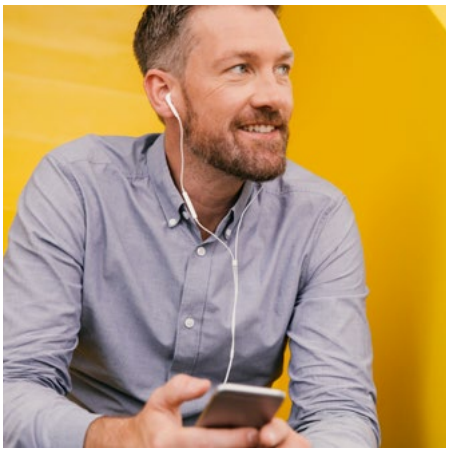
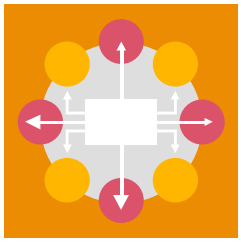
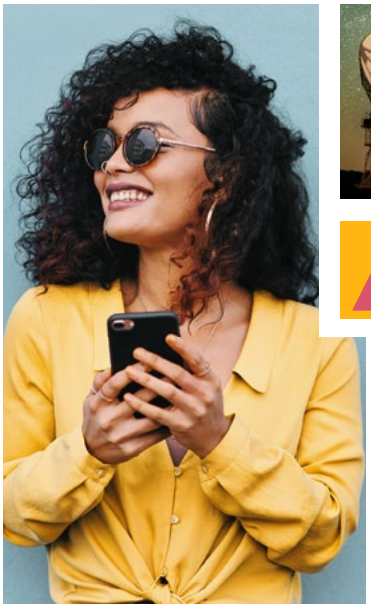
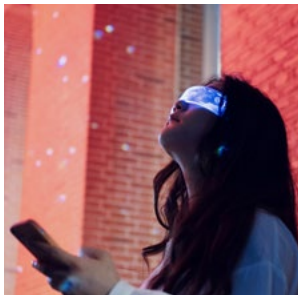
The Year of

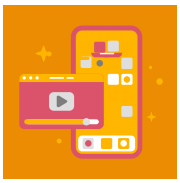
Optimism











2022 Australian Telecommunications, Media & Technology Outlook

pwc

Contents

1. Foreword

In this new report, PwC Australia looks at 2022 as the 'year of optimism' for the telecommunications, media and technology (TMT) sector.

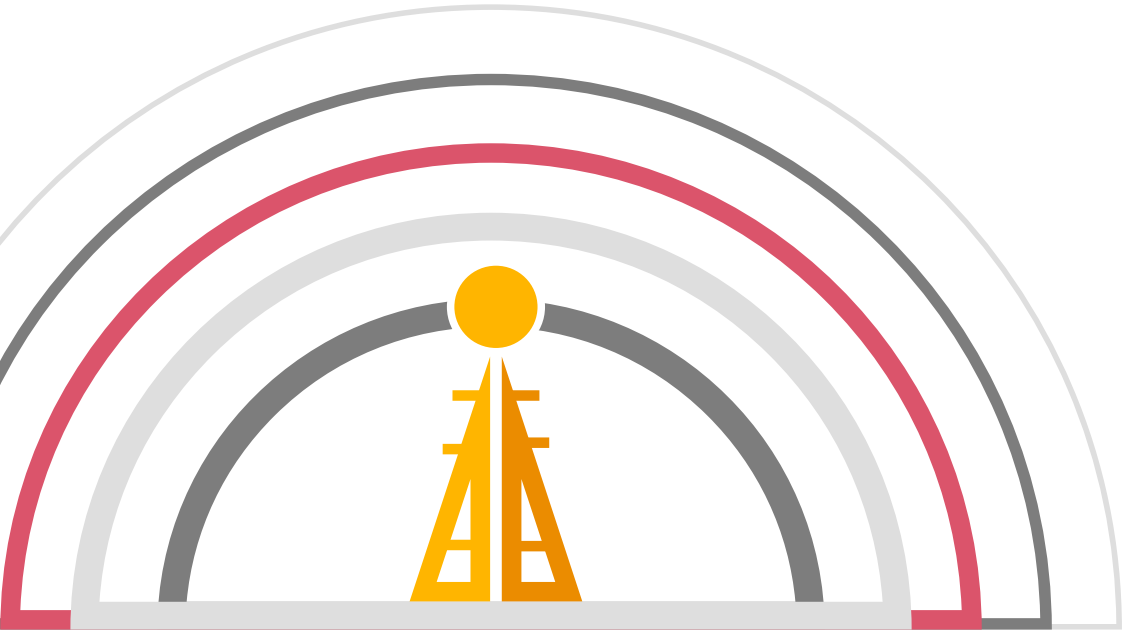
As we pass the two-year mark of the Covid-19 pandemic, the case for a prosperous digital economy only strengthens, coinciding with a global economic turn towards growth.

The opportunity this presents aligns with rapid advances in some of the core technologies that underpin Australia's digital economy. In this report, we survey the most important trends in technology, which combine to mark a new dawn for digitisation.

These economic and technological shifts are creating new market opportunities and new business model possibilities in 2022.

However, on the back of the pandemic and the United Nations Climate Change Conference (COP26), it's hard to imagine a strategy for growth that doesn't encompass a commitment to responsible business. Increasingly, customers, investors, employees and the public are challenging sector leaders to understand their social and environmental impact and recast prosperity in these terms.

The sector has never been more economically significant, and the formula for success has never been more sophisticated. Leaders will need to review the strategic landscape with fresh eyes, and advance strategies spanning market growth, business model innovation and environmental, social and governance (ESG) responsibilities.



2. Turning to growth

Rebounding global economy

As we pass the two-year mark of the pandemic, the global economy has rebounded from the depths of mid-2020. In its latest revisions, the International Monetary Fund (IMF) projected global GDP to grow 4.4 percent in 2022.[1] Although this is a downtick from 2021, after factoring in the Omicron variant, this is still formidable.

In Australia, financial vulnerability remains for some sectors and communities, but in aggregate the nation is expected to see real GDP growth of 4.1 percent in 2022.

Growth is equally expected for our region. The Asia Pacific is projected to remain the fastest-growing region in the world, led by China and India. The IMF expects 4.8 percent GDP growth for China. Furthermore, if Association of Southeast Asian Nations (ASEAN) member states realise their combined growth forecast of 5.3 percent, it will be the first time since 1990 that ASEAN's growth exceeds that of China.[2]

While the region's recovery is encouraging, it continues to be challenged with new, highly transmissible COVID-19 variants, associated supply chain disruptions and uneven vaccination rollouts. The evolving growth potential worldwide, rising uncertainties due to trade tensions and the impact of COVID-19 have made it imperative for companies in the Asia Pacific to restructure their supply chains and engage with regional networks.

According to our 25th Annual Global CEO Survey, Asia Pacific CEOs appear increasingly bullish on global and regional growth opportunities, even as they rebalance which countries to focus on. The US and China remain the top two priority regions for trade, but Australia has leapt from 8th place last year to 3rd (increasing from 10 percent to 18 percent preference). This highlights the practical benefits of intra-regional trade.[3]

1. https://www.imf.org/en/Publications/WEO/Issues/2022/01/25/world-economic-outlook-update-january-2022
2. https://www.austrade.gov.au/news/covid-19/updates/asean as at 6 December 2021
3. https://www.pwc.com/asiapacific-ceo

The accelerated digital economy

As a key determinant of the global economy in 2022, and instrumental in recoveries around the world, the digital economy has certainly taken centre stage. Worth an estimated US$11.5 trillion and almost 16 percent of global GDP, the digital economy grew 2.5 times faster than global GDP over the 15 years preceding the pandemic.[4]

For Australia, PwC economic modelling suggests digitisation could add $90 billion to the economy and create up to 250,000 new jobs by 2025. This will have a ripple effect across industries, including creating jobs in all categories, from customer service to logistics to professional services.[5] By 2030, this could equate to a $230 billion incremental contribution to GDP, encompassing a $10 billion connectivity growth opportunity for the telecommunications sector.

The digital economy enables us to:

- Restart the economy post-COVID, connecting workers and reaching customers
- Drive regional small to medium business growth, creating new services and markets
- Provide access to global customers and suppliers
- Advance smart manufacturing, infrastructure, transport and cities
- Strengthen healthcare and education, closing the gaps in distance and resourcing
- Drive clean energy innovation to powerour recovery
- Accelerate positive social and environmental impact.

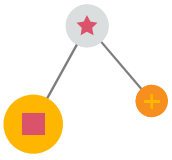
The otherwise slow-burning digital transformation of Australian businesses was certainly fired up in response to COVID-19's work from home requirements. The federal government has also embraced the Digital Economy as instrumental to Australia's economic recovery, investing in infrastructure, skills, regulations, and digital trade for a total spend of $2 billion over the 2021 and 2022 budgets. This is in addition to the $1.67 billion Cyber Security Strategy 2020, and a $4.5 billion investment in NBN upgrades.[6] More than just a reactionary measure, the government's declared ambition is to be a Top Ten Digital Economy by 2030.[7]

Telecommunications, media & technology

Steadily growing demand for connectivity and security.

Cloud and IoT hit the mainstream, catalysing growth in emerging technologies.

Fourth Industrial Revolution and digitisation find fertile soil amid the pandemic.



Interconnected businesses see converging boundaries.

High merger and acquisition (M&A) activity to consolidate new capabilities.

Digital leadership adopted as a national yardstick.

4. https://www.brookings.edu/research/trends-in-the-information-technology-sector/
5. https://exchange.telstra.com.au/unlocking-businesses-90-billion-digital-potential/
6. https://www.pm.gov.au/media/modern-digital-economy-secure-australias-future
7. https://digitaleconomy.pmc.gov.au/sites/default/files/2021-07/digital-economy-strategy.pdf

Sitting at the heart of the digital economy, TMT businesses have never been more engaged, which in turn has driven competition and disruptive innovation. Though not without challenges, the sector has witnessed positive share momentum since the pandemic, and digital adjacency revenues are expected to accelerate growth globally.

Across the sector, the pandemic has upended customer behaviour, accelerating digitisation of customer journeys, transactions and experiences. Enterprises are riding the digital wave and adapting to new media and communications.

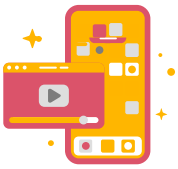
Technology infrastructure is being uplifted and expanded to support aspirations, although the pandemic has placed a practical limit on non-critical capital works, with labour and supply chain disruptions causing delays.

Unprecedented and highly contested opportunity demands truly innovative responses and the creation of visionary experiences for customers and the community. Technology is also the 'great enabler', delivering transformational benefits across industry and society.

