

**DIGITAL
HORIZONS:**
TECHNOLOGY,
INNOVATION,
AND THE
FUTURE OF
ACCOUNTING

Think Ahead

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DIGITAL HORIZONS: TECHNOLOGY, INNOVATION, AND THE FUTURE OF ACCOUNTING

This report intends to establish a foundation from which to explore this exciting future by first reflecting on how ACCA members are thinking about their future, and then addressing the role that technology is expected to play in this future landscape. In the summer of 2023, it is almost impossible to avert focus from the swell of interest and activity around artificial intelligence (AI), and generative AI more specifically. Therefore, the report will also discuss the impact of AI on the accountancy landscape while highlighting the crucial role of finance professionals in steering ethical and responsible adoption.

The *Digital Horizons* survey was conducted in March 2023 garnering 1,074 responses across ACCA's global membership. The survey was targeted at members currently employed across all regions and sectors. Students were not included. Twelve roundtables were held with 81 participants across the Asia Pacific, UK & Europe, Africa, and North America.

Contents

Executive summary	5
Survey demographics	8
1. Introduction	9
Innovation cycles	9
How do we navigate our digital horizon?	12
2. The technologies of the 'digital horizon'	13
Technology landscape	13
What's the fuss about AI?	14
The new kid on the block: Generative AI	15
Hype and expectations	18
The perception–implementation gap	19
3. Digital transformation and technology adoption	21
Technology state of play	21
Why adopt new technologies?	24
Challenges to adoption	27
Identifying potential innovator traits: commerciality, leadership, pragmatism	29
4. Deeper Dive: adopting artificial intelligence	35
AI: Definitions for accountancy and finance	35
How do machines 'learn'?	37
Trusting AI	38
Implementing machine learning in practice: Example – Three UK	42
Putting generative AI into practice	45
Changing how we interact with technology: should you learn 'prompt engineering'?	48
Ethical accountability	49
5. What does this mean for finance teams?	51
AI literacy supports future accountability	51
Will AI displace accountancy and finance jobs?	53
Future avenues	54
6. Skills for the future	56
Member practices and training intentions	56
Data literacy for decision-making	57
The basis of advanced analytics: data modelling	59
7. Towards the digital horizon	61
References	62

Executive summary

The *Digital Horizons* report reveals a profession grappling with new technologies, different speeds of adoption and multiple challenges to streamlining delivery.

Yet the report also highlights new possibilities to drive value through digital implementation – and it's here that the right skills and mindset are crucial. Drawing on the survey results of over 1,000 ACCA members as well as 12 roundtables across the world, this report presents an initial assessment on the technology landscape current state of play.

Adoption of new technologies remains limited and uneven

When it comes to technology organisation size does in fact appear to matter. There is an obvious gap between larger organisations and small and medium-sized enterprises (SMEs) or small and medium-sized practitioners (SMPs). Larger corporates and the bigger accountancy firms are more likely to be implementing new technologies – critically they may also be more focused on gaining competitive advantage through digital transformation initiatives.

It is clear that there remains a great opportunity to expand the understanding of and engagement with some of the more widely applicable technologies such as AI and Machine Learning to realise the potential of these technologies across accountancy and finance.

Leading organisations see technology as value adding, not just efficiency enhancing

For the majority of respondents, digital adoption is viewed through the lens of efficiency, with efficiency, process optimisation and cost savings identified as the top three reasons why new technology is being adopted.

In fact, technology adoption is still primarily treated as an efficiency play by more than half of all survey respondents. Despite widespread optimism about the extent to which digital transformation, more broadly, can enhance things like flexibility / adaptability, quality of products or services, sustainability performance, transparency, and/or regulatory compliance, practical business constraints may typically enforce a focus on a narrower set of goals, at least initially.

But according to our survey leading organisations are increasingly attuned to the wider benefits digital adoption can bring. They are more likely to be focused on competitive advantage and enhancing customer / client insights as well as exhibiting stronger leadership and data governance processes to embed the technology successfully.

Widespread expectations around the potential for technology and digital transformation to enhance things like quality, compliance, and sustainability performance remain largely prospective.



Evolution or revolution: respondents are split on the potential value of AI

When it comes to artificial intelligence (AI), ACCA members are overwhelmingly positive about its potential to save them time, and half would be willing to use AI for business-critical tasks.

