luke Sanderson / Shutterstock.com

Optimised performance

Transformation 1

OP

Transformation 1: Optimised performance

Transformation of the operation of buildings, cities and markets

The operation of buildings and cities, and of markets related to real estate, is on a path to exceptional levels of performance, largely driven by big-data analytics, the IoT, BIM, and blockchain technologies.

The shift to high-efficiency operations

Big-data analytics and the IoT are changing how facilities are operated, with real time data enabling real time monitoring and control. Applications of this in buildings include:

- energy, water and waste sensors that improve efficiency

- lighting, temperature, humidity, air quality and noise sensors that improve comfort

- user-controlled systems offering more tailored comfort, or access to services and amenities

- security systems that make occupancy and activity more visible

- retail systems that monitor store activity and identify customers for marketing.

In time, we can expect facility and system managers to oversee real estate portfolios from centralised dashboards that show information on, and allow control of, functions including air conditioning, vertical transport, security, environmental performance, electronic signage, and car parking. Such systems can be expected to have voice-controlled and AI-enabled user interfaces, made possible by AI platforms such as IBM's Watson.

Operations teams can receive alerts and analytics relating to environmental underperformance, enabling fast remediation. Australian data-system providers such as Envizi and Buildings Alive are delivering advanced environmental-performance analytics and building-systems providers such as Vivid Technology are offering IoT platforms for buildings.

Efficiencies are also being achieved by sharing data between buildings and external systems. For example, data about parking space availability can be provided to vehicles on the street, shortening search times and reducing traffic. Logistics are becoming better coordinated to reduce traffic and loading-dock congestion.

Building information modelling (BIM) is increasingly used for design and construction but will also be a powerful operational tool, making hidden structures and systems in buildings visible and enabling maintenance, upgrades, and end-of-life reuse, as well as stakeholder engagement. In Australia, uptake of BIM for operations has been steady for infrastructure but slow for buildings in the private sector. We might expect further uptake as the benefits of BIM are better understood, the software becomes easier and cheaper to use, and stakeholders such as architects, engineers, quantity surveyors and building managers, gain experience with the technology.

Facility-management activities like cleaning and security are becoming automated, with robots such as Knightscope security guards in the United States providing cheap roaming surveillance.

Top: Operational BIM model
from the International Towers,
Barangaroo, Sydney

Image source: ineni Realtime

Left: Knightscope K5 security
guard in a Westfield shopping
centre, San Jose

Whole facilities are being automated

Facilities themselves are automating. Systems such as the Amazon Robotics (formerly Kiva Systems) automated storage and retrieval system are generating significant workforce and real estate productivity improvements in fulfilling orders at Amazon distribution centres. Globally, 100,000 of its robots are working alongside 125,000 employees.[6] While people are still employed to select products from robotically moved shelves, AI that can reliably identify products will assumedly help enable the full automation of distribution centres like Amazon's.

Similar robots to those used by Amazon can pick up cars on arrival in a parking building and store them quickly and space-efficiently. Automated bicycle storage facilities are also becoming available, such as the large underground Eco Cycle facility in Tokyo with its high-speed bike retrieval.

In logistics, UPS, DHL, and FedEx are experimenting with the robotic loading of parcels, and Amazon has announced Prime Air, a 30-minute drone-delivery service.[7] Fully automated 'dark' facilities are now being developed around the world, where the lights are kept off due to human activities not being required.

Automation is also allowing the emergence of highly automated micro-factories. Tucked into urban settings,

these often specialise in personally customised products, and can deliver sustainability benefits by streamlining logistics. One example is the Adidas pop-up 'storefactory' in a Berlin shopping mall, which sold made-to-order merino wool sweaters. Customers were body-scanned and could then, a few hours later, collect a sweater made to their measurements.[8]

Tenants will enjoy more sophisticated services

Technology enabled 'smart' buildings are offering enhanced services and experiences to building users, including easier parking, wayfinding and access to amenities, less-invasive security, coordination of workspace usage, and better comfort controls. Equiem is an example of an app-based platform offered by landlords to their tenants for improved services and better engagement.

In office buildings, digital platforms support the flexible accommodation options that tenants are increasingly looking for as their ways of working and employing evolve, such as with agile working. Mirvac, in its 2018 report *The Future of the Smart Precinct*, foresees that 'Office buildings will no longer comprise mainly full-time employees of the host organisation but a shifting cast of freelancers, part-timers, consultants, partners, suppliers and collaborators.'[9]

We can expect to see office tenants renting on a fixed lease for part of their spatial needs while also using shared building facilities on a flexible basis as required. Some refer to the flexible part of this arrangement as 'workplace as a service' (WaaS).

The flexible use of office space allows greater utilisation of a building and amortisation of the sustainability impacts of the materials embodied in it. It also creates financial and environmental operational cost efficiencies and reduces the need for more building and infrastructure construction. Furthermore, with businesses operating globally, rental costs increasing, and flexible work practices becoming more popular, we are likely to see greater building utilisation throughout the 24-hour day.

Monitoring space usage permits enhanced tuning or design of the space in response to the needs of users. Monitoring technology will also support better performance-based leasing around indoor environmental quality (IEQ). Numerous products for monitoring and reporting IEQ have been entering the market, as have similar products for the outdoors.

Cities are getting smart

Many cities, property owners and developers worldwide are embracing digitalisation in pursuit of a wide range of economic, social and environmental

Increasing access to data across our cities

Monitoring and control of city systems

outcomes. A 'smart city' movement focused on the clever deployment of technology in cities is now thriving.

City administrations, developers and infrastructure operators are using big data to inform a wide range of planning and design decisions, and virtual city models are being used for tasks such as planning, reviewing proposed building designs, and engaging community stakeholders in projects.

Vast IoT sensor networks and real-time dashboards are emerging to allow the monitoring and control of city systems, infrastructure, buildings, and places; from managing car parking, traffic, security and events, to monitoring footfall in green spaces to help plan watering, or monitoring rubbish bins on the street to determine when best to empty them.

For example, a pedestrian in a city with serious air pollution might review pollution maps and choose routes accordingly.

Resilience is being enabled

Digital technologies, such as with the provision of analytics, are beginning to improve the resilience of buildings, businesses and cities. For example, transport information can be communicated in office buildings via lift screens, allowing tenants to adapt their commutes in real time.

In the event of emergencies, building-monitoring technologies can help by providing clearer pictures of people's locations or situation, highlighting threats and helping responders be more effective while staying safe. Digital Globe is providing open access to satellite before-and-after imagery to support relief in the wake of large-scale natural disasters.

The built environment is watching you

The built environment is increasingly monitoring its users. Public places, such as stadiums in Australia, are using facial recognition to identify people who are blacklisted or might pose a threat to the public. Some shopping centres and supermarkets now use facial-detection (which examine but do not identify faces) or facial-recognition systems to identify security threats or better market to customers. DeepMagic's AI-driven Qick Store platform for small pop-up shops in the United States offers automatic monitoring of shopper activities for fraudulent behaviour.

In some countries, digital technology is being widely deployed for surveillance. In China, which is predicted to have 626m closed-circuit television (CCTV) cameras by 2020,[11] some cities employ facial recognition to identify jaywalkers and post their names and images on large public screens to shame them. Police forces in the United States and other countries are also exploring AI-driven systems that can identify people in public spaces and predict if they might commit a crime; potentially a useful crime fighting tool at the cost of civil liberties.

While accepting (or ignoring) that they might already be monitored online or by their smartphones, members of the public might feel very differently about losing their privacy in the built environment. Indeed, the 'privacy paradox', where we want both freedom and privacy in the digital world, hasn't really been tested for the built environment. Owners and operators, including city administrations, should consider that segments of the public might feel uneasy in, or avoid, certain places with surveillance and uncertainty about use of the data collected.

City of Sydney Digital Strategy

Communities are being more actively engaged through apps and social media platforms that can target specific demographic segments to take part in city events, activities, and civic-participation opportunities such as offering input into the planning of new developments. Cities are also increasingly concerned with community engagement around digital technology. This might include the shoring up of trust through the open management of private data, or the development of digital literacy and inclusion in the community, as the City of Sydney is doing with its *Digital Strategy*.[10]

City users themselves are receiving a suite of analytics on hand to inform how to best use their cities; from navigation to accessing events, education and participation in democratic processes.

Is this the end of privacy?

Given the extent to which we will be monitored and our personal data will be analysed, shared, and hacked, it seems increasingly plausible that we will lose much of our privacy. Your personal data is already being collected or hacked, and on-sold. Fitness wristbands sell data to health insurers, intelligent digital assistants (IDAs) could collect data on what you say and do in your home or office, Uber and AVs collect data on your activities and many businesses that serve you are suffering data breaches. We should contemplate what our privacy really means to us now, and what living transparent lives might mean in the future. Would you want your children growing up in a city where their lives are public and they are constantly tracked?

Regulation, such as the EU's General Data Protection Regulation (GDPR), is advancing to protect personal privacy. The GDPR launched on 25 May 2018 and impacted data collecting organisations around the world by addressing the export of data outside of the European Union (EU). Such regulation is typically focused on internet data, but we might expect future controls on built-environment data.

Professor Toby Walsh, a leading expert in AI, does not believe we have necessarily reached the end of personal privacy. We still have control over a lot of valuable analogue data, such as our heartbeats, which would be highly attractive for marketing purposes. Technologies such as blockchain may also assist with data security, and the increased storage capacity of our computer devices in the future may mean we can retain our data in the devices rather than transferring it to the cloud for computation.[12]

Digital marketplaces will transform real estate services

Many functions in the real estate market, from analysis to brokerage, are being streamlined through digitalisation, creating opportunities for better governance.

Blockchain-based systems can improve the efficiency, speed, and integrity of real estate transactions by reducing bureaucracy, fraud and mistakes in public records, and by increasing transparency. They can help with tracking, verifying ownership and ensuring the accuracy of documents, and transferring property deeds. Ubitquity, out of the United States, is an example of a blockchain-secured platform for real estate record-keeping.

The process of leasing might itself become blockchain-based, removing some transaction intermediaries. This would suit a more flexible leasing model where transactions between leasor and leasee could be more fluid and direct, and it may also speed up the transferral of land titles. Sweden started pursuing a blockchain-based system for property transactions in 2018.[13]

Blockchain systems are looking to be equally transformative in the energy market, with Power Ledger in Australia enabling producers of renewable energy, like residents with excess solar-generation capacity, to sell their power directly to end users, bypassing the utilities and maximising returns.

We can expect to see the digital capability of buildings being assessed and rated, as Wired Score is doing in countries like Britain. Given the benefits that smart buildings and cities offer, high performers could carry a market premium and underperformers might be devalued.

Sustainability management will be streamlined

The management of sustainability in buildings, occupied premises, businesses and cities will largely be automated, particularly reporting. There will be less demand for specialist sustainability management roles, although person-to-person leadership and engagement will continue to be vital.

Transformation 1: Optimised performance

A closer look: Sidewalk Toronto

Sidewalk Labs is the urban innovation business of Alphabet Inc., Google's parent company, and was founded in 2015 to improve urban infrastructure through the use of technology. Sidewalk is currently transforming Quayside, a brownfield ex-port site in Toronto, into what is being promoted as one of the world's most technologically innovative neighbourhoods. This 4.9-hectare project, known as Sidewalk Toronto, is a prototype for the development of the broader 325-hectare Port Lands precinct.