Telco

Coming into the pandemic, the telco sector was grappling with value creation amid the decade-long threat of service commoditisation and disruption from digital natives.

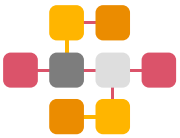
Despite the immediate shake-up, the industry displayed resilience and successfully re-allocated resources to capitalise on emerging trends and differentiated capability build-up. The last period has also seen fundamental profit pool change driven by 5G, cloud, Internet of Things (IoT), cybersecurity and artificial intelligence (AI). Asset revaluations are returning cash to the coffers of savvy telcos.



Entertainment and media

The future of the entertainment and media sector is being largely determined by COVID-19-induced digital disruption.

In 2021, this market evolution coalesced into power shifts that have rapidly reshaped the segments. For 2022, the most defining shift will be the ongoing migration of customers to digital consumption and the rise of non-fungible tokens (NFTs), bringing scarcity and uniqueness to digital goods that will drive new models of ownership, customer engagement and loyalty. Moreover, the type of content and the way it is consumed continues to evolve: from the now integral role streaming plays in TV and audio to immersion in the 'metaverse' through nascent but increasingly sophisticated consumer technology.



Technology

Tech, communications and healthcare companies were, as expected, the top performers during the pandemic.

As a horizontal sector permeating every industry, technology (including telecommunications) is Australia's third biggest by value, behind mining and financial services, contributing $167 billion to the Australian economy annually and employing over 860,000 Australians.[8] In 2022, one of the most pronounced challenges in our burgeoning tech sector is the supply of skilled workers. Australia will need 1 million people in tech jobs by 2025, requiring 286,000 people to enter the tech job market in the next four years.[9] With global tech brands increasing their presence in Australia, the competition for talent is fierce.

8. https://techcouncil.com.au/mission/
9. https://techcouncil.com.au/def/

Informed optimism

76% optimisic

Q. How do you believe global economic growth (i.e., gross domestic product) will change, if at all, over the next 12 months? Australian respondents in 2021: 70% of CEOs shared near-term optimism for improvement in global growth. 2022: 76%.

The 4,446 CEOs from 89 countries and territories who responded to our 25th Annual Global CEO Survey displayed optimism about continued economic resilience. Those same CEOs carried that same confidence for global growth into their own businesses, with 50 percent 'very confident' or 'extremely confident' in 12-month revenue growth prospects.

Optimism has been matched with a sense of the need to change. The survey found Australian CEOs intend to move from a reactive to a proactive market posture. In our global sample, the largest companies are three times more likely to have made a net-zero commitment than the average company. Locally, 62 percent of CEOs plan to change their long-term investments in sustainability and ESG initiatives. Globally, concern over the ability to attract and retain talent is strongly linked in CEOs' minds with health risks and social inequality. Locally, 100 percent of CEOs surveyed rank cybersecurity as a top threat to growth. These are just some examples of how full the CEO 'inbox' has become. We see optimism, but certainly not complacency. There is deep recognition that both the operating environment and the nature of business have fundamentally changed.

Challenges aside, the confluence of a rebounding global economy, the continued rise of digital and exciting technological developments in every corner of the sector have made 2022 the year of optimism for TMT.

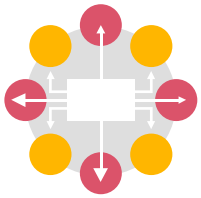
For more CEO Survey findings head here

3. The new dawn of digitisation

To form a view of the strategic landscape for opportunity in 2022, we're interested in the trends that will most materially shape the markets and business models of our sector in the next five years. Based on maturity and impact, we see six shifts shaping opportunity, and as these technologies converge, we are witnessing a new dawn of digitisation.

6 technology shifts defining opportunity in 2022

01



Data explosion

02

Cloud and edge computing

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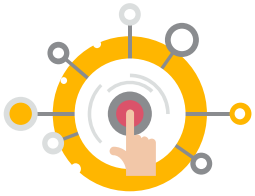
5G and IoT

04

AI, automation and robotics

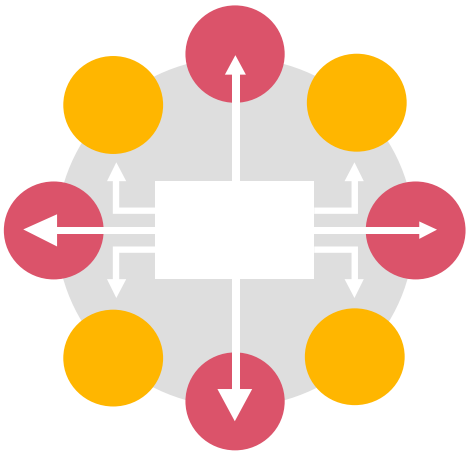
05



Identity and security

06

Emerging technologies



01

Data explosion

The pandemic yielded explosive growth in data usage and online engagement. This spike has evolved into new behavioural standards, presenting both opportunity and cost for the sector.

Globally, telcos have reported carrying up to 60 percent more data on their networks than before the pandemic.[10] This is a boon for hyperscale data centres, and an ongoing dilemma for network operators as data is increasingly commoditised.

High online engagement is also enriching datasets, creating new value for businesses through analytics including AI. As our devices, our interactions and our lives enter the great global dataset, various players are seizing the opportunity to deliver inspiring, intelligent solutions. However, the opportunity is tempered by growing risks to privacy and security, and legitimate concerns about discrimination through algorithmic bias. Both realities present an opportunity for our sector.

For enterprise leaders, data explosion presents a question of how to effectively manage and use a deluge of potentially valuable but unstructured information. IDC predicts that by 2025, 80 percent of global data will be unstructured – that is, not arranged into a defined schema for searching and analysis.[12] This means that businesses will increasingly rely on advanced analytical approaches, including AI and machine learning, to untap the value of new datasets.

In 2022, explosive growth in data will be a constant. Global data creation and replication is expected to maintain a 23 percent compound annual growth rate, with the world's data set leaping from 64.2 zettabytes in 2020 to 181 zettabytes in 2025.[13]

Percentage increase from 2019 to 2020[11]

Connectivity and traffic	% ↗
Online traffic	25%
Data consumption	34%
Smartphone video	39%
Page views	29%
Online engagement	**% ↗**
Global retail e-commerce sales	28%
Online transactions	43%
Conversion rate	15%
Connected TV video ad impressions	69%
Tiktok downloads	19%
Zoom, MS Teams and Google Meet users	~ 2000%

10. https://www.oecd.org/coronavirus/policy-responses/keeping-the-internet-up-and-running-in-times-of-crisis-4017c4c9/
11. PWC Global Media Outlook, Reuters, Nokia, Statista, OECD, Strategy& analysis (rounded).
12. https://www.idc.com/getdoc.jsp?containerId=US47509621
13. https://www.statista.com/statistics/871513/worldwide-data-created/

02

Cloud and edge computing

Cloud technologies are a critical enabler of digital transformation.

We've seen an increase in hybrid and multi-cloud deployments in large enterprises, with workloads for security and regulation remaining on premises. Ninety-three percent of enterprises have a multi-cloud strategy and employ 4.4 clouds per enterprise on average – 2.2 public and 2.2 private.[14]

However, recognising hybrid cloud as more of an emergent than a planned phenomenon, many leaders are deciding to take stock of their assets. In 2022, it is estimated that 40 percent of publicly listed organisations in Australia and New Zealand will reset their cloud selection processes to focus on business outcomes, and 45 percent of large enterprises' IT budgets will be redistributed due to adoption of integrated as-a-service bundles in the areas of security, cloud platforms, virtual workspace and connectivity.[15] This is a large-scale market switching opportunity.

And with global spending on managed cloud services set to reach US$75 billion in 2022, hyperscalers are increasingly relying on service providers to plan, build and run services, which underscores the important role of partnerships.[16]

Edge computing steps forward

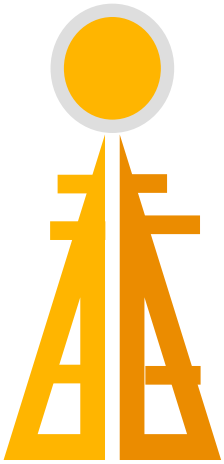
While cloud computing has myriad benefits, it isn't the solution to every challenge. The cost of bandwidth to transport data between a business and its data centre(s) can add up.

Edge computing lowers this cost while capitalising on the explosive growth of IoT and high-speed transmission with 5G. Edge computing brings computation and data storage closer to devices at the edge of the network, reducing latency and bandwidth requirements, and enabling a raft of new use cases. Operators such as Vodafone UK are building edge capabilities to allow clients to discover these low-latency applications.

Today, edge computing is already being used for processing in areas with low or no internet connectivity, such as farms and mining operations. Increasingly, however, edge will be used for its low-latency benefits and will grow rapidly in contexts such as predictive network maintenance, smart grids, hospital and home patient monitoring, cloud gaming, and interactive and augmented content delivery.

101: Edge computing and the future of cloud

14. https://www.statista.com/statistics/871513/worldwide-data-created/
15. IDC FutureScape Worldwide IT Industry 2022 Predictions – Australia and New Zealand Implications
16. Source: Strategy& analysis; "Perspectives on Cloud Trends and Growth Opportunities" PwC, 2017, IDC FutureScape: Worldwide Cloud 2019 Predictions



03

5G and IoT

5G is now a reality. In the middle of last year, Australia passed the tipping point of having more than 50 percent 5G-enabled mobile devices in the market. Lightning fast network connections are rolling into cities, and the new technology's impact is likely to be pervasive within five years.

Exponentially improving on 4G, 5G is 100 times faster and delivers 1,000 times more capacity. 5G creates game-changing improvements along three vectors:

Capacity	Connection	Speed
Enhanced mobile broadband and increased capacity – 1,000 times more than 4G	Machine communication, supporting up to 1 million connected devices per square kilometre – unlocking the promise and potential of IoT)	Ultra-reliable low-latency communication (URLLC), with latency of 1 millisecond (ms) compared with 50–100 ms for long-term evolution (LTE) – making 5G a trusted platform for time-critical actions, from autonomous vehicle steering to precision healthcare and financial market decision making

Consumers will enjoy great connection, bandwidth and security – all important factors for using online services, enjoying immersive content and accessing remote working flexibility.

For business, 5G is about much more than mobile speeds. New levels of connection will amplify the insight leaders receive from connected technologies. Alongside 5G, IoT is poised to be one of the biggest contributors of economic value in our digital economy, supporting the collection of rich data from billions of connected sensors and devices.

Together, these technologies enable a vast array of new experiences, with positive social implications. We will see supercharged healthcare, smart utilities, connected industrial manufacturing and enhanced consumer applications.