Indeed, there is general agreement that AI has the potential to make processes more efficient and more effective. On the other hand, there is less consensus about the purpose of pursuing efficiency gains and the extent to which AI can be used to take a more transformational approach.

Many see AI as not dissimilar to previous transitions, such as the move from Excel to Business Intelligence tools. But as the acceleration of business amplifies demands on finance teams it might be necessary to reconstruct tasks, realising the role that technology plays as an enabler of capabilities but also as a converter of value.

It's early days for Generative AI in accountancy and finance

Generative AI models are acclaimed for their ability to summarise or interpret large amounts of information quickly and produce novel or new content from this information. These technologies offer new possibilities in reporting, research, and risk assessment if used responsibly, yet risks prevail in their application. The potential for misuse is significant, where Generative AI models have not been specifically trained on and/or fine-tuned for a particular purpose or on the most relevant and recent data.

The model's inability to discern truth is a determining factor limiting uses to situations where:

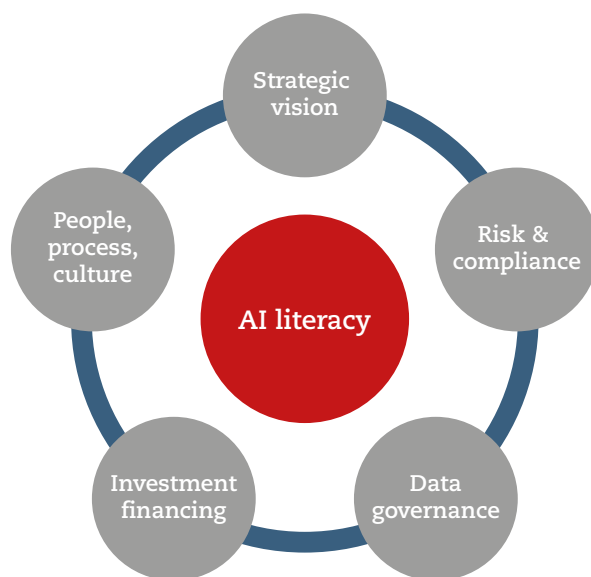
1. It is possible / relatively simple to check or correct outputs;
2. Where there is a clear source of truth such as within the training data or in original documents;
3. Where the generative capabilities are being used for creative or inspirational purposes.

FINANCE TEAMS HAVE A CRITICAL ROLE TO PLAY IN HELPING ENSURE THAT AI MODELS ARE USED ETHICALLY AND EFFECTIVELY ACROSS THE ORGANISATION.

AI adoption needs a circle of accountability

Accountancy and finance professionals should be pragmatic in their approach. Risks will evolve, and it's critical that accountants continually understand how risks can be assessed and mitigated with all technology adoption, but particularly AI.

Professional accountants and finance teams must collaborate on ethical and effective AI adoption across organisations. Our report suggests there is a circle of accountability that establishes the core practices required to ensure ethical adoption:



- **Strategic vision:** Aligning the capabilities of AI to the strategy of the organisation.
- **People, process, culture:** Sharing AI best practices across the organisation.
- **Risk and compliance:** Ensuring risk professionals collaborate with technology teams to govern AI.
- **Investment financing:** AI investment entails uncertainty; financial flexibility to support experimentation is key.
- **Data governance:** Data governance is key in ensuring the ethical use of AI and compliance with legal requirements.

Finance teams have a critical role to play in helping ensure that AI models are used ethically and effectively across the organisation. This requires that finance professionals keep up to date with the latest developments in AI technologies and, secondly, actively collaborate across the organisation with those teams who are driving innovative solutions around this emerging technology.

How will AI affect jobs in finance?

When it comes to the impact of new technologies on jobs, cautionary tales are relevant. Fears of increasing complexity, expressed by more than a third of survey respondents, should be a firm reminder that change requires effective management and a people-focused approach. Technical and cultural challenges tend to be intertwined.

However, an overly pessimistic account masks the fact that demand(s) on and for accountancy and finance professionals continue to grow. The adoption of AI increases rather than decreases the importance of experts – such as finance and/or risk professionals – to oversee critical processes and functions. AI may offer helpful support and productivity boosts, but it will not be able to

replace the ability to think critically and consider a broad array of contextual factors when making decisions, even when made on the basis of AI-driven insights.