Toronto's Port Lands redevelopment precinct

One of the operative design principles is to treat the city as an open platform, which includes offering a virtual model of the city that third parties can plan with and develop solutions for.

Canadian media and communities in Toronto have shown some concern about how Sidewalk will manage the data it will collect from the numerous sensors installed in the city, which Sidewalk argues will be used to provide increased amenities to the community.[14]

The *Torontoist* newsletter posed 35 questions to Sidewalk to help better evaluate its intentions and commitments.[15] These included:

Who is the user that Sidewalk Labs is ultimately serving? How will Sidewalks Labs balance the needs of those users when making decisions about development, privacy, security, access, etc.?

Who will own/control/have access to the data that is captured by the sensors deployed in this project?

Who controls the Sidewalk Labs platform? Is it the residents? City Hall? Sidewalk Labs?

How vertically integrated with Alphabet products will this new smart city be?

What privacy protection process will be followed to ensure data collected is anonymous?

How are people's movements tracked in space and time? Especially marginalised community members, including homeless people?

If the data is to be 'open' what does this mean? Will all of the data be open, or will only certain data be made available through an API? Who will determine what data will be shared?

Will the way data is treated by algorithms be open?

These are examples of the sorts of questions developers, communities and governments might focus on with smart developments to ensure that community needs are best met. This is especially pertinent when the technologies and models of governance around them are new and untested.

Transformation 1: Optimised performance

Focal issues

To help prepare your strategic response to **Optimised performance**, consider how the following digitalisation-driven ESG issues may be of material consequence to your organisation and key stakeholders.

OP1 | **E**

Environmental optimisation

Optimised building, infrastructure and city environmental systems.

Opportunity to improve energy, greenhouse gas (GHG), water and waste performance, save costs, achieve higher-quality reporting, and meet higher market or industry standards.

System sensors and controls, analytics, and stakeholder engagement tools will enable very high levels of environmental operational performance in buildings and infrastructure. Performance can be managed with real-time data and be visible to facility managers, occupants and investors, and to city users and administrators; so will underperformance and its causes.

In cities, significant improvements will be made to the management of environmental impacts in many areas such as utilities, traffic and green spaces, and planning decision-making enhanced through advanced analytics.

Q: How could you further automate the environmental management of your premises for improved performance, returns and reporting?

OP2 | **S**

User experience

Enhanced experiences for building and city users.

Opportunity to improve the satisfaction of building and city users, and the market attractiveness of employers, properties, precincts and cities.

Risk of reduced competitiveness if not meeting market expectations.

Users of buildings and urban places will enjoy greater amenity and more seamless experiences with easier-to-use services. This can include more uplifting experiences, improved productivity, well-being and satisfaction.

City users will experience improved safety, security, accessibility, mobility, civic engagement, and event and crisis management. Buildings, precincts, and cities will need to meet rising expectations around technology from their users, and delivering this may be a source of competitive advantage.

Q: How could you improve the experience for employees and visitors through technology-enabled buildings and locations?

OP3 | S

Healthy spaces

Improved management of the healthiness of indoor and outdoor spaces.

Opportunity to improve user health, well-being and productivity, and the attractiveness of employers, properties, neighbourhoods, cities and their operators.

Risk of reduced market attractiveness for underperforming spaces.

Owners and occupiers will use IoT sensors in workplaces to monitor IEQ aspects such as light quality, air quality, thermal comfort and noise levels. These can be used to verify performance against higher IEQ specifications in leases.

Tenants might choose locations with better air quality, and community groups may use data from sensors to advocate for improvements in outdoor air quality. Indoor and outdoor spaces could be rated online.

Q: How could monitoring technology enhance the IEQ performance of your premises for improved well-being and productivity?

OP4 | E

Building utilisation

Reduced sustainability impacts of building materials through greater building utilisation.

Opportunity to reduce the embedded environmental and social impacts of building stock, and enhance returns from assets.

Commercial properties can move to more flexible usage models where spaces are accessed through digital platforms for shorter terms or on an as-needed basis. This will increase building utilisation and reduce demand for additional building stock.

Globalisation and flexible work practices are increasing the range of the working day and some workplaces might have two or more tenants using the space at different times.

Q: How could you get greater use out of your building space, including throughout the 24-hour day?

OP5 | **S**

Operational resilience

Enhanced resilience of buildings, businesses and communities.

Opportunity to reduce social, environmental, operational, and financial impacts in times of disruptive events or stresses.

Buildings and cities will use better information to improve preparation for, or recovery from, disruptions caused by events such as terrorism, extreme weather, infrastructure failure, earthquakes and fire, or protracted stresses such as those caused by heat or infrastructure underperformance.

Building users and communities can be better engaged for resilience before, during and after events.

Q: What information or analytics could make your organisation more resilient to disruptive events or stresses?

OP6 | **G**

Marketplace integrity

Improved governability of real estate-related marketplaces.

Opportunity to achieve fairer and more reliable marketplaces, reduce business risks, and improve the reputations of associated parties.

Risk of reduced governability where non-transparent systems are used.

Big data analytics and blockchain technology are creating simpler and more secure, reliable and transparent marketplaces for real estate asset services and products. This can give customers and regulators greater certainty of quality, as well as speeding up transactions, reducing associated costs and eliminating spurious deals.

Regtech (the use of technologies to meet regulatory requirements) allows performance in relation to regulations to be readily monitored and verified, and compliance processes streamlined.

Reduced governability can occur where the algorithms or data used in systems are not transparent and auditable.

Q: How could digital technology enhance the quality, reliability, and accountability of marketplace services you provide or are vested in?

OP7 | S

Personal privacy

Increased responsibility for built environment data.

Risk of harm to people, reduced attractiveness of locations, litigation, prosecution or reputational damage.

Real estate owners, occupiers, and operators need to take responsibility for an escalating amount of personal data collected from the built environment. This data includes people's locations, activity history, associates, and consumer preferences, and can be of great value to third parties for customer targeting, surveillance, commercial intelligence and more.

The responsibility will not only apply to the security of the data but also to its dissemination to other parties, who may, in turn, pass it on to others. We should expect public concern about who is collecting data in the built environment, what they are doing with it, whether they can be trusted and who has ownership rights over it, as well as more regulation.

Q: What personal data in your organisation's possession could cause harm to people if transferred to other parties, intentionally or unintentionally?

OP8 | E

Electronic waste

Increased production of electronic waste (e-waste).

Risk of increased resource scarcity and toxicity to the environment and humans, reputational damage and increased regulation.

The accelerating deployment of technology can increase the amount of e-waste, with its associated environmental and social impacts. A lot of technology can be expected to have short lives in deployment, as it and the expectations of users evolves rapidly.

Proactive technology companies are designing products for reuse or recycling at the end of their useful lives. Technology deployers, owners and operators should install and manage technology in a way that prepares for the avoidance of e-waste.

Q: How is your organisation managing e-waste, including helping to 'close the loop'?

Reworked labour

Transformation 2

RL

Transformation of the labour force

The use of increasingly intelligent computers and robotics is leading to a potentially large-scale displacement of jobs, as well improved work experiences for many.

"If you can build a machine to do what people do and do it faster and better and more reliably than people, then why not?"

Martin Ford, author of *Rise of the Robots*[16]

Jobs will be automated across the board

Job automation will affect all trades and professions to varying degrees; this is already playing out. *The Automation Advantage*, a 2017 report for Google by economics consultancy AlphaBeta, analyses the susceptibility of Australian jobs to automation over the next 30 years. It points to large impacts on construction site teams, facility management services such as cleaning and security, hospitality, logistics, and retail and administrative office roles. Professionals such as architects, designers, surveyors, planners, lawyers, and engineers are also expected to be affected, but to a lesser degree.

A report by Professor Hugh Durrant-Whyte and associates has established that 40 per cent of current Australian jobs have a greater than 70 per cent probability of being automated in the next 10 to 15 years.[17] Durrant-Whyte's results, like AlphaBeta's, predict that labourers, machine operators and drivers, clerical and administrative workers, and many technicians and trade workers, will be the most affected.

The professions – from medicine and law to engineering, architecture and quantity surveying – can expect to be heavily affected over time. In *The Future of the Professions*, Richard and Daniel Susskind conclude that 'in the end the traditional professions will be dismantled, leaving most (but not all) professionals to be replaced by less expert people and high-performing systems.'[18] This is a bold prediction, but one worth considering.

Automation has powerful drivers behind it, including quality improvement, safety, and, most notably, cost reduction. Countries with declining working-age populations can be expected to actively pursue it,

Table 2: Susceptibility of selected Australian jobs to automation in the next 30 years (percentage of job susceptible)

Job	%	Job	%
Construction and mining labourers	86	Information and organisation professionals	28
Glaziers, plasterers and tilers	85	HR and training professionals	22
Cleaners and laundry assistants	77	Medical professionals	21
Plumbers	60	Tertiary education teachers	18
Hospitality workers	58	Architects, designers, planners and surveyors	17
Bricklayers, and carpenters and joiners	55	Business and systems analysts, and programmers	17
Truck drivers	48	Chief executives, GMs and legislators	15
ICT and telecommunications technicians	45	Business administration managers	14
Clerical and office support workers	44	Building and engineering technicians	13
Security officers	44	Construction, distribution and production managers	13
Automobile, bus and rail drivers	41	Legal professionals	13
Electricians	41	ICT managers	12
Sales assistants and salespersons	35	Engineering professionals	10
Financial and insurance clerks	34	Real estate sales agents	9
Accountants, auditors and company secretaries	29	Contract, program and project administrators	7

Source: AlphaBeta[19]

which could have the flow on effect of reducing the cost of technology through scaling up of production, and increasing its broader uptake.

Automation will also extend into the way we manage work and employment. Professor Toby Walsh predicts that firms might have computers hire and fire people, and that computers will conduct various employee management tasks, including scheduling activities, approving holidays, and monitoring and rewarding performance.[20]

The impacts of automation are being debated

There is debate on the level of impact of job automation. Much of this occurs around the extent of new job creation, with some people suggesting that as many jobs will be created as are lost. Generally speaking, this does seem unlikely given the rates of

employment in new technology companies, which usually hire only a fraction of the workers employed by traditional companies. Indeed, one of the major promises of automation is labour productivity improvement, reducing the number of workers needed.

Jim Chalmers and Mark Quigley argue in *Changing Jobs* that relatively few jobs are created in new technology businesses and note that WhatsApp had only 55 employees when Facebook bought it for US$19bn.[21]

We should expect automation to be pursued aggressively due to its benefits, particularly economic. For example, AlphaBeta predicts the following benefits to Australia:

an AUD $2.2 trillion boost to national income between 2015 and 2030 through productivity gains

an 11 per cent reduction in workforce injuries as dangerous manual tasks are automated

improved satisfaction for 62 per cent of low skilled workers.[22]

While job automation has been happening since the Industrial Revolution, these are very different times and high rates of change, which makes adaptation difficult, should give us cause for concern. Those cautious about such change are sometimes branded 'Luddites', but this parallel with the 'alarmists' who attacked the Victorian mills in vain is a curious one. After all, there was little interest in labour rights, corporate responsibility or sustainability in Victorian England, and there was certainly a lot of suffering, which we can all agree needs to be avoided in modern society – and typically is.