5G creates the potential for entirely new service offerings, use cases, business models and revenue opportunities. We estimate 5G technology will impact the local economy by a cumulative A$230 billion over the next decade. In 2022, the question isn't if to play, but how.

How to supercharge your business with 5G

04

AI and automation

In 2022, AI has well and truly left the laboratory and is emerging as a mission-critical capability.

The field has advanced rapidly, in step with its enabling and related tech trends, including exponentially growing computing power, cloud adoption, IoT and sensor proliferation, and most importantly, a continually expanding global dataset.

While the fringes and future of this field may be hard to define, all the major cloud vendors now support native AI environments, providing tools, libraries and frameworks for powerful real-world applications and improved scalability and governance.

Through a growing market of highly intuitive tools, leveraging increasingly rich public and private data, AI is performing tasks that would previously have required human cognition. This includes augmenting human decisions on everything from capital project oversight to customer retention and go-to-market strategies for new products. AI is also embedded in devices ranging from desktop speakers to autonomous vehicles, and is finding a role in business and industrial processes.

Telcos are adopting AI for automation of operations and customer experience functions

Energy savings

Automation of mobile networks to reduce OPEX (e.g. turn off cells)

5G planning

Use of machine learning to predict mobile data growth and prioritise rollout locations

Targeted promotions

Identification of cross-selling opportunities and next best action

Predictive alarm handling

Use of predictive AI to plan and resolve network faults

Customer care management

Implementation of AI-powered, conversational chatbots, and intelligent process automation

Personalised experience and loyalty

Automated and personalised messaging to customer

Capacity management

Automation to stall network investments and reduce manual workloads

Customer care resourcing

Use of predictive AI to assess touchpoint volumes for work delegation and resourcing

Multi-vendor configuration

Automation of complex multi-vendor networks

Global AI study results

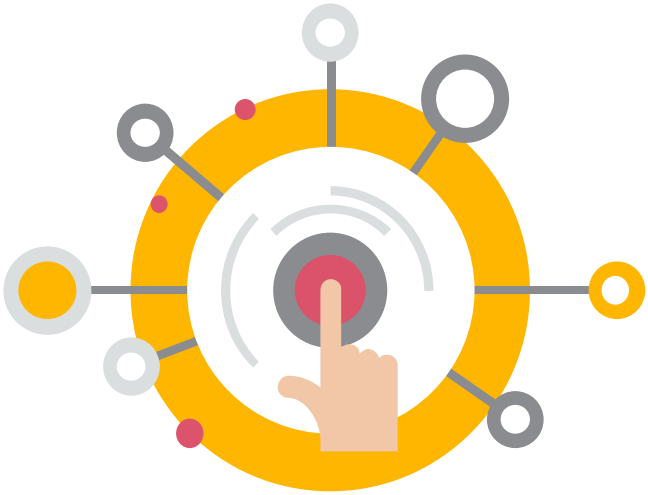
Entrusting important social and economic functions to intelligent, autonomous artificial agents naturally raises new and complex challenges about how to ethically apply and manage AI. As such, Responsible AI has become a major priority for technology leaders in 2022. This involves seeking to improve privacy, explainability, fairness, bias detection, algorithmic accountability and governance related to the use of AI.

In 2022, every large business is partly a technology business. And every technology business will need to come to terms with the vast opportunities, risks and social ramifications of AI.

Responsible AI

When you use AI to support business-critical decisions based on sensitive data, you need to be sure you understand what AI is doing, and why. Is it making accurate, bias-aware decisions? Is it violating anyone's privacy? Can you govern and monitor this powerful technology? Globally, organisations recognise the need for Responsible AI but are at different stages of the journey.

Creating AI you can trust



05

Identity and security

Technology vulnerabilities continue to proliferate along with data and digital touchpoints, fuelling a demand for cybersecurity.

According to our Global CEO Survey, CEOs in Australia register cyber risks as their most serious concern (71 percent). And globally, more than 60 percent of organisations expect a surge in reportable incidents in 2022.[17]

In the constantly evolving landscape of cybersecurity and digital trust, digital identity is a lightning rod. It continues to serve as the primary instrument for accessing government services, as well as many other online services related to retailing, banking, the workplace, education and health. Customer digital identities now absorb social attributes, security credentials, interests, preferences, relationships and even feelings. Users are creating and sharing more information than ever, but are also more aware of its value. As cyberattacks become more frequent and conspicuous, dependable management of digital identities is a table-stakes expectation. It is where technology intersects with the very human value of trust.

Globally, digital identity is in a state of flux, adjusting to rapidly evolving social expectations and regulatory mandates. In 2017, the Australian Government introduced the Consumer Data Right (CDR). Intended to give consumers greater access to and control over their data and improve the ability to compare and switch between products and services, CDR will move from its starting point of banking and into energy and telecommunications in 2022.

It will pay dividends to take a strategic approach to data management, identity and cybersecurity.

Blockchain

Featured in our emerging tech 'Essential Eight', blockchain could play a defining role in building trust. PwC's Time for trust report states blockchain has the potential to add US$1.76 trillion to global domestic product over the next decade, making processes faster and creating greater trust, transparency and security around the transactions it underlies.

How blockchain will transform business and the economy

According to IDC, by 2025 the valuations of public enterprises in Australia and New Zealand will be based as much on confidence in data controls as in financial controls.[18]

PwC's 2022 Global Digital Trust Insights Survey offers the C-suite a guide to simplifying cyber with intention. It focuses on four questions that tend to get short shrift but, if properly considered, can yield significant dividends.

2022 Global Digital Trust Insights Survey

17. https://www.pwc.com/asiapacific-ceo
18. IDC FutureScape Worldwide IT Industry 2022 Predictions — Australia and New Zealand Implications

Emerging technologies: The Essential Eight

Following CEO Mark Zuckerberg's consolidation of Facebook apps and technologies under a new brand, Meta, hype around the metaverse has reached fever pitch, garnering the attention of tech companies, business leaders and the public. While it's uncertain how exactly the metaverse will evolve, it ultimately represents convergence of the emerging technology developments we have been tracking for the past decade.

Our work in this area started with analysis of more than 250 emerging technologies to pinpoint those that would have the greatest business impact across industries. We called those with the most potential the Essential Eight (see graphic in the following page).

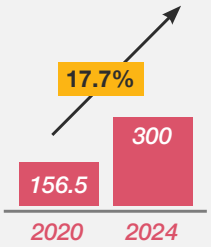
These emerging technologies continue to evolve and make their mark, with the pandemic only accelerating adoption. Some, like AI, are becoming integral to every type of business. Others, such as 3D printing, have been more concentrated in certain areas like manufacturing.

Today, one of the most notable dynamics of the Essential Eight is the extent to which they have concurrently reached critical mass. In 2020, these technologies constituted a US$1 trillion market opportunity that is set to double by 2024. A review of their respective compound annual growth rates shows these technologies are not to be ignored.

Emerging technologies: The Essential Eight

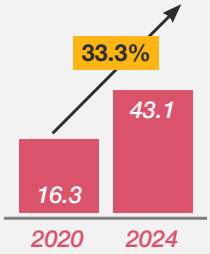
Artificial Intelligence

- Chatbots to enhance service
- Personalisation, facial recognition
- Fraud prevention, spam filtering
- Smart content, personalised learning
- Autonomous vehicles
- Manufacturing
- Automation of repetitive tasks
- Business analytics



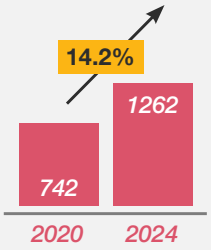
Drones

- Delivery of mail and retail goods
- Aerial surveillance of vast areas (e.g. agriculture) or hard-to-reach/dangerous locations (e.g. mines)
- Inspection of right-of-way, transmission and distribution lines



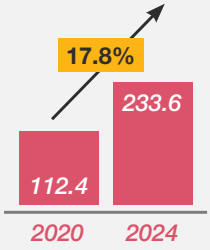
Internet of Things (IOT)

- Manufacturing operations
- Production asset management
- Electricity smart grid
- Remote health monitoring
- Smart homes
- Public safety and emergency response



Robots

- Collaborative robotics supporting manufacturing and assembly
- Companion and service
- Assisting surgeries with extreme precision
- Material removal, waste management
- Defence and smart city applications

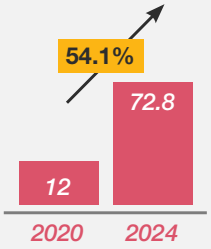


Augmented Reality

- AR-enabled smart glasses can help warehouse workers fulfill orders with precision, airline manufacturers assemble planes and electrical workers make repairs

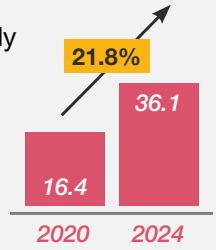
Virtual Reality

- The gaming and entertainment industries are obvious proving grounds for VR
- Remotely try on items of retail clothing
- Streaming live events through an immersive experience
- Access to doctors through virtual visits and other telemedicine applications



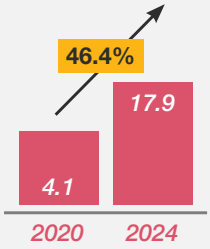
3D Printing

- Create complex automotive geometry parts not possible with traditional manufacturing
- Produce detailed models directly from 3D CAD1, BIM2 or other digital data
- Medical use, e.g. metal casting of dental crowns
- Affordable housing techniques



Blockchain

- Digital ledgers of shipments, goods tracking, integrity of logistical transactions
- Secure personal information
- Collect and sort votes, public administration
- Insurance and lending mechanisms
- Financial exchanges, transferring money through distributed ledgers



Key 5-year CAGR

All in Bn USD Source: IDC, Strategy& analysis

The Essential Eight technologies

Demystifying the metaverse

The practical and profound impact of convergence

While promising technologies like quantum computing might rewrite the digital economy rule book, we see the most practical and profound impact in the next five years continuing to come from today's essential technologies.

Convergence reconfigures these essential technologies into powerful combinations that significantly expand our capacity to work smarter and more seamlessly. Combining building-block technologies is a practical exercise with profound consequences. Convergence is responsible for what can be called the new dawn of digitisation.

Here are six defining examples of technological convergence that illustrate the trend.[19]

1. Automated trust

Why it matters

Trust is at the heart of all relationships. If employees, customers, investors and communities can't trust the safety, security and privacy of operations, your business will suffer and you may be subject to legal and regulatory actions.

To automate trust, Essential Eight technologies – especially blockchain, IoT and AI – can work together to establish the authenticity of data, verify identities and enable secure multiparty transactions. Converged technologies provide ways to automate trust in physical, digital and human assets.