Moreover, while some tasks will inevitably be transformed by technology, new opportunities will also emerge in areas like sustainability reporting and algorithm audits. By proactively developing crucial new skills like AI literacy, enhanced data capabilities, and decision science frameworks, professionals can ensure they remain integral to steering their organisations and clients to a better future.

The digital horizon brings change but also new potential to add value. With the right skills and mindsets, professionals can advance their capabilities and their profession to meet the emerging challenges ahead.

FIGURE ES1: Key technologies transforming the landscape

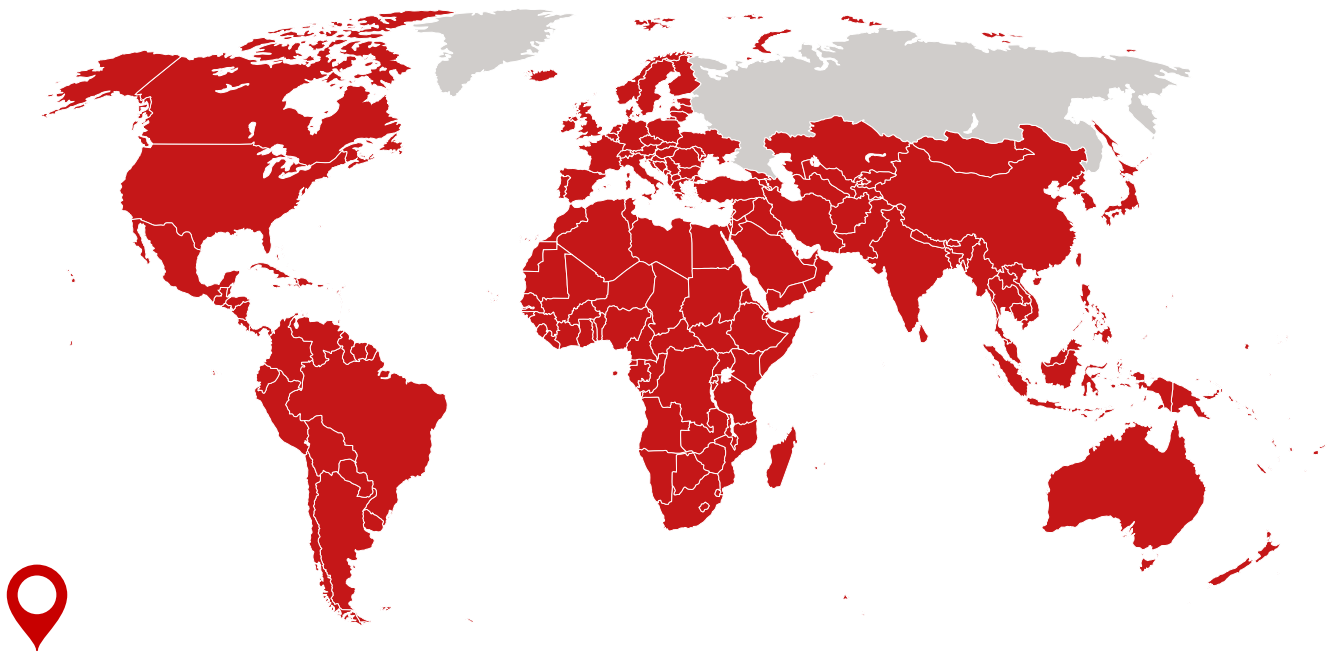


Click on each icon to read descriptions of the key technologies in Section 2

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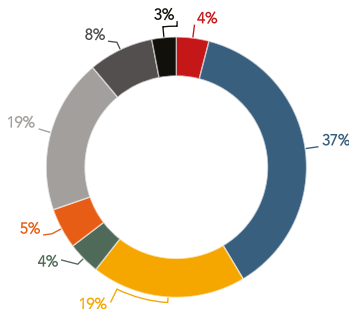
Survey demographics

The ACCA would like to express our deepest thanks to all members who participated in the survey and the roundtables in support of this research.

