The intelligent, experiential and competitive workplace: Part 1

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Abstract   This two-part paper explores how intelligent automation and the convergence of accelerating technology advancements will shape the future of work and transform the workforce and the workplace of the future. Part 1 examines key intelligent automation advances and challenges with an overview of the emerging workforce and workplace models. Part 2 assesses the impact of intelligent automation and artificial intelligence (AI) upon the workforce and the workplace in greater depth, as well as the societal impacts to consider as these advancing technologies transform business, society and life itself. The paper begins with the premise that the business world is at a major inflection point whereby more businesses than not have completed their first phase of digital transformation. The COVID-19 pandemic accelerated AI, robotics, workplace automation and digital transformation initiatives that were already well underway. Trends that have been gathering momentum for years, such as workplace mobility and diverse 'hybrid workplace' behaviours, have rapidly gained adoption to now become mainstream. Just as the office is becoming an ecosystem of workplace options, the workforce is becoming increasingly 'liquid' and distributed; the 'human cloud' continues to evolve as many organisations turn to contract, on-demand, highly flexible and elastic labour models. Digital workplace technologies — from meeting solution software to enterprise chat platforms and desktop-as-a-service — have enabled the adoption of remote working and creation of workplace ecosystems inclusive of flexible 'hybrid' workplaces that can accommodate working in the office, at home or anywhere. As the post-digital era advances, the convergence of AI, robotics, workplace automation and virtual/augmented/extended reality (VR/AR/XR) technologies and 5G mobile networks will enable completely new ways of working and accelerate societal transformation. Digital technologies will enable rich, immersive and distributed virtual collaboration that will power new levels of human performance. The next phase of digital transformation will be driven by businesses willing to make AI investments to improve their competitive advantage. Over the next decade, AI will offer employees unprecedented information awareness and insight, providing greater freedom from low-value-add activities and the ability to easily adopt

and use these emerging complex technologies. In the future of work, AI and immersive XR technologies will lead to greater levels of human–machine collaboration; however, policymakers, public and private organisations will need to address the risks and challenges of an increasingly AI-enabled digital world. New ways of working will offer the promise of unlocking greater human potential and may lead to some worker displacement, as well as intensifying the demand for greater workforce reskilling and continuous lifelong learning. Increasingly sophisticated AI applications, including facial recognition and deep learning neural networks, will provide new insights to address complex business problems and societal challenges. These very same advanced AI applications will also raise difficult questions regarding transparency, ethics, equity and privacy.

KEYWORDS: digital transformation, intelligent automation, experiential workplace, virtual/extended reality, telepresence, immersive collaborative platform technologies, human–machine collaboration, robotic process automation (RPA)

INTRODUCTION: THE FUTURE OF WORK IS DIGITAL

During the early years of the 21st century, 'digital transformation' was a new concept sweeping through nearly every industry sector. Today, the business world is at a major inflection point whereby more businesses than not have completed their first phase of digital transformation. As the post-digital era advances, intelligent automation including artificial intelligence (AI), robotics, workplace automation and extended reality (XR) technologies will enable completely new ways of working and will have a significant impact on future societal transformation.

Competitive advantage in 2030 will depend upon how quickly an organisation can adapt and adopt multiple digital transformation leading practices. Those who gain will leverage emerging technologies quickly to further enable and optimise the customer experience and to fully 'personalise' the employee experience.

As a major disruptor of traditional business, the COVID-19 pandemic accelerated AI, robotics, workplace automation and digital transformation initiatives that were already well underway. It spurred organisations to completely reimagine their business models, rethink their workforce models and reinvent their future real estate and workplace strategies — transforming work, the workforce and the workplace.

Forward-looking companies viewed the pandemic as an opportunity to pursue their next-generation technology initiatives to gain competitive advantage. A recent study showed that the top 10 per cent of companies leading technology innovation are achieving two to three times the revenue growth of their competitors — a divide that Accenture calls 'the digital achievement gap'.[1]

Technology trends, catalysed by the pandemic, will continue to drive transformative workforce and workplace trends. How and where work is performed is evolving continually as AI and automation increasingly advance beyond the manufacturing floor and into the white-collar office. From performing simple repetitive tasks, automated systems have graduated to complex chores such as understanding human voices, deboning chickens and handling chemical liquids.[2]

Greater automation helped US companies navigate the unprecedented disruption of the pandemic. Adjusted for inflation, US productivity rose by almost 4 per cent after the fourth quarter of 2019, nearly twice the increase in output-per-worker over the past five quarters, according to the Bureau of Labor Statistics. Now, the US is producing

roughly the same amount of goods and services as before the pandemic — but with 8.2m fewer workers, equal to the combined payrolls of every employer in Virginia, Arizona and Iowa.[3]

Three-quarters of companies surveyed by McKinsey Global Institute in autumn 2020 expect investment in new technologies to accelerate from 2020 through 2024, with the potential to boost productivity growth in countries such as the US by a full percentage point, improve living standards, and more than double pre-pandemic growth trends.[4]

Cloud computing, AI, extended AR and VR, digital twins, intelligent collaborative telepresence tools and other emerging technologies have come to the fore, perceived as promising tools for real-world use rather than the stuff of science fiction. Almost one-third of companies are currently using AI in their businesses and many others are joining the race, despite continuing challenges. IBM research identifies the top three barriers to AI adoption for businesses as limited AI expertise or knowledge (39 per cent), increasing data complexity and data silos (32 per cent) and lack of tools/platforms for developing AI models (28 per cent). No wonder one-third of global IT professionals report their company plans to invest in both skills and AI solutions over the next 12 months.[5]