For example, IoT sensors can track a pallet of food from the time it leaves the farm to when it gets to the warehouse and then the retail store, verifying the entire supply chain. This authenticates where a specific shipment is along the route and the condition of the food during each leg of the journey; for example, by monitoring whether the shipping container is becoming too hot, too cold or too humid. This information is recorded in a secure blockchain.

Together, IoT and blockchain create an immutable supply chain, ensuring buyers are getting an authentic product that has not been damaged or switched along the way. These technologies can also verify a product's carbon profile, its possession of hazardous materials and whether it has been disposed of correctly and safely.

2. Extended reality

Why it matters

XR technologies could deliver a US$1.5 trillion boost to the global economy by 2030. The value will emerge in creating new customer experiences, speeding up product development and improving workplace safety.

Augmented reality (AR), virtual reality (VR) and mixed reality (MR) are a continuum of immersive technologies housed under the umbrella term extended reality (XR), which merges the physical and virtual worlds.

XR has major applications in the entertainment space, as well as in our everyday lives where – like our mobile phones – XR devices continuously provide information about the world around us.

In the business realm, AR and MR are being used as job aids and for training, while VR simulates environments for users to practice soft skills and job techniques. XR helps workers to practice risky tasks in a safe but realistic way. Examples include training pilots; educating oil rig workers on complicated safety procedures; teaching insurance adjusters to identify water, smoke and fire damage; and upskilling doctors to perform surgeries.

Our 'Seeing is believing' **report** explores how XR might benefit industries like manufacturing, healthcare, energy, retail and education here.

19. https://www.pwc.com/us/en/tech-effect/emerging-tech/essential-eight-technologies.html

3. Immersive interfaces

Why it matters

For people to work more effectively and creatively, they must be able to interact with technology in a natural, fluid way. Immersive interfaces help achieve this.

Immersive interfaces are the next frontier after voice interfaces. Now that we can talk to our tech, the next step is using our senses to interact.

Immersive interfaces enable more natural, frictionless communications between people, humans, computers and digital environments. These technologies take advantage of human dynamics such as touch and emotion to bring users closer to the digital world, humanising interactions with technology.

Capable of gathering and processing massive amounts of data locally with onboard AI, immersive interfaces can respond to body movement, brain waves and inferred emotion – in addition to traditional interfaces such as voice and text. By pairing this information with contextual data about users and situations, immersive interfaces offer insights and augment workflows, allowing users to intuitively interact with the physical–digital world.

Touch interfaces, known as haptics, are already being applied in healthcare, engineering, automotive and other industries to help users interact with digital interfaces through gesture controls.

4. Working autonomy

Why it matters

By automating workflows and providing access to previously inaccessible insights to support decision making, working autonomy helps companies help their people to improve productivity.

Automation involves transitioning manual processes into digital ones, converging AI, IoT, robotics and drones. Working autonomy is the point on the continuum where automation has transitioned from point solutions to broad and dynamic workflows. Intelligent automation gives systems the ability to learn from prior decisions and make intelligent decisions on their own, freeing people to focus on other important work.

Working autonomy is enabling the automation of everything from backend data processing to ridesharing and factory production. Autonomous systems gather large amounts of previously inaccessible data from IoT sensors, transaction histories, machine data, human input and many other sources for analytics and feedback. This can result in more intelligent operations and better predictive maintenance.

5. Digital reflection

Why it matters

Digital replicas of real-world systems, processes and places are a space for safe testing. In a digital reflection, you can model different scenarios and explore different outcomes without the associated risk or cost.

Digital Reflection is a general term for the virtual recreation and simulation of complex, interdependent physical processes and interactions, thanks to advances in AI and IoT.

These reflections can evolve without human intervention to uncover new insights. Virtual replicas of physical objects – products, processes, places and even human societies – can be experienced or experimented on in simulations to gain a deeper understanding of their environment and life-cycle.

Digital twins are a prime example. These can capture a virtual model of an organisation, identifying elements that are hindering or enabling strategy and making specific recommendations based on embedded pattern recognition.

Using a virtual replica of a physical object, actions can be tested against real-time scenarios to predict an immediate outcome or inform decisions. Businesses could use this tech to develop a virtual automobile, perform contact scenario optimisation, understand product fault risks, optimise a factory or even plan for a city's resilience during a crisis.

6. Hyperconnected networks

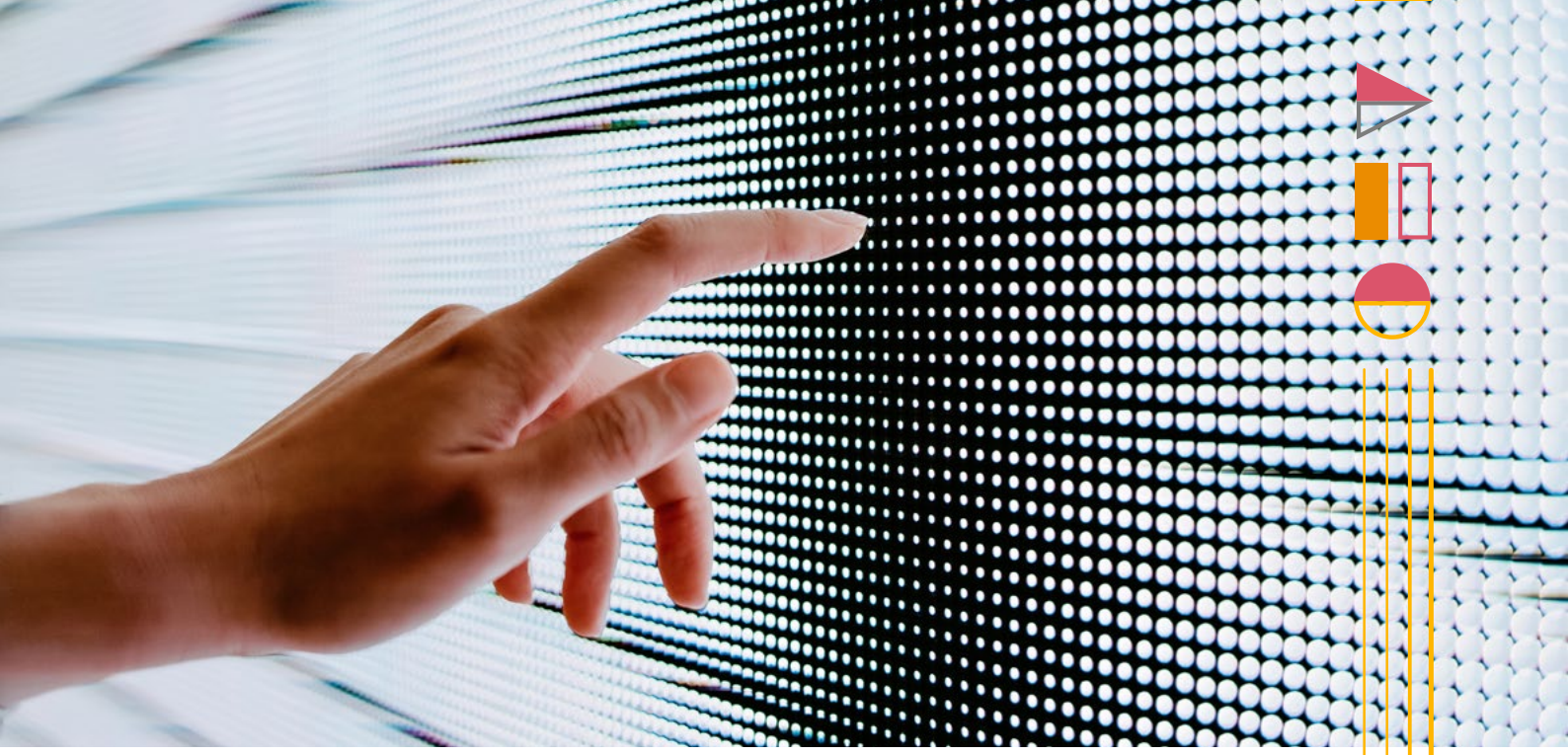
Why it matters

As the volume of data continues to grow, it becomes increasingly important to gather, distribute and house data in an accessible way. Hyperconnected networks can handle data from diverse sources efficiently and securely on a massive scale. Hyperconnected networks will ultimately create a world blanketed in connectivity and free from 'dead spots'. Hyperconnected network design could also be an avenue for the strategic decarbonisation of network infrastructure.

Hyperconnected networks rely on an infrastructure of networks and IoT to process information at blistering speeds to intelligently connect people, devices and systems. These technologies are pushing connectivity further and processing faster than ever before, enabling seamless interactions between humans and autonomous systems.

Billions of IoT-connected endpoints, combined with the cloud, 5G and mesh networking, can create stable, high-speed, low-latency networks that serve as the backbones of larger-scale infrastructure for ubiquitous connectivity.

Localised IoT device-to-device communication can produce AI-driven insights and responses without involving an exchange with the cloud. When processing time is not critical, data will be sent to the network through 5G, satellites, low-power wide area network (LPWAN) and other communications standards.



An eye to the future

In the technology sector, it pays to have a watching brief. Here are some of the many trends on our radar at PwC, chosen for their medium-term impact potential.

Quantum computing

Quantum computing represents a departure from the entire history of classical computing, moving from binary bits (0s and 1s) to the mysterious quantum bit or qubit, which operates according to the laws of quantum mechanics.

Through 'entanglement' with other qubits, computing power grows exponentially, such that a 30-qubit quantum computer would equal the processing power of a conventional computer running 10 trillion floating-point operations per second. To put that in perspective, it's been postulated that it would take an approximately 400-qubit quantum computer to beat any existing supercomputer. Yet this seems likely to happen soon: Australian researchers at the University of NSW have already proved that near error-free quantum computing is possible and IBM has promised to deliver a 1,000-qubit quantum computer by 2023.

Quantum computing is likely to revolutionise drug research, new energy generation, materials design, financial modelling and AI. It also appears likely to render today's public-key encryptions vulnerable, rewriting the rules of cybersecurity.

New Energy

The future of energy interests us for many reasons. First, energy is inextricably linked with technological innovation. Second, our industry has its own carbon footprint and energy costs to manage. Third, customers are looking for responsible products designed to capitalise on energy innovation. Fourth, advances in battery and storage technologies will change the face of communications network infrastructure and IoT devices.

Global energy trends such as diversification of energy sources and asset classes, government incentives for clean energy research and development (R&D), and perhaps most significantly, the decreasing cost of renewable energy sources (particularly solar and wind), have seen a rapid deployment of renewable generating capacity throughout the world.

Australia's renewable energy market has now largely overcome its political risk issues and is once again attracting massive interest from developers, contractors, manufacturers, and local and international investors. Accounting for about 4 percent of Australian electricity demand, the TMT sector has many parts to play in the energy revolution.