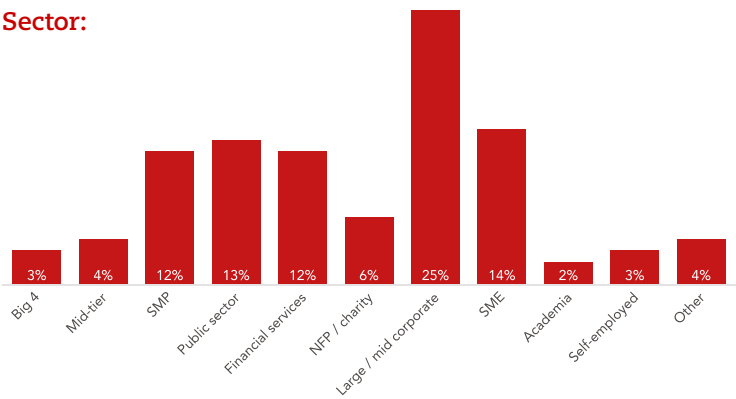


Location of survey respondents:

● North America ● Western Europe ● Asia Pacific ● Middle East
● Central & Eastern Europe ● Africa ● South Asia ● Caribbean



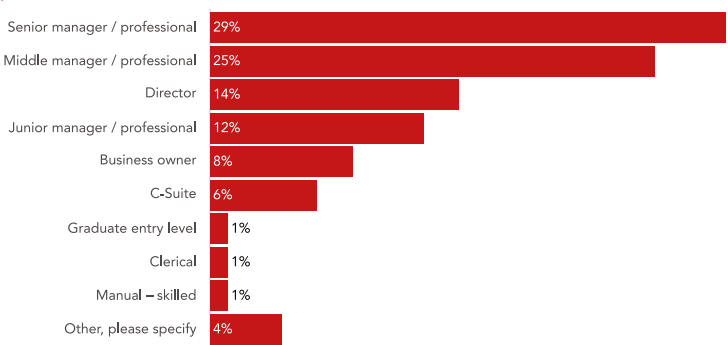
Sector:



Location of roundtable participants:

North America	13%
Western Europe	21%
Asia Pacific	18%
Middle East	14%
Central & Eastern Europe	5%
Africa	14%
South Asia	9%
Caribbean	2%
China & Hong Kong SAR	4%

Job role:



1. Introduction

The digital horizon serves as a compelling metaphor when contemplating the future of accountancy and finance. First and foremost, it alludes to the imminent advancements in technologies, charting a course towards an ever-evolving landscape of automation, artificial intelligence, and other technologies.

More than just tools and technologies, however, it also hints at the vast expanses of data that are products of our increasingly digital interactions and that serve as critical inputs for future developments. As such, it also draws attention to the ways in which our digital comprehension might be challenged. As we sail towards the horizon, we are confronted with new paradigms that threaten to make our domains of expertise less familiar. Finally, the metaphor is apt as it symbolises the convergence of the physical and digital domains. In the context of accountancy, this could refer to present situations where digital ledgers, virtual financial interactions, and more traditional practices seamlessly intertwine. But it also looks to the extension of those circumstances and captures our move towards a blurring of the lines between the physical and digital worlds. With advancements like IoT, cyber-physical systems, and augmented reality, the information from the digital world influences and drives actions in the physical world and vice versa. This seamless integration allows for real-time feedback loops and automation that were previously unthinkable. As such, the digital horizon offers a useful means for considering how accountancy and finance professionals can anticipate and adapt to the transformative shifts on the brink of realisation.

The *Digital Horizons* report intends to establish a foundation from which to explore this exciting future by first reflecting on how ACCA members are thinking about their future, and then addressing the role that technology is expected to play in this future landscape. In the summer of 2023, it is almost impossible to avert focus from the swell of interest and activity around artificial intelligence (AI), and generative AI more specifically. Therefore, the report will also discuss the impact of AI on the accountancy landscape while highlighting the crucial role of finance professionals in steering ethical and responsible adoption.

THE DIGITAL HORIZON OFFERS A USEFUL MEANS FOR CONSIDERING HOW ACCOUNTANCY AND FINANCE PROFESSIONALS CAN ANTICIPATE AND ADAPT TO THE TRANSFORMATIVE SHIFTS ON THE BRINK OF REALISATION.

Innovation cycles

Since the 1960s, diffusion theories have sought to understand and explain the ways in which innovation occurs (Rogers 1962). Taking inspiration from research on complex systems such as biology and population science, diffusion theories have been widely applied to other complex systems related to social, economic and international systems. What unites these various applications is the idea of the sigmoid curve (s-curve), which represents the rate of diffusion or growth of a particular variable over time.