A 2018 study published in *Harvard Business Review* of 152 US projects indicated that the three best uses of AI technologies in the near term would be cognitive RPA for back-office administrative and financial processes, gaining insights through data analysis, and engaging with customers and employees. Also important, the study found that incremental change — using AI to augment human capabilities — was demonstrably more effective than attempts at 'moon shot' wholesale transformation.[6]

While adoption of AI technologies was projected to grow in 2020, the rate of adoption flattened during the pandemic. Reduced business spending may have led to a pause in some technology investments; however, interest in AI tools may resurge as the economy recovers through 2021 and beyond. In addition, companies may turn to new tools emerging from the major cloud service providers that could prove to be easier to use than those currently available. Previously, many companies tended to use open-source AI developer tools, requiring expertise in short supply.[7]
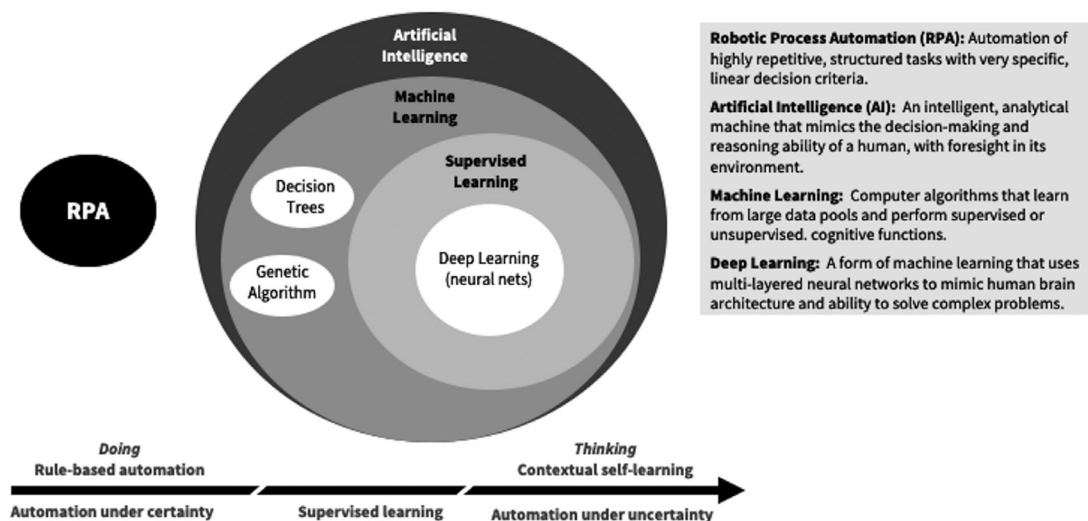
Figure 1: Machine learning and deep learning acceleration
Source: A.T. Kearney[8]

These technologies will enable businesses to create and deliver new products and services and lead to entirely new ways of working. Greater adoption of AI, intelligent automation and other cognitive technologies will provide machine assistance to humans in their daily work activities, engaging talent in new ways and enabling greater collaboration with partners within growing human–machine collaborative ecosystems.

Human–machine collaboration will free humans to focus upon higher-value creative activities with stronger focus upon more innovative and strategic work.

THE NEW HYBRID WORKPLACE MODEL EMERGES

Combining work-at-home with work-in-the-office, 'hybrid working' has become the preferred mode for many employees. As the pandemic forced the widespread rapid adoption of remote working, employees have embraced these new remote work and hybrid workplace behaviours that allow employees greater levels of workplace flexibility.

There is no turning back to traditional historical workplace models. Having tested work-at-home en masse, many employees want to retain the remote working behaviours and the resulting benefits of hybrid, flexible workplace programmes into the future — and they have shown that they can work remotely effectively and productively when supported by the right technology.

Whether working at home or physically in the office or elsewhere within diverse workplace ecosystem environments, many employees will expect responsive 'smart' digital workplace technologies that will enable greater productivity and human performance. These 'smart' workplaces will be designed for the growing presence of AI-assisted work platforms including immersive, collaborative virtual technologies.

Workplace technology has been a critical enabler as companies reshaped their business and workforce models during the pandemic and adapted to remote and hybrid working. Trends that have been gathering momentum for years, such as workplace mobility, have rapidly become mainstream. From meeting solution software to enterprise chat platforms and desktop-as-a-service, many digital workplace technologies advanced from nice-to-have to must-have status.[9]

Some companies are already using AI to enable productivity for a geographically dispersed workforce. Engineering giant Honeywell, for example, has developed tools that use augmented/virtual reality (AR/VR), along with AI, to extract learnings from experienced employees, many of whom are of retirement age, to share with millennial hires. Throughout their everyday tasks, the engineering employees wear special headsets that capture everything they do using image recognition technology. Newer employees can use a VR application to play back the recording and virtually experience how veteran peers perform their roles. The technology also enables the company to solve problems in the field more quickly, with fewer engineers and at lower cost.[10]

AI, VR/AR/XR, digital twins and advanced immersive collaborative platform technologies will continue to change how we work and how workplaces will be designed and organised. Entirely new ways of working will continue to emerge with the greater adoption of AI and other cognitive technologies that will bring ever-increasing intelligent machine assistance into the work day, whether one is working in the office, at home or at another option provided by the continued growth of hybrid workplace ecosystem(s).