The future of energy

6G

Although 5G is clearly today's focus, each new generation technology standard for broadband cellular networks has brought transformational change to our sector. 6G is at an early stage of development, but likely to explore greater support for edge computing, AI, blockchain, security, privacy, and of course, increased capacity and speed. Watch this space.

4. Evolving market opportunities

Customer expectations and the future of service

When we polled consumers in June 2021 for PwC's Global Consumer Insights Pulse Survey, we found that the pandemic had spurred many respondents to become more digital, more local and more conscious of health and safety. Connectivity was recognised as the lifeline it has long been, and customers sought greater value and performance from service providers.

Fast forward to our December 2021 Global Consumer Insights Survey and what changed? With 76 percent of respondents reporting being at least partially vaccinated, consumers are planning to spend more, with many seeing improvements in their lifestyle prospects as employers support new ways of working.

Of course, some things never change; when it comes to shopping, price and convenience still matter most, even as other factors, such as sustainability, are increasingly on consumers' minds. A good customer experience leaves people feeling heard and appreciated. It minimises friction, maximises efficiency and maintains a human element.

In 2022, it is clear customers are expanding their digital horizons and, as they explore, their expectations will grow with them. For brands, this means delivering a superior customer experience across the entire length of customer journeys.

Global consumer insights

Some important glimpses into customer behaviours and expectations in 2022 include:

41%

said they shopped daily or weekly via mobile or smartphone, compared with 39 percent six months earlier and 12 percent five years earlier.

59%

said they had become more protective of their personal data over the preceding six months.

52%

said they were more eco-friendly than they were six months earlier. This statistic had ticked up by 2 percentage points since our June 2021 Pulse survey.

Almost 70%

were prioritising getting the best deal when shopping either in-store or online.

Source: PwC December 2021 Global Consumer Insights Pulse Survey

Small business digital maturity

Before the pandemic, the Australian Government's Small Business Digital Taskforce report (published in 2018) showed SMEs struggling to understand how digital technology could increase efficiency in their business. Low digital engagement saw only 40 percent using cloud services and less than half having a web presence. By 2020, almost 90 percent of SMEs had engaged with new technologies to adapt. In one year, we saw more web growth for SMEs than in the last decade.[20]

In 2022, SMEs will rise further through the ranks of digital maturity, looking to take advantage of the cloud to scale their business with reduced cost and increased security. To retain staff, business leaders have learned to provide the same sort of flexibility found in Australia's largest workplaces, and technology-led business model innovation has been a vibrant feature of our economy.

The federal Budget has underwritten a business-led economic recovery, positioning business at the centre of Australia's return to growth.

For more on 2021-2022 Federal Budget insights, head here: **Federal Budget analysis**

Industry innovation

Digital transformation is picking up across the industry, driven by 5G and IoT use cases.

By 2030, 5G technology is predicted to add as much as US$1.3 trillion to global GDP. More than 10 percent of this figure is projected to lie in healthcare applications (US$530 billion), smart utilities management (US$330 billion) and consumer and media applications (US$254 billion).[21]

IoT spend is expected to grow significantly over coming years, with a third of IoT expenditure manifesting in five industry groups: manufacturing and production, electricity and smart grids, remote health, the smart home, and public safety and emergency response.[22]

In 2022, smart TMT players will frame 5G and IoT as prime industry opportunities.

How 5G and IoT will impact Australian industry

20. https://digitaleconomy.pmc.gov.au/strategy/priorities/digital-smes
21. https://www.pwc.com.au/digitalpulse/5g-economic-impact.html
22. IDC IOT Trends 2019, Strategy& Analysis

Media power shifts

PwC Australia's Entertainment & Media Outlook report 2021–2025 has focused on the power shifts taking place as the industry rebounds from 2020 and consumer habits propelled by the pandemic continue to transform sectors and business models.

We see five major shifts impacting the sector, albeit to varying degrees, depending on the consumer interaction and revenue model. While these shifts are having a profound impact, they should not be interpreted as undermining the stability or resilience of the market overall. The contraction of 2020 is giving way to a solid rebound this year, and a return to 2019 revenue levels within the next three years for most parts of the industry.

As we move through the decade ahead, how people consume media and entertainment content will continue to evolve. This will range from consumers owning digital artifacts as NFTs to increasingly sophisticated user-generated content across video, audio and gaming. We can also expect to see the crossover of real-world and digital interactions as the metaverse continues to develop, driven by consumer-facing technology.

In 2022, these power shifts are already in motion and have been accelerated by the pandemic. There is a macro shift in consumption occurring, powered by sustained digital disruption. The first and most powerful change is the macro shift in consumption, powered by sustained digital disruption.

This change is, in turn, driving:

- Control shifts where power moves to the consumer
- Creative shifts that move power to creators and originators
- Location shifts where consumers have high 'anywhere, anytime' consumption needs
- Regulatory shifts where the focus on market power and privacy intensifies

Entertainment & Media Outlook report 2021–2025

Gen Z igniting the roaring tech twenties

In 2002, just over 10 percent of the world was connected to the internet.[23] Today, that number is more than 60 percent, or 4.95 billion people.

The number of social media users has increased by 10 percent over the past 12 months. Over 90 percent of users already use social media every month, with seven platforms now supporting more than 1 billion active users.[24] The pandemic has led to billions of people quickly adopting mobile cloud applications to work, play, learn and shop, setting the stage for innovation at a speed the world has never seen.

What does it mean for business when there's a marketplace of 4.95 billion daily users? It means the 'roaring tech twenties' are here!

While Gen Z may be tech opportunity instigators, the extraordinary events of the pandemic have seen the rest of society following fast. The result will be an increasingly digitised global economy, with the potential for tremendous innovation and growth.

Living in a world of unicorns

"Gen Z and millennials will still live online more than their parents and grandparents. Many times, this is the segment creating the new markets and opportunities fuelling the digital economy. Increasingly the tech world is going to cater to their needs and preferences. For example, demand for the products and services of edtech, gaming, and streaming unicorns has skyrocketed, as have their valuations. Thirty-three entertainment and media companies have achieved unicorn status since 2020"

Vicki Huff Eckert
Global New Ventures & Innovation,
TMT Vice Chair, US.

23. "Individuals Using the Internet", World Bank, accessed February 2022 https://data.worldbank.org/indicator/IT.NET.USER.ZS
24. https://ourworldindata.org/internet

Finding value in towers and fibre

Across many industries, and most notably those with property-centric business models like energy and healthcare, the principle of divesting 'heavy' assets and entrusting them to specialised owners has become a point of dogma.

Companies that decouple infrastructure from their core service business effectively are rewarded by the market. As standalone businesses, infrastructure assets are free to attract a much more favourable market multiple, while service entities are liberated to have a more singular focus of delivering for customers. This divestment trend has been bolstered by the success of real estate investment trusts (REITs), the best-performing ASX sector in 2021, with returns exceeding 27 percent.[25] For telcos and technology operators with asset-intensive backbones, this has meant critical consideration of assets like towers and fibre.

US and then European telcos have divested data centres, mobile virtual network operators have leaned on incumbent service providers, and tower sale-and-leaseback models have proven shrewd. Whereas once the tower environment was relatively passive, the dynamics of 5G rollouts and constant technological evolution have meant towers now warrant more commercial steering. In addition to their critical role in 5G, towers could even form the centrepiece of bold edge computing and IoT strategies. As TMT players contemplate their infrastructure positions, it will be important to have a clear conception of what assets are core to differentiation, and where latent value can be released.

The fibre-optic cable market has meandered over the years in a dance with the funding and rollout of Australia's NBN. But on first principles, fibre remains critical to an exponential data ecosystem. Macro trends in IoT, internet usage and our world-leading smartphone penetration underpin the longevity of towers and fibre, making them great strategic levers for growth – whether owned or divested.

Hyperscaling networks and global infrastructure

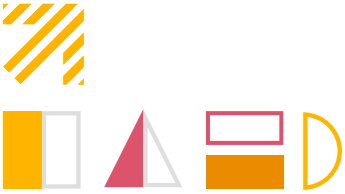
In addition to finding value in towers and fibre, TMT players have the opportunity to embark on their own global infrastructure journey, or partner with hyperscalers for differentiation.

Hyperscaling refers to the provision of infrastructure as a service. Players like Alibaba, Amazon, Google and Microsoft act as aggregators, managing fluctuating market requirements for data centre and cloud services while optimising this demand in aggregate.

Backed by hyperscale data centres, customers enjoy cost-effective, reliable and dynamically scalable services. Hyperscaling has led to many enterprise customers having relationships with one or more global vendors, often resulting in a hybrid cloud technology architecture by default.

The final piece in the global infrastructure puzzle is undersea cable. Almost all the world's internet data (about 99 percent) is transmitted through undersea cables the width of a garden hose.[26] The global market for these cables is growing, along with bilateral links in Asia. So too are the hyperscale data centre market, hybrid cloud engineering requirements and, spurred by geopolitical uncertainty, demand for sovereign data solutions in Australia.

With all this growth, innovation is flourishing to produce hyperscale infrastructure that is more energy and water efficient. This is in turn creating opportunities for a step change in both the cost profile and ecological footprint of expanding networks.



25. https://www.afr.com/property/commercial/new-year-brings-fresh-opportunity-for-property-bankers-20220106-p59m8v
26. https://edition.cnn.com/2019/07/25/asia/internet-undersea-cables-intl-hnk/

Regional markets and restructuring supply chains

The Asia Pacific is changing. Shifting from the passive growth that marked its prosperous rise, the region is now compelled to build a resilient future on six pillars: advancing the digital economy, enabling regional enterprise growth, rebalancing supply chains, fostering innovation, future-proofing the labour force and building towards a net-zero economy.

"The pandemic is only the latest disruption to uncover the fragility of global supply chains, reinforcing the need to rebuild for the future. Asia Pacific is poised to become the world's growth engine but will need businesses to prioritise supply chain transformation for resilient growth" –

Sridharan Nair, PwC Asia Pacific Vice Chairman, Markets

For Australia, the need to look to Asia has never been greater, as diversifying market opportunities will be a key part of Australia's economic recovery.

Fortunately, the feeling is mutual. According to PwC's Annual Global CEO Survey, Asia Pacific CEOs are increasingly bullish on both global and regional growth opportunities, while also rebalancing priority regions. In the preferencing of trade nations, Australia has leapt from 8th place last year to 3rd, indicating a major opportunity for unprecedented intra-regional trade.[27]

Australia's second chance in Asia

27. https://www.pwc.com/asiapacific-ceo

Surging deals

The established pattern of deals surging after an economic downturn should continue in 2022. New market opportunities, tech convergence and an abundance of capital are paving the way for plentiful deal making across the TMT sector this year. In addition to optimism among dealmakers, three trends define the global deals landscape:

New market opportunities lead to consolidation.