Terminology derived from these studies has seeped into the public conscious. Talk of early versus later adopters, for example, a ubiquitous phrase amongst technology observers, stems directly from Rogers' *Diffusion of Innovations* written in 1962. The s-curve has also proven to be a widely useful representation of how several processes typically work, including around the spread of innovation, rates of adoption, phases of adaptation, and performance improvement. Of course, in dealing with complex systems what these studies tend to lack is the ability to address all the critical factors distinguishing one s-curve from another or even what drives the trajectory of a particular innovation. But they do provide useful illustrative models that point towards particular phases during which different variables and considerations are likely to come into play.

It can be argued, for example, that each major industrial revolution has been defined by a group of technologies following S-curves of performance improvement. In this sense, s-curves are generally indicative of how technologies propel innovation over time. When considered in a solitary fashion, an s-curve might demonstrate the way in which one technology matures and its development levels off over time.

While initial progress may be slow, as knowledge increases the rate of improvement follows a steep upward trend until practical and economic constraints limit further advancement. When an established technology nears this performance limit, it often creates opportunities for new technologies to emerge and follow a new S-curve trajectory. In some ways, s-curves can also reflect the way in which technologies are adopted over time.

Industrial revolutions

Thus, over a longer period, s-curves reflect an element of cyclical by following repetitive cycles of emergence, improvement, peak, decline and replacement. New technologies build on old ones to continue economic and social advancements (Figure 1.1).

This element of cyclical leads directly into our conceptualisation of industrial revolutions (Figure 1.2).



For example, the first industrial revolution was driven by steam power and mechanisation.



The second industrial revolution was catalysed by electricity generation and use. Electrical technologies such as motors, lighting and appliances led to more widespread automation in factories.



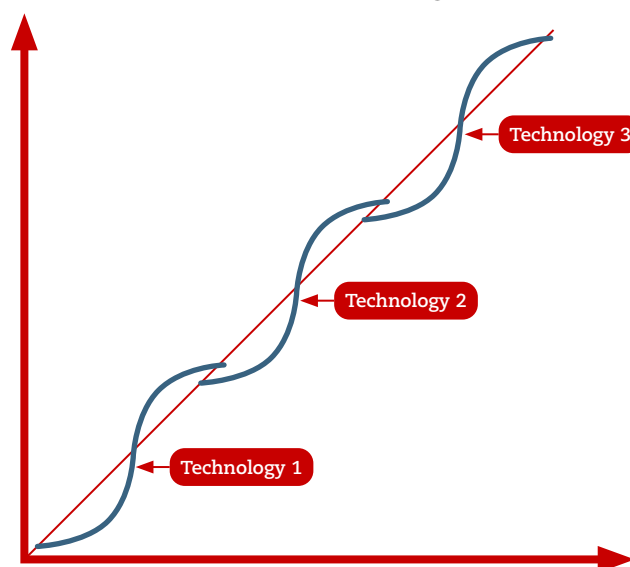
The third revolution was powered by electronics and computing, with transistors, microchips and software improving dramatically, enabling more advanced forms of automation, communication and analysis.

During this period, the limits of paper-based bookkeeping were also reached as the amount of data became unmanageable. Basic accounting software such as VisiCalc emerged in the 1970s and '80s, allowing for improved efficiency, accuracy and analysis compared with manual methods, but these early programs quickly reached limits in areas such as reporting, data sharing and workflow.

The development of enterprise-wide accounting systems such as SAP and Oracle in the 1980s and '90s moved accountancy to a client/server model, enabling faster reporting, improved data security and consolidated views across departments and locations. Challenges then emerged from system speed, connectivity and cost.

The rise of cloud-based accounting and software as a service (SaaS) such as QuickBooks Online and Xero in the 2000s signified the next phase