NEW WORKFORCE MODELS WILL CONTINUE TO EVOLVE

Concurrently, new flexible workforce models are also continuing to emerge, evolve and diversify. Just as the office is becoming an ecosystem of workplace options, the workforce is increasingly becoming a 'liquid

talent network' as the need for flexible talent ecosystems grows. In many organisations, employees have become contingent, contract, flexible labour. The continued growth of the 'human cloud', per the ground-breaking research of MIT researcher Tom Malone, is the result of companies seeking to attract critical digital talent from diverse geographies, as well as to better manage workforce costs and dynamically changing talent demands.

As remote working has proven that many employees can work from anywhere, whether the office, at home, or a coworking space, companies now recognise that talent can also be found anywhere — even far beyond the boundaries of the corporate footprint. Leveraging the liquid workforce will continue to grow as companies recognise the availability of talent beyond geographic borders and with the continued maturation of powerful digital collaborative technologies that will fully enable remote work, including distributed collaboration and innovation. Looking ahead, workforce ecosystems comprising talent clusters across dispersed geographic locations will increasingly enable new levels of enterprise human performance.

Talent will always be considered the most critical enterprise asset. The technology companies that have led the Dow-Jones Index during the past two years may be characterised by a lack of hard assets, but these high-performing companies have a wealth of top talent. Their human assets create the intellectual property offerings that result in exceedingly high revenue and margin growth. The pace of business innovation is accelerating, as noted in the *Fortune CEO Daily* by editor Alan Murray: 'It only takes imagination to improve on someone else's intellectual property. No factory retooling is necessary when the latest innovation is an algorithm.'[11]

Inside and outside the office, AI and immersive collaborative digital technologies will connect the physical and digital realms, further dissolving the boundaries between the physical in-office and distributed remote digital workers. Throughout this process of transformation, entirely new cultural and societal challenges will continue to emerge as businesses and governments assess the implications of technology tools that the public may perceive as overly invasive and possibly inherently biased. The AI-enabled workforce of the future will continue to evolve as human–machine collaborative ecosystems diversify and grow with increasingly immersive digital and collaborative experimentation.

ANTICIPATING THE FUTURE OF WORK

The following narrative explores the future of maturing AI, robotics and workplace automation technologies and the evolution of workforce and workplace models. The great expectations of technologies that seemed revolutionary a decade ago are now coming to fruition, augmenting the business transformation accelerated by the COVID-19 pandemic and expanded by post-pandemic economic factors. The transformation of work, the workforce and the workplace are now fully underway in parallel.

The future of work is already taking shape — and forward-looking enterprises are seizing the opportunity while balancing expectations for personal privacy. Organisations now have a tremendous opportunity to leverage their digital technologies and explore new ones for innovation and productivity gains in the post-digital age of the 2020s.

GREAT EXPECTATIONS, DISAPPOINTMENTS AND NEW DIRECTIONS

New technologies are often met with enthusiasm — as evidenced by the existence of the Gartner Hype Cycle — yet often fail to transform the world as expected or on the expected delivery timelines. Since

its beginning in the 1950s, the field of AI has cycled several times between 'AI spring' periods of optimism and massive investment, and 'AI winter' periods of disappointment, loss of confidence and reduced funding. Even with today's seemingly fast pace of AI breakthroughs, the development of long-promised technologies such as self-driving cars, housekeeping robots and conversational companions has turned out to be much harder than many people expected. As Portland State University Davis Professor Melanie Mitchell observes, 'One reason for these repeating cycles is our limited understanding of the nature and complexity of intelligence itself.'[12]

Consider voice-activated technology. When Apple launched the iPhone 4S in 2011 with its intelligent assistant, Siri, many prognosticators predicted that voice activation would completely replace keyboards. Yet, today, keyboards are as ubiquitous as ever — even as AI-enabled, voice-activated technologies such as Siri, Cortana, Alexa, smartphone text messaging and television remote controllers have become commonplace.

Another over-hyped technology, of course, is AI itself, subjected to great expectations for decades. In the 1968 film, *2001: A Space Odyssey*, for example, a pivotal moment in the plot is driven by an AI-powered spaceship computer with lip-reading capabilities — yet even today, the film is ahead of its time.

CEO Sundar Pichai at Alphabet Inc. (parent company of Google) once described developments in AI as 'more profound than fire or electricity'.[13] Consulting firm PWC has projected the economic value of AI activity to reach US$13tr by 2030. Others have forecast the widespread adoption of AI for such uses as interpreting radiology scans, enabling self-driving cars and accelerating medical research.[14]

While use of AI has significantly advanced, the grandest claims have been stymied by real-world obstacles. One is the significant investment required to adopt intelligent applications in a business environment. In addition, AI requires enormous data sets from which to learn, and data is not always readily available. Another, perhaps more significant obstacle is that, while current AI applications excel at pattern and image recognition, most lack cognitive abilities — 'common sense' — that many humans take for granted.[15]

ADVANCES IN VOICE ACTIVATION, NATURAL LANGUAGE PROCESSING, MACHINE LEARNING

While many AI technologies are still approaching the Peak of Expectations in Gartner's 2020 Hype Cycle, some are now advancing toward the Trough of Disillusionment. Natural language processing (NLP), deep neural networks, machine learning (ML), chatbots and certain other technologies are among those that are seeing wide adoption. Office workers often use AI-powered services without even knowing it. Internet search engines, Amazon's Alexa, Apple's Siri, Google's Gmail and other everyday tools are all becoming AI-enabled within the increasingly digital workplace.[16]

Deep learning — a subset of ML that is more nuanced and adaptive — is being applied in numerous industries. Cyber security teams, for instance, use deep learning and analytics to uncover potential IT threats. Financial services companies including JPMorgan Chase are using deep learning-based text analytics to detect insider trading activity and maintain regulatory compliance. Hedge funds apply text analytics to massive document repositories to uncover insights into future investment performance and market sentiment. Oil and gas companies are using deep learning algorithms to optimise their operations.[17]

Looking to add efficiency to its internal legal operations, Accenture built 'Accenture's Legal Intelligence Contract Exploration' (ALICE) tool to expedite contract searches.