Market opportunities created by innovation and technology, combined with a favourable capital-raising environment in 2021, have led to significant growth in the number of technology companies globally. In a crowded market, well-funded players are using M&A to rapidly scale their businesses in the race for market dominance.

Tech convergence follows tech disruption.

Technologies such as AI, IoT and software-as-a-service cloud computing have enabled disruptive business models to gain traction in traditional industries like healthcare, advertising, automotive and banking, and led to tech convergence. As these 'hybrid-tech' companies infiltrate large markets, such as the multi-trillion-dollar global healthcare market, the race to exploit emerging technologies creates opportunities for M&A, either as an acquirer or as a target to be acquired.

Capital investment is readily available and going global.

The business models of the new generation of tech companies are lower cost and more scalable than before – boosting valuations and making it easier to attract funding. The Silicon Valley venture capital funding model, which centres on scaling companies ahead of initial public offerings (IPOs), has also gone global. India, for instance, has seen a huge growth in the number of start-ups valued at more than $1 billion, with 79 unicorns in 2021 with a total valuation of US$260 billion. Digital infrastructure owners are also continuing to consider restructuring their assets to unlock invested capital and gain greater focus on their core business.

In the Asia Pacific, legacy tech companies are l ikely to divest slow-growth businesses and reinvest proceeds in emerging technologies and fast-growing industries. These include data and analytics, cloud robotic process automation and cybersecurity. The telco industry is likely to see a similar trend of divestitures as corporations focus on the growing 5G market. IPOs are also on the rise for tech-enabled start-ups, following the global trend.

Finally, ESG is increasingly being considered in M&A decision-making and strategy, as investors use ESG criteria to assess risks and to identify value creation opportunities.

Global M&A outlook

Living in a world of unicorns

Skills, talent, and the future of work

The digital revolution requires a skills revolution. For TMT, demand for skills and talent is outstripping supply, and this has been exacerbated by travel restrictions impeding our traditional engagement of foreign nationals to prop up domestic expertise. With Google announcing a plan for 6,000 local jobs, and other global players arriving with growth ambitions and deep pockets, competition is fierce.[28]

Australia's shift to a higher-skilled, more services-based digital economy can be seen in the changing industry, occupation and skill mix of jobs. The National Skills Commission has identified digital skills as the fastest-growing emerging skill area, predicting that over the next five years the number of software and applications programmers will jump by 30 percent. Employment in science, technology, engineering and maths fields is projected to grow by 12.9 percent over the same period, and 'computing' is recognised as one of the four most important and rapidly growing skills needs over the coming years.[29]

In 2021, PwC surveyed more than 32,000 workers globally, finding workers want more digital skills, more inclusivity and more flexibility. From Australian respondents, we heard:

59%

were worried that automation was putting people's jobs at risk. However, 60 percent agreed technology presented more opportunities than risks

75%

were ready to learn new skills or retrain to remain employable

82%

were confident they could adapt to new technology entering their workplace

49%

felt positive about the future world of work and what it meant for them

56%

said there are elements of their current job they could perform remotely

New world, new skills

As the world emerges from the pandemic, the new dawn of digitisation has fundamentally changed the way many jobs are carried out. This requires new thinking about skills and the role of technology in work, while recognising the enduring importance of humanity, integrity and creativity. A strong employee value proposition is no longer a nice to have, but a must. And to access every possible opportunity, TMT players should be alive to the importance of workforce diversity and deliberate inclusion efforts to help drive better outcomes.

In 2022, we expect talent will be the most strategic market opportunity of all. And in support of skills and capability, our TMT sector will need to rethink leadership as well. This includes driving collaboration and performance around critical success factors such as customer experience, digitisation, trust, climate and radical collaboration.

What workers want
Where next for skills?
Future of Work maturity radar

28. https://www.afr.com/technology/start-ups-battle-big-business-as-tech-skills-shortage-threatens-growth-20211213-p59gzf
29. https://www.nationalskillscommission.gov.au/2021-state-australias-skills-2021-now-and-future

5. Evolving business models

Products and services: Digital first at last

All signs point to Australia's recovery from COVID-19 being a digital one, and those who directly address the forces of change are most likely to prevail. In a recent IDC survey about enterprise resilience, 48 percent of Australian organisations said the disruptions of the pandemic highlighted the need to have a digital-first strategy and start to execute it.[30]

'Digital first' is a business model mantra stating that any new challenge or opportunity should first be understood as a digital one. For many TMT companies, the digital experience – how consumers engage with, navigate through and react to a company's digital products, services and platforms – is their business, so evolving this bias towards digital first is paramount.

In a digital-first business model, the sensibilities of product and service design – including understanding your customer, solving customer problems, planning for process and experience, and knowing the product life-cycle – are extended to every aspect of business, experience and technology, whether market facing or internal.

Australian businesses are in turn discovering that the digital first imperative represents a major shift in culture, ways of working and organisational design.

Technology architecture: a moving landscape

Many of the top strategic technology trends identified by Gartner for 2022 can be found on the to-do list of enterprise architects. These range from data fabric, cybersecurity mesh, cloud-native platforms and decision intelligence to AI engineering and hyper-automation. As Gartner says, these are the "force multipliers of digital business and innovation".[31]

In simpler terms, architecture is a plan for how to organise and orchestrate your technology assets to extract the greatest value today and tomorrow. Architects contend with a moving technology landscape, trying to future-proof decisions and remain open to the possibilities of what might come.

In 2022, attention will be drawn to some of the seismic shifts in technology that require a strategic response:

Hybrid cloud

Having now figured prominently in many technology strategies, the next opportunity for cloud is to critically examine portfolios and rationalise them, applying intentional business-outcome principles and governance to cloud decisions. The accounting treatment of cloud services has also shifted tech spending from capex to opex, requiring more nuanced financial tracking and recognition rules.

AI and automation

As AI and automation soar, data flows start to concentrate in unexpected ways. Support for AI use cases necessitates data democratisation, a data catalogue, reusable features and federated practices. Machine learning ops is also emerging as a set of practices to facilitate better collaboration between machine and deep learning practitioners and operations engineers.

Edge

As edge architecture becomes increasingly important to emerging 5G business value, technology architecture will need to demonstrate a strategic command of components that are active at its edge, including devices, sensors and servers.

Security by design

According to the "DevSecOps Manifesto", penned by some practitioners, security should be integrated into development and operations at all levels to achieve security with less friction, to foster innovation, and to ensure security and privacy aren't afterthoughts.[32]

Data mesh

Mesh is an intentionally distributed architecture with an abstracted layer of centralised governance and standardisation for discovery, security, authentication and more. Connections are dynamic and non-hierarchical, resulting in more seamless interoperability, particularly in multi-cloud environments. In mesh, data is treated as a product owned by the teams with the most intimate knowledge of its use.

Mastering agile at scale

Agile at scale refers to the use of agile methods to drive customer-aligned outcomes at the team level and applying these principles and practices to other layers of an organisation. Leaving the language aside, at its core, agile is about getting the right people to work more closely together, orientating around a shared view of value and continually looping back on progress. At an enterprise level, this ideal can encounter institutional barriers and legitimate constraints.

Extending agile into the core of large Australian companies has been a journey of discovery that continues to reveal lessons and opportunities. We are also contending with new dynamics as a result of the pandemic. As a business community and across industries and geographies, we've proven we can dramatically change the way we get work done and where we can succeed. However, it has often also put a spotlight on what's broken.

As we look at industry leaders tackling their next stage of adoption and maturity, we see three key challenges:

Commitment

Going all in changing the planning and funding processes across the company to enable faster work occurring at a team level

Prioritisation

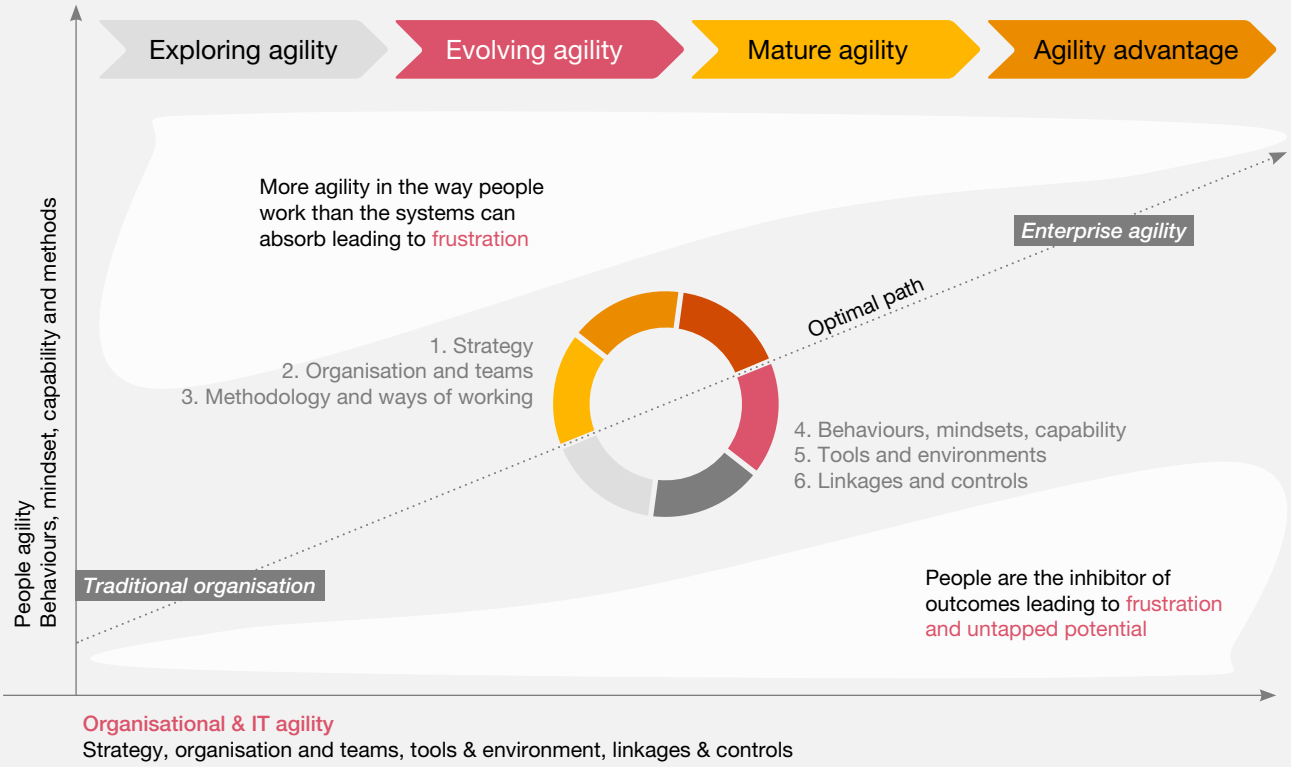
Making tough calls on prioritisation collaboratively to relieve the tension in the system between strategic outcomes and capacity

Focus

Ensuring the right work methods accompany a more agile mindset across each part of the organisation and its specific work context, then connecting these multiple work methods effectively through organisation-wide systems

Now is the time to be brave, to innovate and iterate, and define a new path. Leaders should make a conscious decision to embrace experimentation.