Automation will provoke a challenging transition

Job losses will likely happen at different rates. For some industries and roles, they might be gradual, and accommodated by not refilling naturally vacated positions. For others, cuts could be rapid and disruptive; this may happen in sectors that have to adjust quickly to remain price-competitive.

Certain segments of the population may be more heavily affected than others, such as some older workers and those less capable of working with the new technologies. If not effectively managed, this could lead to a significant change in workforce demographics, with effects such as loss of experience, wisdom and diversity.

Workforces trimmed by automation will likely face significant well-being consequences. Remaining employees will have to adapt to work more closely with technology, and may spend less time working in teams, losing some of the well-being benefits that come from human relationships.

We should consider the possibility of a range of flow-on effects for real estate. Certain types of office, retail or industrial tenant might be affected, reducing demand for particular real estate categories or markets.

Communities that are more reliant on susceptible employment types might also be economically affected, with the flow-on effect of reducing their discretionary spending in shopping centres and high-street shops. They may value support from their businesses, landlords, and governments.

Finally, as we think about the digitalised future careers of our children, our staff, people in our communities, and even ourselves, it is helpful to understand the characteristics of the jobs that will best endure. Carl Frey and Michael Osborne, international academic leaders in the study of job automation, defined the job categories least amenable to computerisation as being those involving perception and manipulation, creative intelligence, and social intelligence.[23] This gives us a useful framework to work with.

Is this the end of work?

When we extrapolate the potential of smart machines, we can see a long-term scenario where a large portion of the global workforce is redundant, and the end of working for a wage. For some people, this underpins a utopian vision of a leisure-based society, but it does raise serious questions about how to fund the support of those who do not work, and about how people will find fulfilment in their lives.

Many people, including technology leaders such as Elon Musk, predict the need for a universal basic wage, and pilot programs in this vein are already underway in some European countries. While this may give people more freedom, it might not replace the meaning in life that many people derive from their work. Discussions about the future of work with digitalisation will be an important part of building community or industry visions of a digitalised and sustainable future.

Transformation 2: Reworked labour

A closer look: Automated valuations

The valuation profession is one of many being disrupted by technology. RICS' *The Future of Valuations* report[24] points to a range of technology-driven changes for the profession, including blockchain-based smart contracts, drones for inspections, smart building technologies to reduce the need for inspections, and advanced automated valuation models (AVMs).

AVMs are algorithms that provide an estimate of an asset's value at a point in time. While they have been used for a while, typically in the residential market, they are set to evolve. The extent to which they will either aid or replace the valuer is a matter of debate in the profession.

As AVMs evolve and the cost savings they enable make them more attractive in the market, valuers will need to understand when and when not to use them. As an AI tool, AVMs are limited by the availability of good data and do tend to operate as a black box, making it hard for users to disclose their methodology.

With *The Future of Valuations* and other related initiatives, RICS is helping its profession understand the technologies that are changing their practices and businesses, and to best prepare for a future with them.

"At this point in time, AVMs cannot substitute the valuer in all instances. However, it is hard to imagine improved AVMs (based on AI and big data developments) not having an impact on valuations. It stands to reason that as AVMs develop, their usability will expand towards different property types and more complex valuations."

Sander Scheurwater, author of
The Future of Valuations[25]

Transformation 2: Reworked labour

Focal issues

To help prepare your strategic response to **Reworked labour**, consider how the following digitalisation-driven ESG issues may be of material consequence to your organisation and key stakeholders.

RL1 | **S**

Workforce transitioning

Required transitioning of workers affected by job automation.

Risk of reduced employee well-being and productivity, and of reputational damage for employers.

Employers of workforces experiencing automation may have a responsibility to effectively transition their affected employees. This could extend to industry and professional bodies and includes acknowledging the risk early on and helping to retrain. Particular attention may need to be paid to those workers with less digital literacy or capacity to adapt.

Employees at risk of being replaced, or even those who stay as others are replaced, are likely to experience stress. Attention will need to be paid to their well-being.

Q: What is the short-, medium-, and long-term exposure to job automation for your organisation's employees and how could early commencement of retraining provide a competitive advantage?

RL2 | **S**

Community well-being

Reduced well-being of communities negatively affected by job automation.

Risk of reduced community well-being and prosperity, possibly impacting customer or employee catchments.

Opportunity to enhance reputation and stakeholder relationships.

Communities with large numbers of people in high-susceptibility work may be negatively affected by job automation and even go into decline. These might be employee or customer catchments, and organisations closely associated with them might consider how they could support their resilience.

Attention should be paid to digital literacy in the community to help ensure good access to employment and social opportunities.

Q: In what ways, in the short-, medium-, and long-term, might communities your organisation is associated with be affected by job automation and how could you assist them?

RL3 | **S**

Job enhancement

Improved quality of work experiences.

Opportunity to improve staff well-being and productivity, and help attract and retain talent.

Many jobs, not made redundant by automation, may become safer, more enjoyable, and more fulfilling. We can expect that jobs will focus more on work not suited to machines, such as creative or relationship-based tasks. The need to perform monotonous or less-safe tasks can be reduced.

Organisations can now start orientating towards the jobs that will endure and be enhanced, in order to differentiate in the market for talent.

Q: How might you use digital technologies to improve the work experience that your organisation offers, and its attractiveness to employees?

Exposed business

Transformation 3

EB

Transformation 3: Exposed business

Transformation of the public exposure of organisations

Increased use of big data, the IoT, blockchain technology and social media is leading to the extensive public exposure of the sustainability performance of organisations. It will be hard to hide activity and faults, and organisations should disclose information voluntarily or be prepared to have it disclosed by others.

Data is shining a light on everything

The increasing production of data in all areas is permitting much greater disclosure. The environmental performance of buildings, infrastructure and cities can increasingly be disclosed comprehensively and in real time.

Construction sites, where safety and environmental issues need to be carefully managed, are becoming more transparent through the use of cameras, sensors, and site-surveillance drones. This can improve occupational health and safety (OHS), reduce disputes, and help verify construction quality and the sustainability credentials of material.

Supply chains will also become transparent. In the event of ESG incidents, associated parties up and down the supply chain will be exposed, including by non-governmental organisations (NGOs) and the media. Robin Mellon, CEO of the Supply Chain Sustainability School in Australia, notes that 'Digital technologies will provide, analyse and connect information streams to give us a crystal-clear look through our supply chains. Maximised visibility will allow us to make much more informed – and sustainable – choices.'[26]

Blockchain technology is already being used by NGOs to monitor inventory levels in natural assets from fisheries to forested land, along with social impacts. This allows them to provide an increasingly real-time assessment of the responsibility of companies exploiting those assets, and to ensure the sustainability provenance of products in the market. WWF Australia is working with fishing company Sea Quest (Fiji) and blockchain technology companies ConsenSys and TraSeable to provide a high-quality chain of custody, ensuring the sustainability of Sea Quest's tuna from 'bait to plate'.

Responsible investment analysis can be expected to become comprehensive, with investors having high-quality and up-to-date data available on dashboards. Management and boards will likewise have access to excellent analysis by which to make better decisions on ESG issues.

Performance in data privacy is becoming heavily scrutinised, and regulation will be increasingly tough. Under new mandatory data-breach notification laws, from 23 February 2018, Australian organisations and government agencies have to disclose any eligible data breaches to affected people and the Office of the Australian Information Commissioner.[27]

Organisations are going on public trial

Standards for voluntary disclosure can be expected to become very high, led by progressive organisations and pushed by actors such as NGOs that want greater transparency and accountability from corporations and institutions. Such parties are increasingly using advanced analytics to assess the performance of organisations that do not voluntarily report sustainability to a sufficient standard, crunching bigger and more disparate data sets. Profiles and ratings can be provided to customers through apps and social media and the public can input their own performance appraisals through these channels.

Panama and Paradise Papers key facts[28]

Panama Papers, 2015

BIGGEST leak in history	2.6 terabytes
	financial and legal information from **214,488 entities**
11.5m documents	

Paradise Papers, 2017

offshore financial dealings of **120,000 people and companies**	Second BIGGEST leak in history
1.4 terabytes	**95 media partners**	
13.4m documents	**380 journalists**

Operating below the board, information on those who do not proactively disclose can be hacked and made available in the public realm through leaks. The Panama and Paradise Papers leaks, in 2015 and 2017 respectively, show that there are actors working to cast a light on hidden activities and that even the most powerful are not immune. Both these leaks came from hacks of law firms who no doubt claimed to employ best practices in security and were trusted by their clients. It is worth remembering that in such situations, hackers and leakers are taking the law into their own hands, raising some serious ethical questions.

Easier to use social media technologies might well lead to increased public participation in the exposure of ESG underperformance and activism by social movements. The brand damage suffered by United Airlines in 2017, after the aggravated removal of a passenger from an oversold flight was shared on social media, is one of many examples of the impact it can have.

Organisations may have to carefully manage false reports about them in the media ('fake news'), taking action such as making early disclosures of information in order to establish the story they want. Gartner, a global technology consultancy, predicts that by 2022 most people in mature economies will consume more false information than true. To counter this, they suggest organisations take measures like cultivating unique and recognisable behaviours and values, and protect trust in their brands by adopting a digital ethics strategy.[29]

Technology monopolies impact transparency

Through the control of data, power is becoming concentrated in a small group of extremely powerful companies. Monopolised markets become less transparent and behaviours such as buying and destroying emerging competitors disincentivises innovation and entrepreneurship. The extensive political lobbying capability of such companies, or their ability to manipulate public opinion and voting through social media, can be damaging to the democratic process.

On the flipside, emerging technologies such as blockchain could allow markets to develop beyond the control of technology behemoths, increasing transparency and inclusion. Regulation could also be deployed to manage anticompetitive behaviours and protect democratic systems.

"Brand equity is a prize hard won and easily lost. This will only be amplified in a more transparent world."

Klaus Schwab, founder and executive chairman, World Economic Forum[30]

Members of the public recording police activity during an Occupy protest in Portland, Oregon
Image source: JPL Designs – Shutterstock.com

Transformation 3: Exposed business

A closer look: Cybersecurity

With the volume and value of data exploding, breaches in data security can have increasingly severe consequences, making cybersecurity of paramount importance. However, many organisations are only in the early stages of managing that risk.

We have witnessed many high-profile data breaches in recent years, with security for up to 3bn customer accounts at Yahoo, and 41m customer payment accounts at Target, being compromised in 2013. In 2017, up to 143m credit identities were accessed at Equifax, one of the world's largest credit agencies, and the Australian Defence Force lost sensitive airplane and ship data through a hack into its supply chain. Apple, Gmail, Twitter, Uber, and Vodafone are among many of the brands we commonly use and share data with that have suffered breaches. Hacked data is often sold on the web.