As part of the global consulting firm, Accenture's legal team manages more than a million contracts at any given time. ALICE uses NLP and deep learning to help the legal team uncover contracts with specific keywords and clauses, with a custom-built clause extraction model focused specifically on contract clauses that are critical to risk management and client relationships. As a result, the team can uncover relevant contracts in minutes rather than spending untold hours or days searching for contract details.[18]

Voice activation may not have transformed business as prognosticators had predicted, but voice tools have become more advanced as NLP — another subset of AI — has matured, its development accelerated by the COVID-19 pandemic. While NLP has been around for years, completing simple tasks such as spell check and autocomplete or driving spam filters, it is growing increasingly sophisticated as larger data sets and ML techniques become available. Effective NLP models know, for example, when to query the customer for further information, drawing from a customer's complete history with a business, and when to complete a task for a customer.[19]

Just as humans learn how to understand written sentences, NLP systems now can understand contextual differences in meaning that humans use in text and speech. A group of OpenAI developers used a private beta version of the organisation's GPT-3 deep learning language model to generate short stories, songs, guitar chord charts, code and even an article about the model itself. One developer tester used GPT-3 to create web page layouts with simple written prompts such as 'a blue button that says Subscribe'.[20]

IBM's Global AI Adoption Index 2021 found that almost half of businesses are using applications powered by NLP and one in four businesses planned to begin using NLP technology over the next 12 months. Customer service is the top NLP use case,

with 52 per cent of global IT professionals reporting that their company is using or considering using NLP solutions to improve customer experience.[21]

During a 2019 benchmark test, a best-in-class NLP model scored near the human baseline level of language processing tasks such as semantics, argument structure and logic — creating the need for a new benchmark. In fact, Accenture predicts that within seven years the majority of people's interactions with intelligent systems will happen in NLP and AI-enabled spatial interfaces.[22]

Another much-hyped sector, XR — encompassing VR, AR, mixed reality (MR), digital twins, avatars, haptic feedback, holograms and other immersive technologies — has actually matured to the point of being removed from the Gartner Hype Cycle. Although these technologies are not commonplace in every workplace or home, virtual reality headsets are now widely available in video gaming.

Over the next five years, Gartner predicts that enterprises will move closer to adopting immersive technologies. Companies such as Apple, Accenture and Microsoft have been investing in devices and applications with rich potential for virtual collaboration, virtual meetings, product development, training, connecting with clients and other uses. With the rollout of 5G networks, XR/VR/AR technologies will be transforming everyday decisions and interactions with the physical world. Contrary to common perception, investment in VR and AR for industrial applications is outpacing investment for consumer uses.[23]

According to IDC, spending on AR/VR training — only one of many use cases for AR/VR in the workplace — will grow at a compound annual rate of 46 per cent between 2018 and 2023, reaching over US$8bn by 2023.[24] Also on the horizon are AI-enabled features, such as virtual assistants embedded into immersive technologies to create rich, responsive experiences. The future lies in context-aware, seamless and

adaptable AI-driven systems that put people at the centre.[25]

A deep-learning engine and NLP assistant in an AR environment could, for example, analyse contextual information to help an employee recognise and respond to objects, movements and co-worker emotions.[26]

Already, Microsoft's HoloLens 2 mixed-reality headset delivers contextual understanding of the visual environment, such as recognising that a virtual sofa is not just an image but a piece of furniture or identifying that a piece of equipment is operating in an unsafe manner.

The COVID-19 pandemic undoubtedly accelerated adoption of digital technologies to enable remote working or automation in the absence of reliably safe working conditions. In the second and third quarters of 2020, the US non-residential private sector spent more on computers, software and research and development than on buildings and industrial gear for the first time in over a decade, accelerating adoption of digital payments, telemedicine and industrial automation. Investors are enthusiastically funding innovations in medical diagnostics, logistics, biotechnology and semiconductors.[27]

A look at history will reveal that years often pass before a new technology delivers on the promise of greater productivity. As suggested by *The Economist*, companies may see reduced productivity growth as they invest in new technologies, business processes and expertise. Only much later do upticks in productivity appear — unless an unanticipated crisis such as a global pandemic sparks rapid testing and adoption of new technologies.[28]

THE POST-DIGITAL AGE OF BUSINESS TRANSFORMATION

For many organisations, the COVID-19 pandemic, coupled with technological advances, accelerated digital transformation initiatives that were already underway.

It spurred organisations to completely reimagine their business models, rethink their workforce models and reinvent their future real estate and workplace strategies. Some companies went so far as to completely change their delivery models to serve customers during the pandemic slowdown and shutdown, leading to the rapid expansion of digital e-commerce platforms.

There is no returning to the 'old normal' pre-pandemic and historical ways of working and executives seem to be welcoming the change — 53 per cent of CFOs say the new ways they are serving customers will put their organisations in a better and stronger position down the road.[29] Consumers now have a plethora of digital products and services to explore, including social media platforms, virtual smartphone assistants and smart home assistants that mediate the digital and physical worlds.