- Designing work that works for all
- Closing the agile achievement gap



6. Responsible business

On the back of a pandemic and the COP26 climate change conference, it's hard to imagine a strategy for growth that doesn't encompass a commitment to responsible business.

Increasingly, customers, investors, employees and the public are challenging sector leaders to understand their social and environmental impact and to recast prosperity in these terms.

We've reflected on some of the important dimensions of responsible business for the TMT sector in 2022. These are by no means exhaustive, but are emblematic of the unique role TMT leaders have to play.

Data and decarbonisation

On one hand, technology is enabling every industry to achieve breakthroughs as they pursue ESG outcomes. ICT supports remote communication, reduces avoidable travel and digitally enables sustainable cities. In fact, the Global e-Sustainability Initiative suggests that ICT can facilitate a 20 percent reduction in global carbon emissions by 2030.[33]

Research published by Huawei suggests that a fast rollout of 5G, for instance, could reduce global emissions by half a billion tonnes by 2030.[34] 5G is estimated to deliver 16 times more energy efficiency than 4G. Tech companies have also been developing solutions that help enterprises better report, track, reduce and capture carbon. Technology is the great enabler.

On the other hand, data has a carbon footprint. Data centres and transmission infrastructure require vast supplies of energy. Due to the pandemic, global internet traffic surged by more than 40 percent in 2020 with increased video streaming, video conferencing, online gaming and social networking.[35] AI is booming, but so is its computational load – OpenAI estimates that the amount of compute used for training AI doubles every 3.5 months.[36]

The New York Times reports that Bitcoin network consumes around 91 terawatt-hours of electricity a year – more than is used by Finland, a nation of 5.5 million.[37] Greenpeace estimates that by 2025, the technology sector could consume 20 percent of the world's electricity.[38] If the cloud were a country, it would be the sixth-largest consumer of electricity globally. Yet IDC suggests cloud computing could eliminate 1 billion metric tons of CO2 emissions over the next four years.[39]

In essence, our sector's challenge is to realise opportunities to do business more responsibly, and help others do the same, while mitigating the impact of our own operations. Decarbonisation requires leadership, literacy and a holistic approach to reimagining business models – from products and services to global footprints and supply chains.

Digital inclusion

How companies manage their relationship with customers, workforces and the societies in which they operate is central to the question of social accountability. In TMT, these relationships are captured by the concept of 'digital inclusion'.

Digital inclusion is about ensuring everyone can access and use digital technologies effectively. It sees the best of technology improving the lives and chances of all citizens, particularly those who are disadvantaged.

Our research shows that Australians excluded from the digital world are most likely to be Indigenous, have a disability, have not completed secondary school, are unemployed, are aged over 50, earn lower incomes, have mobile-only connections and/or live in regional and rural areas. And conditions of exclusion intensified during COVID-19 – Australian Bureau of Statistics surveys found that 15 percent of households had no access to a stable internet connection during the 2020 lockdowns.

Digital inclusion leads to improved education, health and employment outcomes, and spurs consumer activity. Also, to meet the demands of rapid technology change without skilled migration, business needs to shift its focus to reskilling and upskilling employees. Instead of thinking about the 'war for talent', we need to think about building an ecosystem of talent. Technology and accelerated digitisation will not deliver promised productivity gains if there are not enough workers with the right skills, and the ability to apply them. This highlights another economic imperative for digital inclusion.

In our Where next for skills' report, PwC notes that many Australians on the wrong side of the digital divide face barriers of access, affordability and digital ability. Having the ability to engage in the digital economy – including cognitive skills and digital acumen – will be even more vital in a post COVID-19 world. These skills can make the difference between an individual's ability to participate in the economy, access government services and connect with their community and someone who cannot. People without basic digital and cognitive skills are at risk of being isolated and disconnected from opportunity.

Where next for skills?

33. https://smarter2030.gesi.org/downloads/Executive_summary2.pdf
34. https://www-file.huawei.com/-/media/CORP2020/pdf/giv/Intelligent_World_2030_en.pdf
35. https://www.iea.org/reports/data-centres-and-data-transmission-networks
36. https://openai.com/blog/ai-and-compute/
37. https://www.nytimes.com/interactive/2021/09/03/climate/bitcoin-carbon-footprint-electricity.html
38. https://www.greenpeace.org/usa/news/greenpeace-finds-amazon-breaking-commitment-to-power-cloud-with-100-renewable-energy/
39. https://www.idc.com/getdoc.jsp?containerId=US47426420

Trust and transparency

Trust has been a key topic for Australian CEOs over the past several years. Many have identified their own trust and reputational drivers, leaving them balancing the competing forces of shareholder expectations with those of customers, employees and the community. Creating a company culture of openness is a lot more complex than merely complying with laws and regulations that protect profits and self-interests. Genuine trust is a force for good. It requires constant focus on community expectations and customers, and honesty with these and other stakeholders. For TMT and technology-enabled enterprises, digitisation has amplified the challenges relating to trust.

Digitisation and trust

Digital and cybersecurity is a practical proof point for TMT trust. Some 78 percent of Australian respondents to our 2022 Global Digital Trust Insights Survey say that too much avoidable, unnecessary organisational complexity poses 'concerning' cyber and privacy risks. Our respondents also made predictions about the next 12 months. Sixty-six percent expect an increase in cybercrime and 70 percent say nation-state attacks are likely to grow. The interconnectivity of IoT tops the list of anticipated vulnerabilities.

To tackle this risk and establish a security mindset, the key will be to frame cybersecurity as not merely a question of defence and controls, but rather as important to business growth, market reputation and customer trust.

2022 Global Digital Trust Insights

Digitisation and transparency

New technology, such as artificial intelligence and machine learning, means leaders have access to more information about their organisation than ever before. With the ability to analyse billions of data points in milliseconds and see what humans might miss, the opportunities to uncover new insights are endless. But if technology is to help drive transparency, companies must be willing to share these types of results — good or bad — with their stakeholders and explain how they're acting on them.

"Trust in digital – among consumers, employees and citizens – is eroding. We stand at a critical inflection point with a new imperative to restore the digital trust needed to drive business growth and shared prosperity in the communities where we live and work. By innovating responsibly and demonstrating ethical leadership, we can make a meaningful difference in two specific areas: building a more resilient and secure internet; and using data in a trusted and transparent way to improve workforce performance."

World Economic Forum[40]

Closing the say–do gap.

In our Annual Global CEO Survey, we asked CEOs about the nature of their engagement with customers across six dimensions of trust and aggregated those responses to create an index of perceived customer trust. It's not yet clear which way the association runs or whether there is a mediating variable that explains the relationship. Still, these findings seem important. For example, CEOs of companies ranking highest on our customer trust index are significantly more likely to have nonfinancial outcomes (such as customer satisfaction, employee engagement, and gender, race, and ethnicity representation) tied to their compensation. In fact, the most highly trusted companies are 1.4 times more likely to have gender diversity targets in their chief executive compensation plans.

40. https://www.weforum.org/agenda/2019/01/trust-in-digital-has-eroded-leaders-must-rebuild-it/

A turning point in ESG

In 2022, societal needs and business opportunities are coming together to transform the way companies craft strategy, drive performance and report results. ESG has found its voice.

The underlying forces at work are well known. Investors, lenders and rating agencies expect greater visibility of an ever-broader range of non-financial metrics to better understand diverse social and environmental risks. Governments' ambitious, top-down commitments to limit carbon emissions are increasingly backed by new regulations and new taxes.

More – much more – can be expected. Activist shareholders, among many other stakeholders, are advocating for net-zero policies and tighter linkages between ESG targets and executive compensation packages. Socially conscious consumers are more inclined to vote with their wallets, encouraging businesses to reappraise their products and purpose, including their role as employers of diverse, engaged workforces. And the pandemic has created significant additional momentum for change.

Beyond compliance and risk mitigation, ESG considerations are manifesting in measurable ways for TMT businesses. Decarbonisation can be tackled for climate change and EBITDA. Social responsibility can deliver community outcomes and underpin and strengthen customer and employee value propositions. Trust and transparency will satisfy stakeholders and generate market returns at a lower cost of debt.

When you put ESG considerations at the heart of your operation, you take bold steps towards a model that will deliver sustainable business advantage and measurable value. It's an approach that makes possible the operational, cultural and financial changes needed to future-proof your business.

That's why we've identified ESG as a key feature of "how to move forward".

7. How to move forward

Gone are the days of single-rule strategies. TMT leaders are simultaneously grappling with disruptive external forces, volatile competitive dynamics, rapid internal change, rising customer and employee expectations, and expanding fiduciary, social and environmental responsibilities.

In 2022, we believe moving forward requires:

- A coherent, capability-driven strategy for growth
- Treating digital innovation as critical to growth
- The integration of business, experience and technology to thrive and win
- A structured approach to responsible business.

This demands new leadership competencies, new ways of thinking and an authentic engagement with new ways of working – across the complex and very human dimensions of technology, trust and responsible transformation.

Realising capabilities-driven growth

In these rapidly changing times, and with constant pressure to compete, it's easy for business leaders to overlook a basic principle: build from your strengths. Sustainable, superior returns accrue to companies that focus on what they do best. The truth is that simple, and yet it's incredibly hard to internalise.

A company's primary source of advantage is a system of three to six mutually reinforcing capabilities that together allow it to fulfill its way to play. A capability is a key strength of your business that customers value and competitors can't beat. It's not a generic activity or skill, but a specific intersection of people, knowledge, IT, tools and processes where your organisation consistently outperforms competitors.

It is the rare company indeed that focuses on 'what we do better than anyone' when making operating decisions across every business unit and product line. Rarer still is the company that has aligned its differentiating internal capabilities with the right external market position. We call such companies 'coherent'.

We're not suggesting that companies disregard market signals in 2022; all strategy is set within this vital context. But we are suggesting they start from the opposite direction, figuring out what they're really good at and then developing those capabilities (three to six at most) until they're best-in-class and interlocking. From there, strategy becomes a matter of aligning that distinctive capabilities system with the right marketplace opportunities – and the market rewards them with outsize returns. We call this the 'coherence premium', and we've measured it.