The Australian Institute of Company Directors advises that, while all reasonable measures should be taken to avoid breaches, it should be assumed that at some stage those measures will be beaten. Organisations should be prepared and resilient; able to get back up and running again quickly.[31]

Increasing number of data breaches by sector

Source: Identity Theft Resource Center: ITRC Breach Report as of Feb 21, 2018

Legend: Business | Educational | Government/Military | Health/Medical | Banking/Credit/Financial
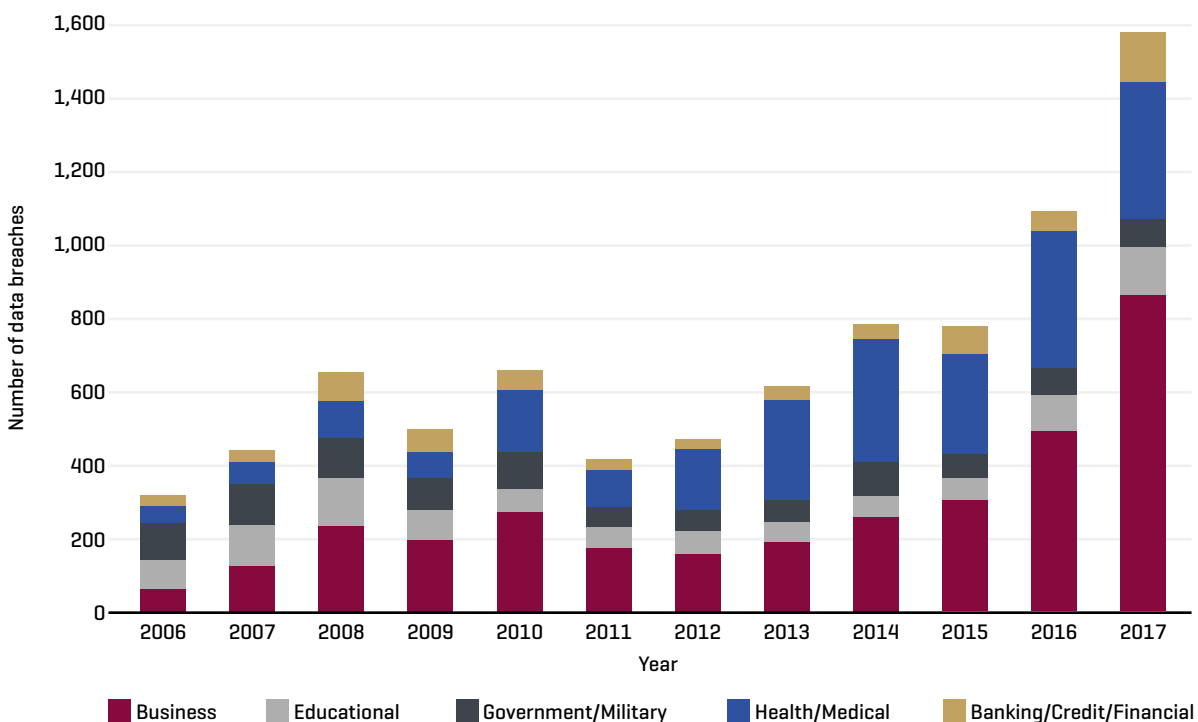
"I am convinced that there are only two types of companies: those that have been hacked and those that will be."

Robert S. Mueller III, former Director, FBI[32]

Parties seeking to access your data might include criminals planning to hold it for ransom, competitors looking to poach intellectual property, disgruntled current or former employees out for revenge, and private or sovereign actors looking to disrupt your operations. Breaches may also simply happen through the honest mistakes of employees or suppliers.

The three core types of breach (known as CIA) are:

1. **Confidentiality:** theft of confidential data

2. **Integrity:** alteration of your data

3. **Availability:** restriction of your use of data or IT systems, such as in the WannaCry ransomware attack of 2017.

The exposure of real estate and cities to the risk of a breach has increased rapidly with the advent of the IoT and the expansion of data collection. A 2016 distributed denial of service (DDoS) attack on *Krebs on Security,* a web-security blog, used 1.5m hacked security cameras and their internet connectivity to bombard the website with requests.[33] Such attacks use IoT devices as armies of enslaved computers, which are often taken over in a weakened state of security, such as when users have not changed factory password settings or applied manufacturer updates.

Eventually, technology such as blockchain technologies might offer better solutions for cybersecurity. In the meantime, we should assume we are all very exposed to the security risks associated with digitalisation.

Table 3: Ten key actions to take on **cybersecurity**	
1.	Ensure cybersecurity is an issue at the board level
2.	Include cybersecurity in planning for enterprise risk management and business continuity
3.	Map your data (often easier said than done) and assess its value. What are the 'crown jewels' for your organisation that you need to protect as a priority?
4.	Consider reducing the amount of data you collect and store to reduce your exposure
5.	Put in place IT protections such as smart password regimes (especially changing factory-set passwords for devices) but give priority to cultural change. Cybersecurity is substantially a people issue, and smart cybercriminals prey on the unprepared; some even employ psychological profilers in their teams
6.	Know your obligations for legal disclosure in the event of a breach. These can be weighty
7.	Examine risks through your supply chain, which is a common source of access to your computer systems and data
8.	Have experts perform penetration testing on your cybersecurity. Ask yourself if you can detect breaches fast enough
9.	Actively prepare to recover in the event of a breach, and practice putting your plans into action. The biggest cost to companies often comes not from the initial breach, but from the failure to detect and recover from it quickly
10.	Consider cybersecurity insurance to cover risks you cannot mitigate or are not prepared to carry.

Security cameras and other internet-connected devices are used for cyber attacks

Transformation 3: Exposed business

Focal issues

To help prepare your strategic response to **Exposed business**, consider how the following digitalisation-driven ESG issues may be of material consequence to your organisation and key stakeholders.

EB1 | **G**

Full transparency

Expanded transparency of sustainability performance.

Risk of reputational damage, litigation or prosecution if ESG issues associated with an organisation are involuntarily exposed.

Organisations must be prepared to deliver high levels of disclosure across the full extent of their operations and material ESG issues. They should consider the consequences of unintended exposure, such as by activists.

Disclosure may include being prepared to demonstrate the ethical basis on which decisions around the use of technology are made, given the significant ESG trade-offs often associated with digitalisation.

Q: If your organisation's ESG performance was involuntarily disclosed by activists tomorrow, what damage could be caused?

EB2 | **G**

Supply chain exposure

Exposed links to ESG issues in supply chains.

Risk of reputational damage, litigation or prosecution.

ESG issues in supply chains are being made much more visible and supply chain members are being called to account on their links to those issues. Actors such as NGOs will increasingly use technology to cast light on supply chains and put pressure on members to be accountable for ESG issues in them.

Technology such as blockchain is driving supply chain accountability by making chains of custody more reliable. ESG issues in the supply chains of technology itself can also be expected to be heavily scrutinised.

Q: What ESG issues exist in your supply chain that would prove consequential to your organisation and its key stakeholders if made public?

EB3 | **S G**

Cybersecurity

Amplified data security risks.

Risk of exposure of individuals to harm and organisations to disruption, loss of competitive advantage, litigation, reputational damage or prosecution.

With greater IoT connectivity of built environment systems, the security of those systems and their data will be critical, and security breaches potentially disastrous. IT networks, lifts, building security, lighting systems, factory robots, rail networks, traffic lights, and numerous other systems might be hacked as a prank or for sabotage, blackmail, terrorism or surveillance. Organisations can be highly exposed through their supply chains.

Cybersecurity breaches can take organisations a long time to identify, diagnose, and fix, often at great cost. Reputational damage to affected parties can be substantial and regulation is increasing.

See *A closer look: Cybersecurity (page 42)*.

Q: Does your organisation have a culture of diligence on cybersecurity, the ability to quickly detect breaches, and a well-tested plan for recovery?

Liberated developments

Transformation 4

LD

Transformation 4: Liberated developments

Transformation of development and construction

BIM, robotics, 3D printing, AR and VR are opening greater possibilities for creating new building forms and architectural designs, increasing ease and quality of construction and enabling new development models.

Built assets will have digital twins

At the core of the digitalisation-driven liberation of development is a virtual model of the asset, created with BIM. These computer models provide a single point of truth for a design and allow for advanced design resolution ahead of construction. Multiple stakeholders in a design can engage with it, test creative design options, and resolve complex issues accurately. BIM can improve building quality, reduce construction errors, and enable 3D printing and construction robotics, as well as AR and VR visualisation.

The BIM model of a structure can include cost and project-scheduling data, as well as environmental data on materials. It can assist with the operation of buildings and their decommissioning at the end of their useful lives.

Stakeholders can now virtually pre-occupy projects

Community or workplace stakeholders in a development or fitout project might walk through a design within a VR environment, or be assisted on-site by AR displayed on a screen or glasses. Such experiential engagement lets stakeholders better comprehend proposals, contribute to the design process and buy into the project, aiding change management.

As an example of this process, Lendlease worked with ineni Realtime to develop a virtual model of its Barangaroo South development in Sydney. 'Virtual Barangaroo' has a variety of uses, including stakeholder

engagement, marketing space, checking view lines, testing office fit-outs and user journeys, and optimising the design.[34]

A further extension is the use of simulated holograms. Microsoft's HoloLens is an AR technology with a headset, which lets you visualise and work with models that appear in real space, much like a hologram would. Building professionals can view and explore a building together and discuss design issues.

Digital technologies are also making what happens on construction sites highly visible. Surveillance drones using lidar and photogrammetry can monitor exactly where construction is at or provide views of problematic locations. AR can be used for building inspections by overlaying the design on the built works, allowing comparisons to be made and revealing hidden elements.

Virtual Barangaroo, Sydney
Image source: ineni Realtime

Construction will be increasingly automated

Robotics and 3D printing are streamlining the construction of buildings and infrastructure, on-site and also off-site in increasingly automated prefabrication facilities. Construction site robots can help to increase safety and reduce the need for humans to participate in dangerous jobs, while also increasing design options and construction speed in complicated locations, such as at height or above roadways. Drones and AVs can speed up the movement of materials on sites.

Laing O'Rourke's high-profile Leadenhall Building project in London used BIM, off-site manufacturing, and just-in-time assembly to reduce construction time from three to two years. The use of prefabricated modules meant that concrete curing did not dictate the critical path for construction, as it typically does, but crane 'hook time' did, a challenge solved by using up to five cranes simultaneously.

Many organisations around the world are innovating in the printing of whole buildings. WinSun Global, a Chinese building printing company, has been printing multi-storey and detached homes. It is working with the government of Dubai on the Dubai 3D Printing Strategy; to print 25 per cent of all new buildings in the city by 2030 and be a world leader with the technology. The Dubai government claims that printing buildings reduces construction costs by 50 to 70 per cent compared to conventional methods.[35] In 2017, WinSun signed a $1.5bn contract with a Saudi Arabian construction company to lease 100 building printers with a view to printing 30m square metres of housing in the country.[36]

3D building printers are already being deployed to provide affordable housing solutions. New Story is a not-for-profit from Austin, Texas, with a 3D printer for application in the developing world that can print a home in 12-24 hours for US$4,000[37]. In 2018 it started printing its first community housing, in El Salvador.

New digital interfaces will aid many work tasks

Many of the 3D-printed structures built today are reasonably basic, with rough finishes. This is being refined, and end products will become more sophisticated and finely finished, as well as produced more quickly. Dutch building-printing company CyBe is offering mobile printers that can move around construction sites and fast-drying mortar that lets structures bear loads within an hour of printing.

Australian company Fast Bricks has developed a robotic bricklaying machine called the Hadrian X, which can lay 1,000 bricks per hour, in contrast to a 'normal' bricklaying rate of 300–400 bricks per day.[38] This illustrates how attractive such technology will be on a cost basis, and how destructive it could be to the labour force.