Even before the pandemic, 45 per cent of executives said that the pace of innovation in their organisations had significantly accelerated over the past three years because of emerging technologies.[30] New technologies are becoming catalysts for change, offering businesses extraordinary new capabilities. As Accenture predicts, the combination of distributed ledger technology, AI, XR and quantum computing (DARQ) will undoubtedly spark a step change across entire industries.

Cognitive technologies are transforming sales and marketing practices, particularly in using algorithms to uncover consumer preferences, or in automated chatbots that respond to basic customer inquiries. In fact, a 2019 Salesforce survey found that AI would be the technology most adopted by marketers in the years to come. In an analysis of more than 400 AI use cases, across 19 industries and nine business functions, McKinsey & Co. determined that the greatest potential value of AI pertains to domains related to marketing and sales, through impacts on marketing activities
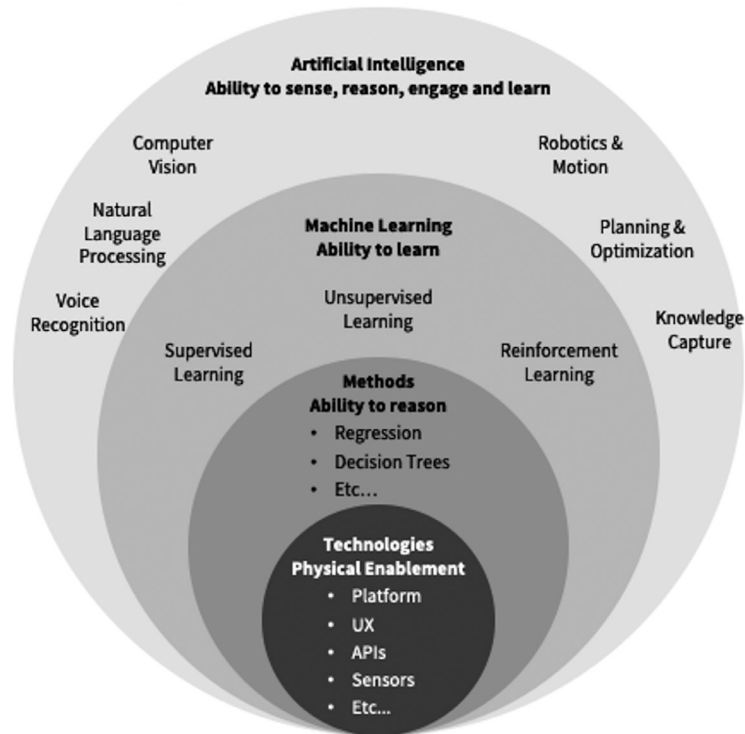
Figure 2: Intelligent automation ecosystem
Source: Deloitte[31]

such as next-best offers to customers, digital advertising and predictive lead scoring.[32]

Digital technologies and AI even played a role in bringing the Pfizer BioNTech SE COVID-19 vaccine to market. Already investing in digital transformation before the pandemic, Pfizer used AI tools to extract insights from vast amounts of clinical trial data. For instance, a Pfizer team created real-time predictive models of COVID-19 case rates at the county level to support clinical trial site selection. A COVID-19 medical dashboard provided researchers with high volumes of data streaming in from multiple external sources. Pfizer also submitted a fully virtual drug application to the US Food and Drug Administration (FDA) — a far cry from the typical application submission comprising thousands of pages of documentation.[33]

New business models are emerging as these technologies become more mature. Companies such as Amazon, Uber and Alibaba are more like ecosystems of companies, while established corporations such as Volkswagen are partnering with technology start-ups to create new products or improve existing ones.

THE CUSTOMISATION MANDATE

In the post-digital world, the next wave of technology will make it possible for products, services and even people's surroundings to be deeply customised — or what Accenture is calling 'individualised' or 'cooperative' — and delivered instantly on-demand.[34]

Stitch Fix, for example, delivers apparel directly to customers without requiring the customers to actually visit a physical store — Stitch Fix has none. Instead, customers fill out style surveys, provide their physical measurements, evaluate sample styles, create links to their Pinterest boards and send in personal notes. Stitch Fix's proprietary algorithms examine numbers, words and Pinterest pins, then summarise the findings for the company's human fashion stylists,

who in turn select suitable clothing to send to each customer.[35]

Automaker Mercedes, for example, is converting 'dumb' robots on its production line into human-operated, AI-assisted 'cobots' to enable unprecedented levels of customisation. Now, no two cars produced are the same.[36] Ralph Lauren, meanwhile, is advancing past simple customisations, such as allowing customers to pick a colour or add embroidery, and into on-demand manufacturing. Using a digital customisation platform, customers will be able to order jackets cut and sewn directly to their specifications.[37]

Customised and personalised experiences are applicable to numerous sectors beyond entertainment, with the potential to transform companies' relationships with both customers and employees. In fact, delivering highly personalised services is a top strategic priority for 90 per cent of businesses. Accenture predicts that within the decade, customer interactions will be multisensory, including haptics, vision, gestures or sound to drive cooperative experiences.[38] Increasingly, companies will be able to understand consumers, employees and business partners and to meet their goals and needs more than ever before, and they will have the ability to move even closer and act 'in the moment' to respond to customer needs and expectations.[39]

ROBOTICS COMING TO THE OFFICE

The role of robotics is evolving not just on the manufacturing floor, but also in the office as a new era of human–computer collaboration emerges. Ultimately, AI will enable software robots to become more intelligent and collaborative with humans, rather than performing simple tasks on their own, and free humans for higher-value work requiring creativity and individual judgment.