The most powerful growth engines are made up of a handful of capabilities providing real differentiation in the market. Companies with capabilities-driven strategy outperform relative to their industry average:

3x

Three times as likely to report above-average growth

2x

Twice as likely to report above-average profits

14%

Deals generate 14.2 percentage points higher annual total shareholder return

Winning through capabilities

Accelerating digital innovation

As Netscape founder Marc Andreessen said in 2011, software is eating the world.[41] That certainly remains true more than a decade later. By 2025, more than 65 percent of Forbes Global 2000 companies will be large-scale producers of software-based digital innovation. By 2023, corporate spending on technology products and services to enable software-based digital innovation – developers, tools, platforms and more – will have increased by more than 50 percent.[42]

For TMT businesses, innovation is everywhere. But digital innovation will be paramount in 2022 and beyond. So organisations must be geared to make the most of the digital innovation opportunity and not be left behind in the runaway digitisation of products and business models.

The hallmark of a successful innovation capability is an obsession with value. The opportunity for integrated digital innovation and value delivery emerges across the six POINTS in the following table.

	Dimensions	Considerations	Benefits enjoyed by leading organisations
P	Portfolio management	Are you investing in the right software offerings?	15% higher EBITDA growth
O	Organisation and talent	Do you have the right organisation and talent for software excellence?	20–35% reduction in headcount-related costs
I	Infrastructure and technology	Are your product infrastructure decisions optimised considering user experience, cost and risk?	>50% of CIO budgets impacted
N	Network footprint	Does your global footprint support your software development goals?	5–20% reduction in footprint expenditure
T	Tax and accounting treatments	Have you appropriately claimed R&D tax credits? Have you optimised your software capitalisation policies?	>10% cash benefit
S	Software development capability	Does your organisation consistently use an effective product development methodology?	2X increase in value delivery

41. https://future.a16z.com/software-is-eating-the-world/
42. IDC: The Future of Digital Innovation: Every Enterprise Must Become a High-Performance Software Producer, Jan 2020.

Aligning business, experience and technology

There is no shortage of ideas in the vibrant TMT sector, but the key is knowing where to invest. This relies on knowing what to build and when, then moving into the effective delivery of ideas and value realisation, by ensuring people from a range of disciplines work harmoniously together.
The challenge requires strategy, design and technology to come together in one place – moving from idea to launch, faster. Get it right and your confidence to try new things grows.
Our proven process to connect the dots and accelerate your best ideas is BXT: aligning business value (B) with human experience (X) and enabling technology (T).

Aligning business, experience and tech

Business.

How you build value –

Industry and functional expertise inform the most relevant ideas:

- Accelerated alignment and co-creation
- Business operations/development
- Cybersecurity and privacy
- Operations management
- Procurement and supply chain
- Cost control
- Supplier relationship management

Experience.

What people remember –

Human-centric thinking engages people and breathes life into work:

- Ethnography and insight
- Customer experience (CX) strategy
- Journey mapping
- Product management
- User experience (UX) design
- Brand innovation
- Graphic design
- Service design
- Behaviour and culture change
- Branding
- Behavioural science
- Customer engagement

Technology.

How to make it real –

Architects of a roadmap that connects tech for the things you make:

- Digital technology strategy and architecture
- Automation
- Agile delivery
- Cloud and networks
- Technology delivery
- IT effectiveness
- IT sourcing
- Data strategy
- Data visualisation, analytics and reporting
- Technology solutions
- Application management services

Turning ESG theory into action

ESG is one of the most important questions facing Australian companies across all industries. Success is not about climate change, diversity and disclosures alone. It's about bringing together your best people and smartest technology so you can see more, go deeper and act faster. Enabling you to tackle the biggest challenges of today – and capture the best opportunities of tomorrow.

At PwC, we have directed a majority of our research, skills acquisition and people development to focus on ESG so that we can help our clients embed ESG into strategy, risk, capital, operations, products and services, remuneration and disclosure to help them transition to the economy of the future. This includes a deep dive into the circular economy, which combines recycling, remanufacturing, reuse, maintenance and redesign to keep components and raw materials out of landfill. In Australia alone, this could generate $1. trillion in direct economic benefits over 20 years and save 165 million tonnes of CO2 per year by 2040.[43]

Environmental

- Managing carbon and climate change vulnerabilities
- Data decarbonisation
- Water, waste and pollution management
- Transition to a circular economy
- Renewable energy and clean technology
- Consideration of the unique rights of First Nations peoples to access, maintain and protect their lands

Social

- Human capital development
- Health and safety
- Ethical supply chain and sourcing
- Human rights
- Privacy and data security
- Community engagement, including a focus on First Nations peoples
- Digital inclusion
- Tech skills for Australia

Governance

- ESG reporting
- Risk mitigation and management
- Board diversity
- Executive pay
- Tax transparency
- Business ethics
- Policies that enhance corporate behaviour including protecting human rights
- Digitisation and trust
- Digitisation and transparency

ESG

Economic realities of ESG

Progress and perils of getting to net zero

Circular economy

43. https://www.pwc.com.au/press-room/2021/circular-economy-to-grow-australian-GDP.html

8. Leading in the year of optimism

Reimagining the outcomes that matter

PwC's 25th Annual Global CEO Survey provides a timely prescription for TMT leaders as they face into the opportunities and challenges of the year of optimism. Together, the promise of markets, the possibilities of business models, and the problems of our time require bold action from CEOs stewarding critical resources.

At the same time, this year's CEO survey underscores just how full CEOs' inboxes have become. Near-term financial imperatives remain mission critical, even as broader societal needs demand mindshare.

Against this backdrop, the following six priorities should help TMT leaders deliver the diverse range of sustained outcomes that stakeholders are increasingly demanding:

Redefining the balance of short- and long-term profitable growth: leaders may be optimistic about near-term economic forecasts, but anxiety about how to capture value from this in terms of operating profitability remains a challenge. The right balance of tactical and strategic focus is required. This includes, for example, exploring adjacent, easy-to-access markets within the Asia Pacific through incremental changes to products and services, realigning shorter-term costs to longer-term value to create the investment capacity needed to grow outside the region. Companies should also look to alternative sources of capital as deal flow and funding levels continue to be at record levels, particularly with the significant private wealth accumulation in Asia.

Recalibrating skills: our survey results point to capability-building priorities related to cybersecurity, the cultivation of trust and the measurement and management of decarbonisation. Given challenges in mobility, the skills shortage is particularly acute, which is creating the need to build capacity and capability locally. This will help drive more inclusive growth and shared value. In addition, the 'inbox problem' has implications for skill building and role modelling among top management and boards. A combination of a growth mindset, empathy and a willingness to embrace debate and dissent become more important than ever.

Resetting the conversation: boards should be talking with their CEOs, and CEOs with their top teams, about their collective inbox problem. Enthusiasm about ESG won't make near-term financial demands go away. Indeed, framing trade-offs realistically may be the only way to bring investors along and create a realistic strategic agenda, as opposed to a wish list, in a world of scarce time, attention and corporate resources.

Reappraising succession: the leadership capacity needed to master today's tenuous trade-offs is likely to come in all shapes and sizes, with external hires and emerging leaders from diverse talent pools critical to rounding out skill sets and resetting the conversation. Succession planning is an area where leaders and boards can challenge themselves immediately to start creating the future to which they aspire.

Rethinking incentives: the strong association between incentives, net-zero commitments and other non-financial outcomes suggests it's time for boards and management teams to take a hard look at the fit between the full set of priorities they want their people to drive, the performance management systems they have in place and the reporting they do against them.

Reimagining collaboration: tackling society's most pressing challenges, realising the digital economy and unlocking the opportunities in a prosperous TMT sector all require collaboration. The year of optimism calls for an unprecedented level of cooperation among business leaders, government officials and policymakers, and investors. Collaboration is especially critical for aligning business with experience and technology and rising to the challenges of responsible business. Before COP26 in Glasgow, the Edelman Trust Barometer found that no single institution was trusted when it comes to climate change action,[44] but together they can create powerful momentum.

44. https://www.edelman.com/trust/2020-trust-barometer

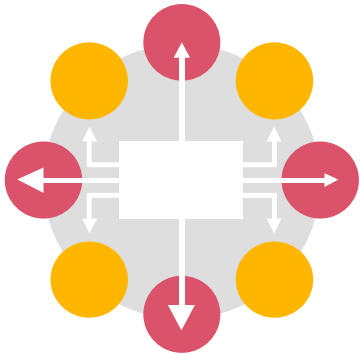
Trust runs through many of these priorities, just as it runs through our survey results, and it speaks to the evolving expectations of customers, employees and even global finance.

To the extent that highly trusted companies are thinking and acting differently, and that those actions could help bridge the gap between society's expectations and the system in which CEOs are operating, trust may be a meaningful enabler of change. And it's only through change – bold, innovative and unbounded – that we can secure our collective future.

[25th Annual Global CEO Survey]

New dawn of digitisation: 2022 checklist

Based on maturity and impact, we have charted six shifts shaping opportunity in 2022. So how should you take action?



01 Data explosion

- Realign your business to shifts in data usage and online engagement.
- Rebalance marketing and communications towards favoured media.
- Understand your structured and unstructured data opportunities.

02 Cloud and edge computing

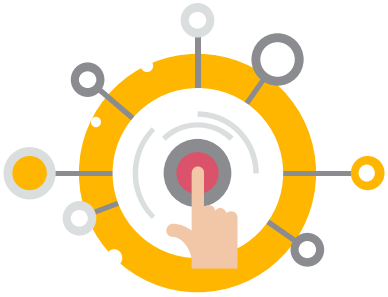
- Reset your cloud strategy for a simple, optimised portfolio anchored on business outcomes.
- Incorporate edge computing into your architecture.

03 5G and IoT

- Define your ‘way to play’ in 5G
- Link your 5G and IoT plans to unlock new low-latency possibilities
- Encourage adoption and proactively manage network evolution

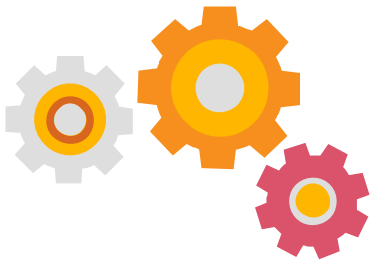
04 AI and automation

- To understand where you can create value, assess AI’s implications for your customers, industry and business model
- Prioritise process automation then start small, test thoroughly and iterate.
- Responsible AI is an essential way to mitigate AI risks and prepare for future regulation



05 Identity and security

- Continually assure sound cyber practices and controls
- Develop an integrated digital identity plan, considering the role of blockchain
- Get ahead of regulatory change (such as the CDR and the European Union’s General Data Protection Regulation)



06 Emerging technologies: The Essential Eight

- Explore how Essential Eight techs might fundamentally affect your strategy

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