While the 3D printing of whole buildings is being piloted around the world, it is likely that the most significant application will be in the printing of parts, on- or off-site. This will create construction efficiencies by streamlining materials supply chains and automating construction.

More broadly, the use of 3D printing is snowballing in numerous applications from cars and consumer goods designed by the customer, to human body parts. The means of printing and the range of printable materials are also expanding. For example, in 2015 Massachusetts Institute of Technology started 3D printing with glass, overcoming the challenge of requiring temperatures of more than 1,000°C,[39] and metals are now printed in micron-thick layers.

The life-cycle impacts of materials are becoming easier to manage

Greater visibility of building materials supply chains through data collection and better quality chains of custody to prove sustainability provenance, coupled with the use of BIM, is increasing our ability to manage and report life-cycle impacts.

More accurate construction methods involving automated factory fabrication, on-site robots or 3D printers can reduce waste, the quantity of materials required, and associated transport requirements. Furthermore, better building quality, achieved through greater design coordination and accuracy, better contract management, and automated fabrication will improve the durability and longevity of use of embedded materials.

The idea of materials passporting, by which a database of the materials in a building can be transferred with building ownership, is now being explored in Europe in order to increase materials reuse and recycling. BIM and RFID tagging of building parts can allow a building to be constructed from a kit of parts for later disassembly and reuse.

Transformation 4: Liberated developments

A closer look: Laing O'Rourke Engineering Excellence Group

Multinational construction contractor Laing O'Rourke has operated technology innovation labs in Sydney and London since 2012 as part of its Engineering Excellence Group. The investment in these stems from founder Ray O'Rourke's early commitment to innovation and a more recent recognition that disruptive technology is causing, and will continue to cause, significant disruption in construction. These labs are helping transition the business more comfortably into a digitalised future, and to enhance and differentiate its service offering now.

Technologies being explored by the Engineering Excellence Group include:

advanced applications of BIM

design and stakeholder-engagement processes using HoloLens

3D printing of building components

person recognition for site safety systems

cooperative construction robots

structure-performance sensors to support long-term maintenance

autonomous construction-site vehicles.

Laing O'Rourke has created its own method of 3D printing structures, called FreeFAB. This uses 3D printers to print moulds for concrete out of wax. It overcomes several key 3D-printing challenges, including effectively integrating reinforcing steel, avoiding layer delamination, and enabling the use of high-quality materials. FreeFAB was used on London's Crossrail project to produce hundreds of individually shaped cladding panels for underground concourses.

FreeFAB 3D printed concourse panels, Crossrail, London
Image source: Laing O'Rourke

Transformation 4: Liberated developments

Focal issues

To help prepare your strategic response to **Liberated developments**, consider how the following digitalisation-driven ESG issues may be of material consequence to your organisation and key stakeholders.

LD1 **E S**

Materials sustainability

Improved management of the life-cycle sustainability impacts of building materials.

Opportunity to reduce environmental and social impacts and differentiate properties.

The full life-cycle impacts of building materials are becoming easier to analyse and manage. Improvements in construction efficiencies and building quality, and new fabrication techniques, can lead to the extended lifespan of materials in use and reduced maintenance requirements, as well as their reuse or recycling at their end-of-life.

We might expect more stringent requirements in green-building ratings, greater market expectations of performance, and increasing regulated standards.

E-waste associated with technology needs to be carefully managed (see Focal issue OP8 on page 29), as too will the potential for 3D printing to generate excessive waste.

Q: In the projects that you deliver or procure, how could you better use emerging digital technologies to reduce the life-cycle sustainability impacts of building materials?

LD2 **S**

Stakeholder inclusion

Enhanced inclusion of stakeholders in development processes.

Opportunity to achieve better fulfilment of community or user needs, greater stakeholder ownership and better designs, and to reduce development risk.

Design teams can better collaborate around virtual models that improve their ability to visualise a design and how it might work in context.

Project partners, investors, members of the public, and future users of buildings and urban spaces can experience them virtually and offer input into the design, allowing a more people-centric design approach that can improve project outcomes.

Q: Which stakeholders associated with your projects might value a virtual experience of the project, and how might this support their engagement and achievement of project outcomes?

LD3 | E S

Architectural quality

Enhanced quality of architecture and construction.

Opportunity to create architecture that better serves its users over the longer term and is more environmentally sustainable.

Options for architectural structures, forms and detailing, and for artworks, are growing with digital technologies. Without the constraints of traditional fabrication methods and construction economics, architectural language might become more expressive, engaging people in more uplifting ways and better embodying culture.

We will have more solutions for tight or complex sites, supporting urban densification and better use of land. The quality of construction will improve through the use of techniques including prefabrication, robots on-site, and better coordination. This will increase length of use and allow better performance in areas such as the control of indoor environments and energy efficiency.

Q: In what ways are your design solutions held back by the limitations of conventional design and fabrication, and how could you use emerging design and construction technologies to assist?

LD4 | S

Site safety

Improved mitigation of injury and death risk on construction sites.

Opportunity to reduce construction-site injuries and deaths, and associated liabilities.

Safety on construction sites can be improved, including through the automation of dangerous jobs and increased on-site monitoring of people, materials and equipment. Machine learning offers predictive understanding of risks on-site; recognising something is about to go wrong before it does.

Liability may even become assigned to parties associated with an injury or death on site where the use of technology could have avoided it.

Q: How could greater monitoring of the construction sites your organisation is associated with, or automation of risky tasks, lead to reduced injuries or deaths?

New Story home printer for developing nations

Image source: New Story

Affordable building

Reduced cost of building.

Opportunity to provide more affordable accommodation to those who need it, with associated reputational benefits.

Advanced prefabrication, robotic construction, and 3D printing are creating opportunities for more affordable building, especially where on-site construction costs are high.

Opportunities for solutions in developing regions are becoming available. These are particularly beneficial where technology such as AR or VR enables better design participation from building users and communities, along with local employment opportunities in construction.

Q: How could you use digital technologies to deliver affordable housing solutions, in your country or overseas?

Reinvented streets

Transformation 5

RS

Transformation 5: Reinvented streets

Transformation of urban mobility and form

The deployment of autonomous vehicles (AVs) and diverse mobility systems, which combine a range of transport modes, will transform our cities. While the greatest effects will be felt beyond 10 years, regulation, legal frameworks and planning for this transformation are being put in place now.

Removing the ape from the driver's seat

AVs are guided by intelligent systems and require little or no human control. In the future, we may laugh at the idea that our roads were as unsafe as they are today, with vehicles driven by apes – ourselves – and not high-performance computer systems.

There are five levels of vehicle autonomy. At levels 1 and 2, a human driver monitors the driving environment, while the automated driving system does so at levels 3, 4, and 5. Vehicles with level 3 autonomous capabilities are already on the market and road, while automotive manufacturers are developing level 4 products.

AVs will enter the market in a mix of types, including:

shared vehicles

private vehicles

taxis (sometimes known as robo-taxis or taxi-bots), pooled and for private use

buses and shuttle buses

'virtual light rail' with pods platooning (driving closely together in unison)

trucks, including platooning vehicles

utility vehicles, e.g. for cleaning roads or collecting waste.

Table 4: International vehicle automation classifications.		
1.	**Driver assistance**	Driver assistance system executes steering or acceleration
2.	**Partial automation**	Driver assistance system executes both steering and acceleration
3.	**Conditional automation**	The automated driving system executes all tasks, but a human driver must be ready to respond to a request to intervene
4.	**High automation**	The automated driving system executes all tasks even if a human driver does not respond to requests to intervene
5.	**Full automation**	The automated driving system executes all tasks in all situations

Source: Society of Automotive Engineers (SAE)

These may initially be a combination of internal-combustion, hybrid, and electric vehicles (EVs), but EVs are expected to increasingly be favoured.

The pros and cons of an AV-based vehicle system

Overall, there is a strong case for adopting AVs and implementing new mobility systems. They offer a range of highly desirable benefits, including:

- Considerable reductions in road deaths and injuries, which are largely caused by human errors. There are currently around 1,200 road deaths each year in Australia[40]

- Reduced cost of mobility

- Increased mobility for the broader population, specifically for the elderly and less-mobile

- Increased access to employment centres, cheaper housing and business space

- Reduced travel times and traffic congestion, and improved productivity during travel time

- Reduced need for car parking, wide roads and future road infrastructure; particularly if the av fleet includes many shared vehicles

- Reduced noise, greenhouse gas emissions and other air pollution, particularly where EVs are used

- Improved use of public transport infrastructure, including providing a solution for the 'last kilometre' barrier to usage (getting to or from the public transport station to your destination)

- Better utilisation of vehicle assets, including reduced embodied environmental impacts

- More efficient freight logistics

- Creation of new businesses, including mobility-service platforms, data sales, in-av entertainment, and vehicle servicing.

On the flipside, if the deployment of AVs is not managed well, a range of adverse effects are possible:

- Surging private ownership, if cars become cheaper and ownership is no longer constrained by driver availability

- Increased urban sprawl as people have greater ability to move to cheaper or more appealing home or work locations

- Undermining of existing public transport

- Risk to personal privacy with private- and public-sector organisations collecting data on the movements, and by implication the activities, of people and businesses

- Public security risks if hacked, for motivations including terrorism

- Negative health effects, such as obesity and diabetes, and associated healthcare costs, if people spend more time in cars, are less active, and drink more alcohol if the need to drive home is no longer a restraint.

The case for diverse mobility systems

Diverse mobility is a high-efficiency multi-modal approach where public transport and mobility as a service (MaaS) are core features. With MaaS, users use an app to book the travel service they need for a trip and utilisation of the whole vehicle fleet and multiple modes of transport is automatically optimised, maximising service to customers.

MaaS platforms are being developed around the world. For example, Finnish company MaaS Global has been testing a subscription-based app called Whim in Helsinki, offering customers monthly packages or the ability to pay as they go. The service integrates access to local public transit, rental cars, city bikes, taxis, long-distance trains, and more.[41]

Table 5: Scenarios for different transport mode mixes

Scenario	Modal mix as a share of passenger distance travelled [%]		No. of vehicles [% change]	Accidents [% change]	Parking spaces [% change]	Emissions [% change]
1. **The premium car that drives itself**	private traditional car: private AV: traditional taxi: robo-taxi: public transport: walking and biking:	35 11 6 4 39 5	–1	–19	0	–9
2. **AVs rule the street**	private traditional car: private AV: traditional taxi: robo-taxi: public transport: walking and biking:	14 31 4 6 38 7	–8	–55	–5	–23
3. **Robo-taxis take over**	private traditional car: private AV: traditional taxi: robo-taxi: public transport: walking and biking:	5 1 0 49 36 9	–46	–86	–39	–81
4. **The ride-sharing revolution**	private traditional car: private AV: traditional taxi: robo-taxi: public transport: walking and biking:	5 1 0 53 32 9	–59	–87	–54	–85

Source: Nikolaus Laing, et al., 2016[43]

The Boston Consulting Group (BCG) and the World Economic Forum have plotted four possible scenarios for future vehicle mixes in mobility systems (see table 5) and their effects on the number of cars on the road, accidents, number of parking spaces, and emissions.[42] As the scenarios progress towards more AVs and greater sharing of vehicles, the benefits in these four areas become much greater. Australian cities might tend towards scenario 1 in the suburbs where densities are low, public transport limited and private vehicle ownership popular, while scenarios 3 and 4 may prevail in inner-city areas.