Already a familiar concept in office applications, robotic process automation (RPA) performs niche tasks to accelerate aspects of a larger workflow. RPA is able to replicate with accelerated accuracy the routine tasks that were once performed only by human beings. Driven by business rules, RPA traditionally does not learn or evolve in response to data. In accounting, for example, RPA is used to execute common, rules-based accounting tasks, such as transferring data from a PDF to an online form, and notifying a human when exceptions arise.

In 2020, as in previous years, RPA remained the most popular automation technology among companies globally, according to Deloitte research. The majority of companies — nearly 80 per cent — have already implemented RPA or plan to do so soon, followed by implementations involving optical character recognition/ intelligent character recognition (OCR/ ICR), business process management (BPM) and AI.[40]

RPA sales were amplified during the pandemic. According to Gartner, global revenue from RPA investment is likely to reach US$1.89bn — an increase of approximately 20 per cent over 2020. Gartner predicts that 90 per cent of large companies, particularly financial services companies, will use RPA in some form by 2022. One RPA company, Uipath, valued at US$35bn, launched its very successful public offering in April 2021.[41]

Piloting RPA in a human resources application, the US National Aeronautics and Space Administration (NASA) found that 86 per cent of transactions were completed successfully without human intervention. As NASA demonstrated, using RPA to fill niches within a greater workflow, such as transferring data to an online form or uncovering possible answers to a customer inquiry, is a common use case.[42]

Using RPA for end-to-end automation of an entire workflow requires an assemblage of point solutions and may not always be possible. Genpact, a global professional services firm with nearly 100,000 employees,

cobbled together multiple RPA technologies itself in an effort to link all individual actions in a particular workflow. One process step involved an employee looking up pricing information on the corporate website, stepping outside the core system. As a workaround, the RPA team incorporated computer vision — adding a camera to an employee computer — to capture the step. Such workarounds can, however, introduce errors and break a process. A better solution is deeper, machine-to-machine integrations.[43]

Genpact human workers can use process mining to monitor and troubleshoot individual instances of that process or fine-tune the process. Through process mining, for instance, if approval is required for changes of more than 10 per cent to an original invoice amount and is given 100 per cent of the time, the underlying business rule in the system could be manually adjusted from 10 per cent to 20 per cent. A pop-up message could remind employees that they do not need finance department approval for an invoice change of 10 per cent or less.[44]

RPA, NLP and new 'low-code' platforms are making technology more accessible, driving a shift toward the 'democratisation' of technology development by putting powerful capabilities into the hands of non-IT specialists. Amazon Web Service's Honeycode, for instance, lets non-technology users build mobile and web applications without writing a single line of code. Salesforce's Lightning App Builder is a point-and-click tool for creating custom pages on the Salesforce application. Power Apps tools can be directly embedded into Microsoft Teams. These tools, and many others, offer an incredible opportunity to bridge the gap between complex technology and workers, enabling every employee to contribute to digital transformation.[45]

Pepsi used Microsoft's Power Apps to rapidly build and deploy transformative digital applications across inventory and merchandising. The group created eight applications without a professional developer on staff and saved US$500,000 in the first year alone — and that was only one team of seven people. At IOOF, an Australian wealth management firm, the CIO launched a low-code competition in which developers were paired with less technical colleagues and all participants were given two weeks off to experiment with OutSystems, their low-code platform of choice. Employees with outdated skills did not need to spend years retraining, and the low-code apps they created are fulfilling mission-critical needs. One has evolved into a full-scale production system.[46]

While IT teams will still handle major implementations and the most advanced technologies, the people facing day-to-day business problems will be empowered to create technology-driven solutions themselves using new tools that do not require deep programming expertise. Every employee can be an innovator, fixing pain points and keeping the business in lockstep with new and changing needs.[47]

ARTIFICIAL INTELLIGENCE, COGNITIVE TECHNOLOGIES AND INTELLIGENT AUTOMATION BECOME ESSENTIAL

The next phase of digital transformation will be driven by businesses willing to make AI investments for competitive advantage. One indicator of AI's importance is that Google is now calling itself an 'AI-first' organisation. Industries particularly ripe for AI transformation include technology and communications, automotive, energy and resources and financial services, followed by media and entertainment, transportation and logistics, consumer packaged goods and retail.[48]

By 2025, at least 90 per cent of new enterprise applications will embed AI. Most of these AI-enabled apps will deliver incremental improvements to make applications 'smarter' and more dynamic. More disruptive AI-led applications will take longer to develop and achieve mainstream adoption, representing about 10 per cent

of total enterprise applications by 2025. By 2024, over 50 per cent of user interface interactions will use AI-enabled computer vision, speech, NLP and AR/VR.[49]

Using algorithms to detect patterns and uncover meaning in vast data pools has been a highly effective use of cognitive technology. Used by major e-tailers and streaming services, ML and deep learning algorithms can predict what a customer will buy, identify financial fraud, inform actuarial modelling, and perform all manner of other data and analytics tasks. Where traditional analytics tools are static, cognitive tools have the ability to improve at their tasks, learn from the data they generate, and even piece together data appearing in slightly different formats. GE, for instance, has used intelligent automation to integrate supplier data and saved US$80m in one year by consolidating vendor contracts that were previously managed at the business unit level.[50]

Hundreds of companies around the world are working on emotion-decoding technology that observes facial micro-movements to identify happiness, anger, surprise, fear and other emotions. The technology is a natural evolution of facial recognition systems that identify individuals, but is far more invasive, with the potential to not just understand how someone is feeling in the moment, but also to decode their intentions and predict their personality.[51]

To teach computers how to predict human behaviour, US tech giants including Amazon, Microsoft and Google all offer basic emotion analysis, while smaller companies such as Affectiva and HireVue tailor it for specific sectors such as automotive, advertisers and recruiters. Disney has used the software to test volunteers' reactions to a range of its films, including *Star Wars: The Force Awakens* and *Zootopia*. Car companies such as Ford, BMW and Kia Motors want to use it to assess driver alertness. The marketing firm Millward Brown has tested it to gauge how audiences respond to advertisements for clients such as Coca-Cola and Intel.[52]
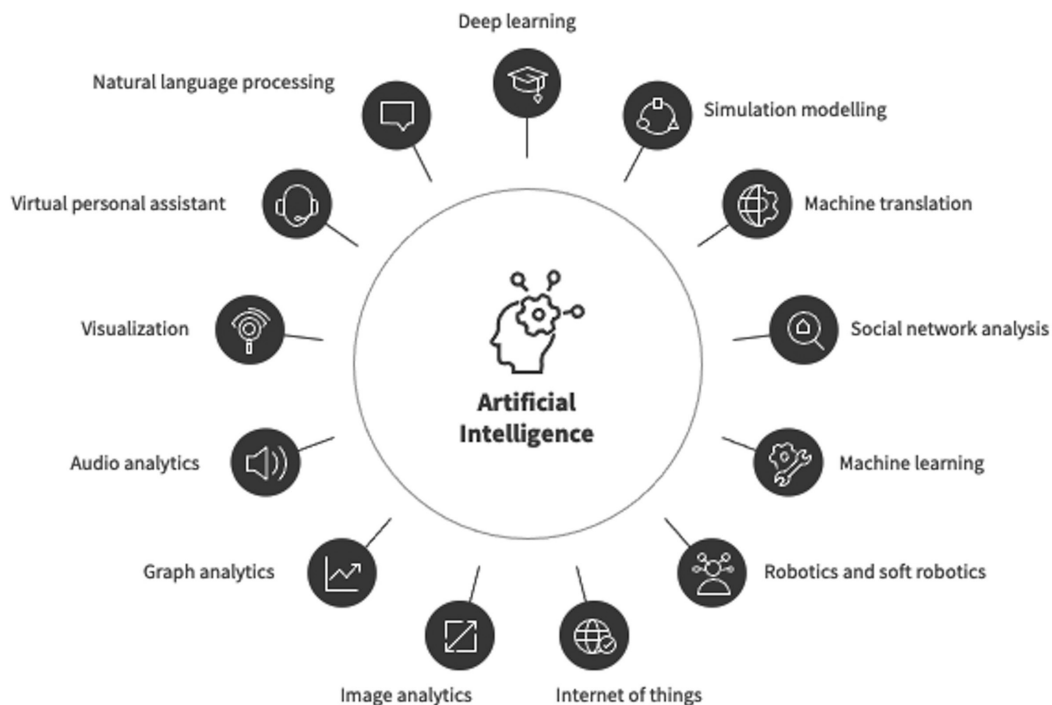

Figure 3: Applications for AI
Source: Naolink[53]

Cognitive technologies are steadily infiltrating business operations across industries, with many companies experiencing both increased revenues in some activities and decreased costs in others. Globally, 50 per cent of companies have adopted AI in at least one function, with adoption being led by the high-technology telecommunications, automotive and assembly sectors in particular. For 22 per cent of companies globally, the use of AI contributed more than 5 per cent of enterprise-wide earnings before interest and taxes in 2019.[54]

More than two-thirds of companies using AI in inventory and parts optimisation, pricing and promotion, customer service analytics and sales and demand forecasting report increased revenue as a result. Over half of companies report reduced costs from incorporating AI into talent management, contact centre automation and warehouse automation.[55]

Forrester, the research group, notes that about two-thirds of financial services companies have implemented or are adding AI in areas from customer insights to IT. AI-driven data mining helps banks identify the most promising customers — and those most likely to commit fraud. Schroders, an investment fund manager, uses AI tools that forecast the performance of companies after initial public offerings, monitor directors' trades and analyse the language in transcripts of meetings. The company is also among the many financial institutions that are using AI and RPA to perform low-judgment, repetitive back-office processes.[56]

Consumer-focused companies such as Netflix and Uber are using AI algorithms to align customers and product offerings. Netflix creates content based on customer preferences, leveraging its real-time access to customer behaviour to increase return on investment and reduce risk. Uber matches supply and demand to provide price-optimised transport that is more convenient and faster than traditional cabs or public transit. Alibaba uses AI to efficiently match buyers and sellers in both its online and brick-and-mortar channels.[57]

In the commercial real estate sector, Oxford Properties Group has developed an AI-powered technology called Project Alpha to create models of potential properties to add to the investment firm's US$62bn, 150m sq. ft portfolio spanning the globe. Project Alpha uses information from approximately 50 data sets to quantify every detail about a property and its environment. Oxford has used the technology to acquire, for example, life sciences properties in Boston, Berkeley, California and Seattle.[58]