There are a number of reasons why the more beneficial scenarios might not be achieved. Fleets dominated by personal or taxi AVs may lead to increases in vehicle kilometres travelled and congestion if vehicles move frequently to optimise parking or locate themselves for pickups. People might also tolerate longer trips if they can use their travel time for work or relaxation, or send their cars on trips they otherwise wouldn't take, such as to run an errand.

A critical determinant of which path we go down will be the cost to the customer. If fleet models can offer excellent utility at lower cost, they might dominate,

and if the trend is for youth to be less inclined to hold drivers licences, this could increase demand for shared mobility. A key barrier to reducing personal car ownership is likely to be cultural attachment to the status associated with owning cars.

The transition is well underway

AV innovation is now several decades old; research units at Carnegie Mellon University tested driverless trucks (big enough to carry the large computers used for the driving system) in the 1980s. With recent advances in AI, the transition is accelerating. Many organisations are developing AVs and supporting technologies, and numerous jurisdictions are starting to develop regulatory frameworks and test vehicles in limited settings.

Most established automotive manufacturers, and new entrants to the field, are developing AVs. Daimler, Volkswagen, Toyota, Nissan, General Motors (GM), and Volvo expect to see level 4 systems and cars in 2020, while some technology companies, such as

RAC Intellibus, pilot autonomous bus in Perth, Australia

Image source: Gnangarra.wikimedia.org

By 2025 automated vehicles (AVs) will be an aspirational commodity common on Australian roads. Level 4 (hands-free driving on highways, freeways and designated arterial roads) will be entrenched. In 2035 over 80% of new vehicles sold will be AVs and around 40–50% of the Australian car fleet will be AVs if traditional car ownership continues to dominate mobility choices.[47]

Brian Haratsis, author of *Autropolis*

Waymo (Google) and Mobileye (Intel) are predicting earlier.[44] Non-traditional automotive businesses such as Google and Uber have large AV programs, with the latter looking to transition its whole operation to AVs.

Some manufacturers, like GM, are also now focusing on service models. GM president Dan Ammann told an investors' conference in San Francisco that GM has a profit margin of 7.5 per cent on car sales, but that a GM-owned fleet of AVs operating 24 hours a day, 7 days a week, would generate profit margins of up to 30 per cent.[45]

The UK has established an Intelligent Mobility Fund of £100m and Singapore has at least ten companies and research institutes testing AVs, and plans to launch driverless taxis as early as 2018.[46]

In Australia, we are seeing sporadic but progressive activity across the states and territories, with AV bus trials taking place on the Darwin waterfront, at Sydney Olympic Park, at Adelaide Airport, in South Perth, and on Melbourne's EastLink and CityLink toll roads. Australia also has a recent history of using autonomous trucks in mining.

Real estate can be put to higher and better uses

If we go down a pathway that greatly reduces private ownership of vehicles, a considerable amount of real estate could be reclaimed from car park facilities, on-street car spaces and excess vehicle lanes on roads. As an indication of the amount of space that could be involved, some US cities dedicate 20 per cent of their land to car parking, and globally there are about 1bn cars that go unused 96 per cent of the time.[48]

Brian Haratsis suggests that car parking requirements could be reduced up to 50 per cent by car- and ride-sharing, and that the amount of land used for roads could be reduced by 20–30 per cent. Roads typically represent 30 per cent of land use in metropolitan areas. He also notes that the revenue impact on car parks could be positive for 10–15 years as denser parking of AVs increases space utilisation.[49]

Streets could become quieter, safer, greener, cooler, and more attractive, and associated real estate could experience value uplift, particularly where roads and parking have previously diminished its appeal.

Diverse mobility will differentiate cities

Different cities will naturally take different paths with AV and diverse mobility adoption, which will evolve in relation to their particular context of urban environments, governance regimes, wealth distributions, social behaviours and public transport systems.

The reinvention of streets through the use of diverse mobility will transform cities, boosting their international competitiveness by improving productivity and liveability. It is foreseeable that city governments will compete to deploy high-quality solutions as they strive to improve or maintain their liveability rankings and regional competitiveness. Some may be able to reinvest capital from car parking assets into projects with civic benefits, such as improvements to infrastructure or public amenities.

Given the strong appeal of AV adoption, and its serious social, economic, and environmental implications, we could expect a quick move to develop new policy frameworks and regulation. The transition needs to be very carefully managed to capture the benefits and avoid the adverse effects listed above.

Which locations have the most to gain?

Real estate will benefit most in jurisdictions that take progressive approaches to reinventing mobility systems, and in neighbourhoods that see marked improvements in liveability, especially where vehicle space is turned into quality public space. With regards to car parking buildings, some will be better suited than others to reuse, such as those with suitable structures and floor to ceiling heights.

Retail patterns and the quality of streets will change as people move around in different ways. For example, the replacement of longer-term street parking with AV drop-offs could increase pedestrian flows and make streets more desirable.

For developers, land that is not close to public transport nodes may become more valuable when AVs enable greater accessibility, and they might reduce development costs through reducing or avoiding the provision of car parking. Some developments might provide their own shared AVs to provide exceptional accessibility, and developers and property owners might now even start considering the inclusion of drone ports on properties, for freight and eventually passengers.

AVs can allow the reduction of congestion and repurposing of considerable amounts of real estate

Transformation 5: Reinvented streets

A closer look: The challenge of implementing diverse mobility

The transition to a diverse mobility system with AVs will be highly beneficial, but not easy.

Electric vehicle infrastructure will be an important part of future mobility systems

For the shift to occur, a number of changes will be needed, including:

- Revisions to legislation and regulation, particularly around privacy and safety. In Australia, the National Transport Commission has identified over 700 provisions in transport-related acts and regulations that could be a barrier to AV take-up[50]

- Development of new standards, including for car safety, privacy and cybersecurity

- Development of new legal frameworks, including ones to determine who would be liable for incidents in the new ecosystem

- Development of service platforms for users, such as MaaS

- Revision of urban plans and upgrades to roads

- Adaptation of the vehicle-service industry and development of new insurance offerings

- Adaptation of the electricity grid to enable smart utilisation of EV batteries

- Testing and refinement of technology

- Development of new fee-charging frameworks, such as per road user

- Establishment of consumer acceptance for the transformation, including the move away from private vehicles and towards ride-sharing.

With such changes underway, we can expect the growth of a vibrant industry built around AVs, diverse mobility, and the reinvention of cities, streets and real estate.

Transformation 5: Reinvented streets

Focal issues

To help prepare your strategic response to **Reinvented streets**, consider how the following digitalisation-driven ESG issues may be of material consequence to your organisation and key stakeholders.

<table>
<tr><td>

RS1 | **E S**

Diverse mobility

Reinvented mobility systems in cities, incorporating autonomous vehicles.

Opportunity to improve mobility for city-dwellers and businesses, with numerous flow-on benefits.

Risk of poor social, environmental and economic outcomes if mobility systems are poorly developed.

Diverse mobility system with AVs and high numbers of shared vehicles and EVs can offer greatly improved safety, better access to jobs, homes and lifestyle opportunities, equality of access to mobility, reduced environmental impacts, and many other benefits.

New systems heavily based on private AVs could lead to a number of negative impacts on cities, including sprawl and congestion.

</td><td>

RS2 | **E S**

Urban uplift

Repurposed real estate currently used for automobiles.

Opportunity to reuse land for higher and better purposes, including enhancing city liveability, resilience and sustainability.

Neighbourhoods with effective diverse mobility systems may see significantly improved liveability and business productivity, along with an associated increase in value and investment attractiveness.

Cities that enjoy the benefits of diverse mobility may become more regionally competitive, while the converse may also be true.

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<tr><td>

Q: How might changes to mobility systems in locations you have a long-term commitment to affect your operations, investments, or stakeholders, for better or for worse?

</td><td>

Q: If the deployment of AVs, or changes to mobility systems, are likely to affect your organisation and key stakeholders, how might you best influence planning and policy development for sustainable outcomes?

</td></tr>
</table>

Troubled minds

Transformation 6

TM

Transformation 6: Troubled minds

Transformation of the human experience

Digitalisation can ultimately transform our whole experience of living, including having significant implications for our mental well-being.

A challenge for the human mind

It could be said that society is addicted to technology, unable to stop consuming the highly seductive digital offerings coming our way. Many of us are already aware of feeling anxious when we are without our mobile phones, a phenomenon sometimes called 'nomophobia', or no-mobile-phobia.[51] AR and VR product and content suppliers can be expected to compel people to maximise time with their products, as social media providers do today.

Mental disorders are already a major health issue, and our society is yet to come to terms with their full impact. The World Health Organization estimates that 300m people globally – 4.4 per cent of the population – live with depression, and that the number of people with mental disorders is rising. Depression is a major contributor to suicides, which number close to 800,000 per year globally.[52]

Technologies are being used to help with mental health issues – online platforms provide assistance to those in need; the Japanese Paro robot baby harp seal is used to calm and emotionally engage patients in care facilities, such as those suffering from dementia. But, taking a bigger view, humankind is embarking on a rapid and radical experiment on itself with technology. This is particularly with regards to the human mind, something we have a poor understanding of, let alone an appreciation of how it will adapt to life in a digitalised world.

"I think that, for sure, technology has addictive qualities that we have to address, and that product designers are working to make those products more addictive, and we need to rein that back as much as possible."

Marc Benioff, CEO, Salesforce – World Economic Forum, 2018[53]

Intelligent digital assistants (IDAs) are becoming commonplace in homes and appearing in workplaces

*300m people globally
live with depression.*

A process of virtual dislocation

People who spend a lot of time working in or inhabiting the virtual world might find the interface between the physical and virtual worlds psychologically complicated. This is to the point of confusing the two, and the physical world beginning to feel boring in comparison. The coming shift from using a handheld device as our technological interface, to using wearable devices such as glasses, is likely to further blur the line between the two worlds.

For some segments of society, including many elderly, the increasing need to form a relationship with technology that they don't understand well or feel comfortable with, could be very confronting. For many, an inability to effectively embrace new technology could put them at a significant disadvantage in the workforce and various social settings, and cause a lot of stress.

Just as social media and AI-like technologies are being used to propagate fake information and create confusion about what is real, our direct experience of the world could be edited to deceive or influence us – including by device and software developers, or hackers and malware distributors. It is also feasible that we ourselves could edit what we see through AR glasses to match our preferences. For example, if we don't like seeing homeless people in the street, we could have them edited out of our vision. All of this could transform the nature of our connection to cities and the people in them.

Commuters immersed in their phones
Image source: credit_e X p o s e Shutterstock.com

Forming intimate human-technology relationships

People are increasingly forming human-like relationships with technologies such as intelligent digital assistants (IDAs) like Google Assistant or Amazon's Alexa. Indeed, Alexa is often referred to as 'her', rather than 'it'.[54] This trend, especially relevant for people living alone, can be expected to grow as IDAs evolve to converse in increasingly human-like ways. IDAs can be very useful, ordering food or managing administrative tasks, but they have the potential to diminish our interpersonal skills and increase our reliance on AI and complacency around it.

We should consider how conversing extensively with IDAs or service chat-bots, or through social media, will affect the way we think. In social media and other digital environments governed by algorithms, the information we receive is often tailored to our existing views and tastes, which may narrow our understanding of the world and constrain our ability to think laterally. We may become much more susceptible to manipulation by political or corporate interests.

Overexposure to technology may inhibit or degrade our relationships with each other and our communities, which is a known contributor to mental ill-health. It could also further debase humankind's weakened relationship with nature, with a flow-on effect of reduced desire to conserve it.

Our identities exposed

Many people are becoming uneasy or anxious about who has their personal data, what it is being used for, and how they might be at risk. Online services we deem essential, such as social media and web applications, often ask us to click 'I agree' to multipage terms of service that we cannot realistically be expected to understand or even take the time to read. We have become desensitised to handing over such data, while being left with a feeling that we are assuming unwanted risk, including to our identities.

While many of us know of someone who has experienced identity theft through personal data being accessed by criminals, it still appears to be an underappreciated social issue. Victims commonly experience severe mental-health effects, given the personal importance and social and economic utility of our identities. A 2017 report from the Identity Theft Resource Center in the US found that 67 per cent of identity-theft victims experienced anxiety and 7 per cent considered suicide.[55] Given the severity of its consequences, we might expect to see greater public attention to this issue.

"We are confronted with new questions around what it means to be human, what data and information about our bodies and health can or should be shared with others, and what rights and responsibilities we have when it comes to changing the very genetic codes of future generations."

Klaus Schwab, founder and Executive Chairman, World Economic Forum[56]

Neil Harbisson, Co-founder of the Transpecies Society, at the Science Museum, London
Image source: Parentesis99 / wikimedia.org

Could our very humanity be at risk?

Thinking longer-term, how will the rapid growth in machine intelligence psychologically affect us as human beings? At a collective level, we may realise that we will soon no longer be the most intelligent 'life form' on Earth, or that AI might not be stoppable or containable. There is no way to control how every individual, organisation and national government develops AI, and we often only act to regulate activities after a serious disaster.

Our immersion in the digital world might well even change the senses that we have developed over hundreds of thousands of years as a species. These are highly tuned through evolution in the physical environment. How will they work for us in the digital world? Will some develop while others diminish?

We must maintain awareness of digitally enabled bioengineering. Data-processing power now allows us to map our own genomes for minimal cost. We can even have this done to some degree of accuracy by online services such as 23andMe and Ancestry.com, where all you need to do is mail in a saliva sample. Such technology could help avoid illness and suffering, but it may also be a path to engineering our own species.

Around the world, the transhumanism movement is exploring the enhancement of human intellectual and physical capabilities with technology. Some people are exploring what it means to be a cyborg with technological enhancements of their bodies. Neil Harbisson, an artist and activist with a colour-sensing antenna fitted to his head, is one of the most notable.

In addition, we are seeing rapid advances in the development of artificial body parts; people are already being implanted with chips and sensors; medicine is pursuing the use of nanotechnology. We are certainly heading in a direction where a major shift in the nature of humanity is possible. For some people this might represent the natural evolution of our species, while for others it might represent the greatest sustainability issue humankind has ever faced.

Transformation 6: Troubled minds

A closer look: Intelligent digital assistants

Intelligent digital assistants (IDAs), also known as personal digital assistants (PDAs), are web-connected AI-based devices and services that respond to human commands to provide information and control systems. Examples include Google Assistant, Amazon's Alexa, Microsoft's Cortana and Apple's Siri.

IDAs are expected to effectively become your cyber twin in time, your agents in the cyber world that operate on your behalf. This may present some significant risks.

"A magic explosion is just about to happen as technology becomes super-powerful and super-fast beyond imagination, rendering us godlike. Intelligent digital assistants will soon become super-intelligent, omnipresent, dirt cheap, invisible, and embedded into absolutely everything – including ourselves."

Gerd Leonhard, author of *Technology vs. Humanity*[57]

Gerd Leonhard, an author and futurist, notes that IDAs will know everything about who we are: every data point, movement, communication, relationship, interest, intention and desire, and will be connected to millions of other IDAs and devices.[58] As such centralised repositories of valuable information, IDAs will be a target for hacking, identity theft and surveillance.

IDAs may start representing you through digital channels – scheduling activities, following up on requests, and sending birthday greetings – depersonalising these sources of human interaction. Our use of them might lead to deskilling, emotional detachment and a reduction in the quantity and quality of our human-to-human relationships.

IDAs will filter your world, so that the information you receive will be determined, in some sense, by what a Google or Amazon thinks you want or should see, or what will deepen or prolong your engagement with their products and services.

Transformation 6: Troubled minds

Focal issues

To help prepare your strategic response to **Troubled minds,** consider how the following digitalisation-driven ESG issues may be of material consequence to your organisation and key stakeholders.

TM1 **S**

Digital exposure

Managed exposure of people to virtual and digitalised experiences.

Risk of mental harm to people over-exposed to digitalised environments, and possible reputational damage or litigation for those with responsibility.

Just like with the excessive use of video games, over-exposure to augmented, virtual or other digital experiences is likely to be detrimental to mental health.

Anyone requiring or encouraging others to participate in such experiences, including for work, will need to take some responsibility for their mental well-being. This may include helping to establish an overall healthy balance of physical and virtual-world experiences.

Q: How is the use of virtual or digital experiences by people you have some responsibility for evolving, at work and in their broader lives?

TM2 **S**

Grounding places

Increased provision of peaceful places that help to psychologically ground people.

Risk of reduced well-being through over-exposure to digitalised city and work environments, and associated reputational damage.

Opportunity to improve people's mindfulness, happiness and productivity, with associated reputational benefits.

As people more intensively inhabit virtual and digitalised environments, in denser and more dynamic cities, they will need more peaceful places where they can psychologically ground themselves in the physical world and clear their minds.

These can be created indoors and outdoors in many different ways: with quietness or views to the distance or sky, or through using light, art, or symbolism from spiritual traditions. The use of nature is one of the most powerful tools, given its fundamental calming effect on people.

Cities, neighbourhoods and workplaces with a good amount of 'grounding places' might support healthier populations and be more attractive to live and work in.

Q: Are sufficient grounding places readily accessible in or around the buildings you own, occupy, or operate?

Facebook advertising campaign after its 2018 'fake news' scandal

Image source: Ink Drop / Shutterstock.com

TM3 | **S G**

Factual information

Increased responsibility for the honesty and factuality of information in digital media.

Risk of disempowerment and harm to individuals and communities, and of reputational damage, litigation or prosecution.

The propagation of false, misleading or incomplete information can be damaging to personal well-being and social equality, with people becoming more likely to make poor choices for themselves, their families, and their communities. Democratic processes can also be compromised.

Social media can act as a large-scale amplifier of false or misleading information, and this is becoming more consequential in real estate and cities with the expansion of online services.

Decision-making on what is appropriate to propagate must be grounded on solid ethical principles.

Q: Where in your organisation might false or misleading information be spreading, and what ethical principles might you use to guide what to propagate?

Map of Focal issues

OP1 Environmental optimisation — E	**OP2** User experience — S	**OP3** Healthy spaces — S	**OP4** Building utilisation — E
OP5 Operational resilience — S	**OP6** Marketplace integrity — G	**OP7** Personal privacy — S	**OP8** Electronic waste — E
RL1 Workforce transitioning — S	**RL2** Community well-being — S	**RL3** Job enhancement — S	**TM1** Digital exposure — S
EB1 Full transparency — G	**EB2** Supply chain exposure — G	**EB3** Cybersecurity — S G	**TM2** Grounding places — S
LD1 Materials sustainability — E S	**LD2** Stakeholder inclusion — S	**LD3** Architectural quality — E S	**TM3** Factual information — S G
LD4 Site safety — S	**LD5** Affordable building — S	**RS1** Diverse mobility — E S	**RS2** Urban uplift — E S

The six transformations

1 **OP** Optimised performance
Transformation of the operation of buildings, cities and markets

2 **RL** Reworked labour
Transformation of the labour force

3 **EB** Exposed business
Transformation of the public exposure of organisations

4 **LD** Liberated developments
Transformation of development and construction

5 **RS** Reinvented streets
Transformation of urban mobility and form

6 **TM** Troubled minds
Transformation of the human experience

E Environmental   **S** Social   **G** Governance

Framework for action

To help organisations begin to navigate sustainable digitalisation, *Crossing the Threshold* offers a *Framework for action*. The first five actions are for all organisations and focus on building required capability, while the final three actions are for those organisations who wish to provide industry leadership.

Actions for organisational capacity

1   Build digital literacy in your organisation

Build digital literacy – understanding of digitalisation and the use of relevant technologies – across your organisation and through to the board level. This is particularly important given that many digital technologies and their power are not yet well-understood.

Play with technologies – such as those in the Menu of technologies (page 16) – and test them in your operations to get to know them well.

Examine what risks and opportunities different digital technologies might present to your organisation, key stakeholders and industry over multiple time horizons. Communicate this to your organisation in non-technical terms.

Build an organisation-wide culture of digitalisation, helping your people to understand the technologies and begin to think in new terms about aspects such as cybersecurity, innovation, and exponential or disruptive change. Check existing assumptions about the pace and nature of digitalisation.

2   Expand strategy to include digitalisation-driven ESG issues

Include digitalisation-driven ESG issues in your sustainability, corporate responsibility, responsible investment, innovation or other business strategies.

Use the *Focal issues* in this primer, and any other digitalisation-driven ESG issues you might identify, in materiality assessments. Update your assessments regularly to pick up on ongoing change.

Actively engage your key stakeholder groups on digitalisation-driven ESG issues to maintain a current understanding of their concerns and needs.

Communicate the strategy internally and externally.

Include relevant risks in your corporate risk register.

3   Develop a culture of ethical decision-making

Establish an organisation-wide culture of ethical decision-making, and be prepared to disclose your decision-making processes on complex ESG issues that affect your stakeholders. The double-edged nature of digitalisation means that we will frequently have to make difficult choices between suboptimal options. Ethics is at the heart of sustainable digitalisation.

Develop an ethical decision-making framework to provide guidance for your employees and board members.

Implement training on applying ethics to decision-making.

Consider engaging an ethicist to help lead change and provide guidance on digitalisation-driven ethical challenges that arise.

4 Maximise the trustworthiness of your organisation

Ensure your organisation is in a position of reputational strength and maintains a lot of trust capital with its stakeholders, such that they may positively work with you on technology deployment projects, or provide grace in the event of a crisis around a digitalisation-driven ESG issue. Do not assume such crises will not occur.

Ensure excellence in performance and disclosure related to sustainability.

Actively engage your stakeholders around ESG issues and excel at ethical decision-making.

Build a positive profile, including in social media and through proactive leadership with sustainable digitalisation.

Pay attention to ESG risks in your supply chain.

Take a proactive and community-focused approach to data ownership.

5 Prioritise mindfulness for yourself and your stakeholders

Give yourself and your stakeholders the space to slow down, look after their mental well-being, and to reflect on the process of digitalisation as it happens around us, so you and they can gain a clear perspective on it. Digitalisation is most likely to be out of our control and harmful if we are not mindful of how we are proceeding with it on a daily basis.

Make the mental health and well-being of your employees and key stakeholders a top priority, including taking care with the amount and nature of digital experiences you require or encourage people to participate in.