Several specific AI capabilities came to the forefront during the COVID-19 pandemic and will now continue to mature, enabling companies to implement AI more easily at scale. Business intelligence platforms are being augmented with NLP, text analytics, predictive analytics and other AI and ML capabilities, enabling business intelligence teams to leverage data and analytics without hiring dedicated data scientists. No-code AI and automated ML platforms are enabling business and operations teams to develop advanced analytical capabilities and automated decision making without specialised data science skills. Embedded in business functions across an enterprise, automated ML platforms will enable teams to quickly implement AI tools to drive efficiencies and create new products and services.[59]

THE NEW ERA OF HUMAN–MACHINE COLLABORATION

Over the next decade, applications pertaining to collaboration, human resources, knowledge management and meeting facilitation, to name a few, will all soon contain AI-based features and some degree of intelligent automation. AI will offer employees unprecedented information awareness and insight, freedom from low-value-add activities and the ability to easily use complex technologies.[60]

The World Economic Forum Klaus Schwab's *The Fourth Industrial Revolution* anticipated that, as soon as 2025, the workforce will be a complex ecosystem of humans and machine power, potentially splitting global work and workflow activities 50/50.[61] Many familiar jobs will no longer require humans at all, while emerging new careers will demand skilled professionals with expertise in managing the machines and leveraging the insights gained from AI-enabled data and analytical platforms.

During 2020, for the first time, companies outside the auto industry — a traditional automation pioneer — accounted for more than half of industrial robot orders, according to the Association for Advancing Automation, an industry group. Fourth quarter 2020 and first quarter 2021 were the second and third best quarters for industry orders in nearly 40 years of record keeping.[62]

Beyond simply automating rote processes, forward-looking companies are looking ahead to incorporate AI, NLP and XR technologies to unlock new ways for humans to interact and collaborate with machines. AI technology has the potential to become a partner on its own alongside human counterparts, comprising a 'superteam' to focus upon innovation and complex problem solving.[63]

Volkswagen already pioneered the superteam concept when it partnered with Autodesk's AI-powered generative design tools to reconceptualise the classic Microbus. Responding to design goals and constraints provided by human engineers, the AI system generated a wide range of feasible — and sometimes unexpected — design solutions. Ultimately, the human–AI team produced parts for the Microbus that were lighter and stronger than any previous parts and reduced the product development life cycle from 1.5 years to just a few months.[64]

As the future of work continues to evolve, emerging AI and intelligent automation technologies will enable the accelerated growth of human–machine collaborative ecosystems. Human–machine collaboration will provide increasingly powerful levels of human performance, improved business performance with significant societal impact, thanks to the ever-increasing capabilities of non-human collaborators.

New ways of working will undoubtedly lead to some worker displacement and reinforce the need for greater workforce
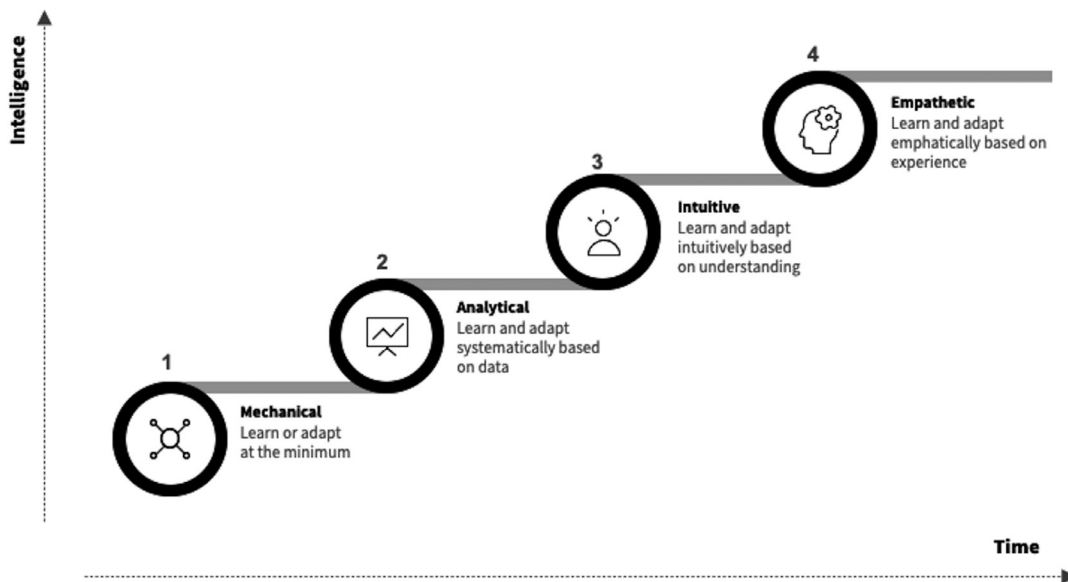
Figure 4: The four levels of intelligence
Source: Huang and Rust[65]

reskilling globally; however, new ways of working will also offer the promise of unlocking greater human potential and human achievement with new job opportunities focused upon innovation and enhanced creativity.[66]

Policymakers, private and public organisations will need to carefully monitor and manage the accelerated growth of intelligent automation to ensure a new future of positive societal benefits filled with opportunities to create a better world for everyone.

Author's note

Part 2 of this paper, to be published in the next issue of *Journal of AI, Robotics & Workplace Automation* (*AIRWA*), will explore the impact of intelligent automation and AI upon the workforce and workplace, as well as the societal impacts of the intelligent automation technologies that will transform business, society and life itself.

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