Develop internal and external 'grounding places' where people can slow down, enjoy peace, and ground themselves in the physical world. Support conducive mindfulness practices.

Disconnect from technology as often as you can; helping to maintain your sense of what the undigitalised world is like.

Actions for industry leadership

6 Champion sustainable digitalisation

Champion the responsible, ethical and sustainable use of technology in real estate, cities, and society. Stand for a reflective and considered discussion on digitalisation in business and the community.

Be a positive role model by acting responsibly, ethically and sustainably with technology in your own activities.

Empower communities and other stakeholders to participate in the discussion and to raise issues of importance to them.

Be a positive voice for sustainable digitalisation and support emerging initiatives on the issue.

7 Build shared vision of a digitalised future

Help create vision of where our industry, cities, and society want to go with digitalisation, which all stakeholders share. This will help avoid the risks involved in digitalisation, and achieve a more desirable outcome as efficiently as possible.

Consider contrasting scenarios for what a future shaped by digitalisation might look like, responding to both opportunities and risks.

Engage and educate stakeholders, and enable them to contribute to creating the scenarios and choose their preferred pathway towards sustainable digitalisation.

8 Drive smart policy that supports sustainable digitalisation

Proactively support the development of critical public and industry policies and frameworks around digitalisation in real estate and cities – for example, those related to AVs or privacy. The opportunity to best shape them for a sustainable outcome may pass quickly.

Understand what types of future policy, planning, legal, and other foundational frameworks might affect you and your stakeholders.

Monitor initiatives to develop policies and frameworks and provide input where relevant.

# A closer look: The ethical use of technology

Around the world, many initiatives run by NGOs, governments, technology companies and industry bodies are looking to advance the ethical use of technology.

In Australia, The Ethics Centre is developing a set of principles to guide this. In the UK, the House of Lords Select Committee on Artificial Intelligence has proposed the following five principles as a code for AI:

1. AI should be developed for the common good and benefit of humanity

2. AI should operate on principles of intelligibility and fairness

3. AI should not be used to diminish the data rights or privacy of individuals, families, or communities

4. All citizens have the right to be educated to enable them to flourish mentally, emotionally, and economically alongside AI

5. The autonomous power to hurt, destroy, or deceive human beings should never be vested in AI.[59]

The chair of the committee, Lord Clement-Jones, notes that "The UK has a unique opportunity to shape AI positively for the public's benefit and to lead the international community in AI's ethical development, rather than passively accept its consequences."[60]

A key challenge will be to manage accountability around the implementation of such principles. Regulations and standards will be important, but market assessment could also help, with customers giving preference to companies that demonstrate the application of ethical principles.
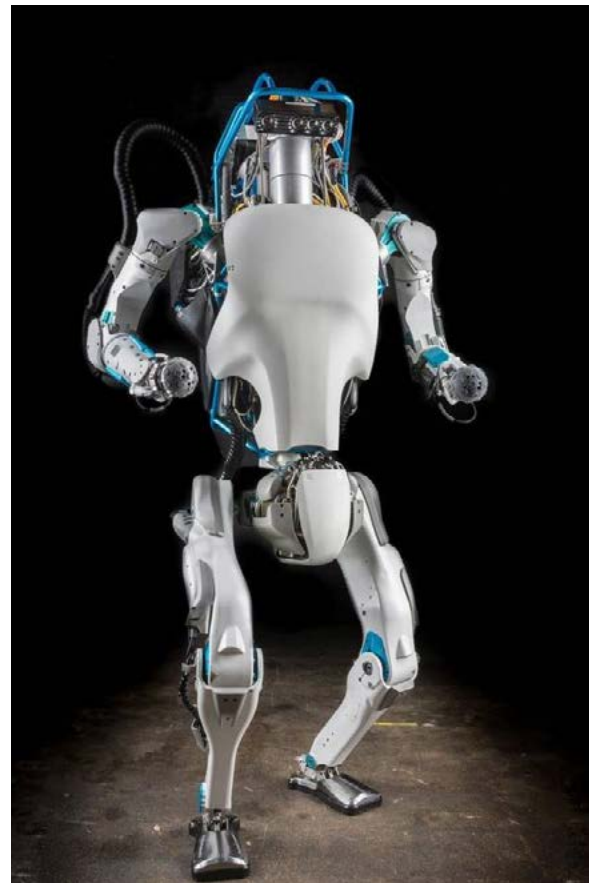
Atlas robot by Boston Dynamics, a Facebook favourite for its human-like movement

Image source: David Carrero Romero / wikimedia.org

Conclusion

Digitalisation is extremely seductive. It promises us dream lifestyles, extraordinary entertainment experiences, and lives grandly projected in the cyber world. It also offers us solutions for many sustainability challenges and the possibility of eliminating work, disease, and even death.

However, when we pause to consider the second edge of the sword, the risks it presents, we realise how dangerous it can also be. As a species always craving more, humankind can be relied on to double down on technology. These are times that demand conscious and wise stewardship as never before.

We should expect the journey towards sustainable digitalisation to be exciting and rewarding, but not easy. We should be prepared for exponential growth, rapid escalation of issues, unpredictability, and lots of debate. There will no doubt be denial and resistance from vested parties.

As a basic navigation aid, we can turn to corporate risk management practices, where risks are identified, assessed and managed, in order to underpin the positive pursuit of opportunities and sustain prosperity.

Given the seriousness of many digitalisation-driven ESG issues, the precautionary principle should be our guide when risks are difficult to assess. In the same way that each of our carbon footprints adds up to a global climate crisis, what might seem like a small and inconsequential use of technology, might be part of something ultimately very serious.

Digitalisation must be seen as a means to improve humanity and our experience of life, not as an end in itself.

The corporate sustainability movement has worked for many years to create a holistic definition of sustainability, and sustainable digitalisation must be brought into this. All key stakeholders must be engaged and taken on the journey and sustainable digitalisation should start by considering what is best for people, communities and the environment.

As stewards of the built environment, the real estate sector has a critical role to play in sustainable digitalisation – using digital technologies in a way that improves the liveability, resilience, and sustainability of our cities. In particular, we need to develop a physical environment that grounds and nurtures people as they increasingly co-exist in digital or virtual environments and in the physical world. Well-being, particularly mental health, needs to be at the very top of the list of ESG issues that we need to manage.

The real estate sector should aim to set the standard for sustainable digitalisation, building on its leading work in sustainability over the past couple of decades. Ethics must be at the very heart of our approach as we do so, and we must start with our own organisations, focusing on the sustainability of digitalisation internally at the same time as we actively engage on it externally.

Crossing the Threshold has primarily focused on the short- to medium-term ESG issues that are likely to be material to real estate stakeholders. We have barely touched on the longer-term implications of digitalisation, partly due to the high levels of uncertainty surrounding them. There are a lot of highly consequential scenarios being explored by experts around the world – from autonomous warfare to transhumanism – some of which are covered in books included in *Recommended Reading* on page 79.

This primer is just the start of a conversation on sustainable digitalisation and much additional research needs to occur, including in two key areas. Firstly, to effectively plot a sustainable course, the longer-term scenarios need careful consideration and debate. Secondly, the *Focal issues*, and other ESG issues that others might add, need further analysis such that they can be more proactively considered in decision-making.

Morphosis and RICS thank you for taking the time to consider the important issues and challenges we have put forward in this primer. We look forward to seeing what you might now do with sustainable digitalisation, and to observing leadership and wise stewardship emerge within our sector and across our cities.

We must always remember that we are from and part of nature.

Acknowledgments

Glossary

Agile working
Technology-supported way of working with high levels of flexibility and employee empowerment.

AI: artificial intelligence
Intelligence exhibited by machines, often associated with the replication of human functions such as learning or problem-solving.

ALM: additive layer manufacturing
The 3D printing of objects layer by layer.

AR: augmented reality
Data overlaid on a view of the real world through a device such as a tablet or pair of glasses.

AV: autonomous vehicle
Vehicle capable of driving without human input by sensing and analysing its environments.

AVM: automated valuation model
Algorithm used to estimate the value of an asset at a point in time.

BIM: building information modelling
3D computer model-based process for the design, construction, and operation of buildings, infrastructure and industrial products.

Blockchain
Highly secure digital ledger in which records (blocks) are secured with cryptography and distributed across networks.

Bots
Software applications designed to perform highly repetitive tasks on the internet. Also known as web robots.

Cybersecurity
Protection of computer systems, data and the services they provide from breach, theft and damage.

DDoS: distributed denial of service (attack)
Type of cyberattack designed to take computers out of service using a flood of traffic, often coming from large numbers of devices or internet protocol (IP) addresses.

Diverse mobility systems
Mobility systems comprising a diversity of modes, such as shared AVs, private AVs, taxi AVs, public transport and bicycles, offered as integrated solutions.

ESG: environment, social, and governance
Three pillar framework for responsible investment or sustainability.

Ethics
Branch of philosophy dealing with moral questions, such as what is right and wrong for people to do.

GDPR: General Data Protection Regulation
European Union (EU) regulation on data protection and privacy for people within the EU, which took effect on 25 May 2018.

GHG: greenhouse gas
Gasses that cause global warming, such as carbon dioxide and methane.

IDA: intelligent digital assistant
Devices and services driven by artificial intelligence, which respond to human commands to provide information and perform tasks online. Also known as personal digital assistants (PDAs).

IEQ: indoor environmental quality

Quality of indoor environments, based on factors such as thermal comfort, air and lighting quality, and noise levels.

Lidar: light detection and ranging

Surveying technology that uses a pulsed laser to measure the distance to an object. Used in AVs.

MaaS: mobility as a service

Mobility solutions that are procured as a service through an app platform.

Material ESG issue

An ESG issue that has consequential impact on your organisation or key stakeholders, or substantively influences their assessments or decisions.[61]

Nanotechnology

Manipulation of matter on an atomic, molecular, or supramolecular scale, such as for the creation of new materials and super-small devices.

Open data

Data that anyone can freely use and republish.

Photogrammetry

Determination of measurements from photographs, such as for creating 3D models.

Platooning

AVs travelling closely together in a convoy.

Precautionary principle

Principle of being precautionary when a risk is uncertain but highly consequential.

Regtech

Digital technologies used to meet regulatory requirements.

Taxibot

Autonomous taxi.

Transhumanism

Movement to enhance human intellect and physiology through the use of science and technology.

VR: virtual reality

Virtual-world experience that fully immerses the viewer using a device such as a headset.

Recommended reading

The following selected books and reports are recommended for those looking to learn more. A full set of references from this primer are included within the notes on page 80.

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"The genie is out of the bottle. We need to move forward on artificial intelligence development but we also need to be mindful of its very real dangers. I fear that AI may replace humans altogether. If people design computer viruses, someone will design AI that replicates itself. This will be a new form of life that will outperform humans."

Professor Stephen Hawking, theoretical physicist, cosmologist and author, November 2017[62]

"Artificial intelligence, robotics and other technological innovations must be so employed that they contribute to the service of humanity and to the protection of our common home."

Pope Francis, 2018[63]

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Morphosis is a corporate sustainability strategy practice specialising in the real estate sector in Australia and internationally. Founded by Simon Carter in 2008, Morphosis works with companies and governments to build resilience over the long-term and be a core part of the global sustainability solution.

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