FIGURE 1.1: The S curve of technological innovation



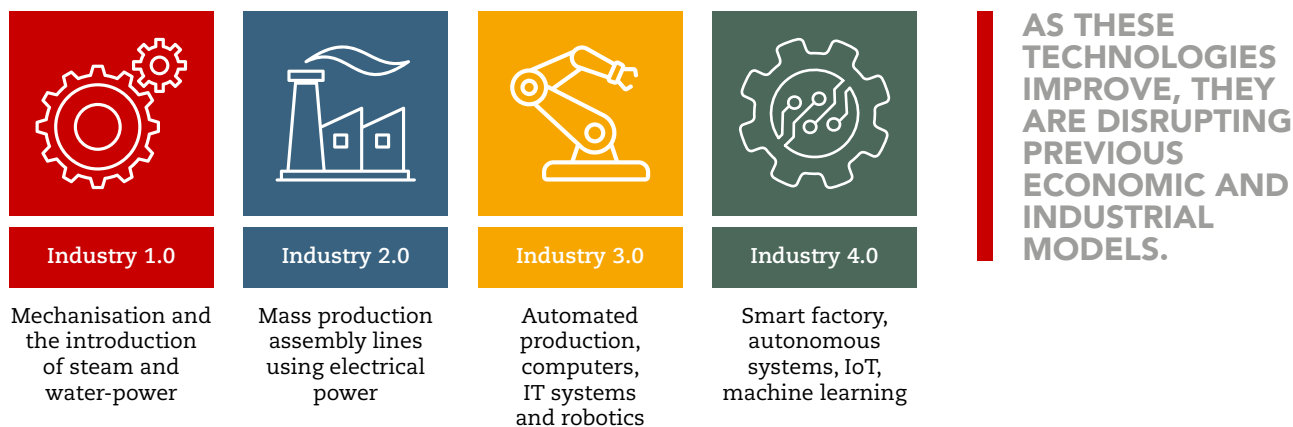
of development. Benefits for personnel included increased mobility, collaboration and automation but also gave rise to concerns about data security, privacy and reliance on internet connectivity.



The fourth industrial revolution is being propelled by digital technologies, including AI, sensors, robotics, and networks. As these technologies improve, they are disrupting previous economic and industrial models. This phase has coincided with the wider adoption of automation into accounting processes, with 'bots' that can handle repetitive, rules-based tasks such as data entry and report generation alongside advanced analytics for faster insights derived from massive datasets.

Inflection points, where one S-curve peaks and another takes off, drive the enormous shifts we call industrial revolutions. Understanding S-curves helps explain the constant cycle of disruption and transformation.

FIGURE 1.2: The progression of industrial revolutions



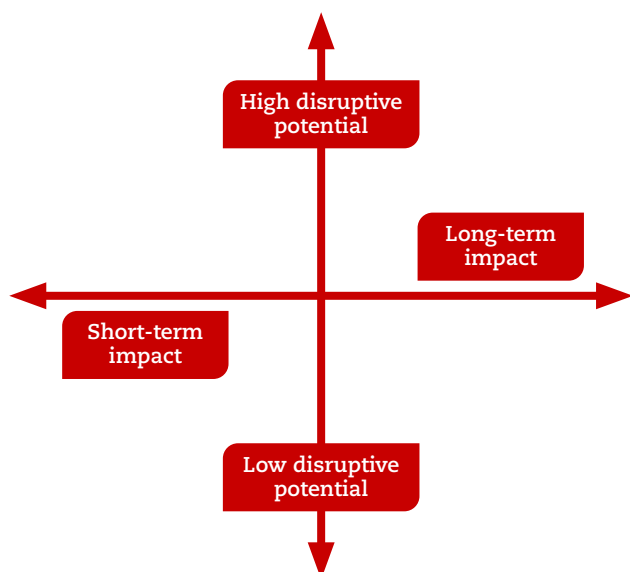
Within the field of AI this dynamic is also playing out. As earlier statistical and rules-based AI approaches reached their limits, new techniques such as deep learning kicked off an exponential climb in capabilities.

The current wave of AI advancement is still on a steep upward trajectory, as larger datasets, more advanced neural network architectures, streamlined frameworks and specialised hardware unlock rapid gains across language, image recognition, decision-making, and other domains.

Just as internal combustion engines and integrated circuits sparked new S-curves to sustain growth when previous technologies peaked, advancements in deep learning and neural networks are carrying the baton of innovation forward. Looking ahead, emerging fields such as multimodal learning, causal inference and trustworthy AI may soon branch off their own curves, sustaining AI's open-ended progress.

This is an exciting but also challenging context for business leaders and finance professionals, who are often looked to for a clear assessment of the potential that any technology holds for their organisation and a widening range of stakeholders. Finding the right balance between potential long-term value and the associated level of disruption is an overarching objective mediated by the complexity of existing processes, legacy considerations, employee needs, customer expectations, environmental and societal impact, and more (Figure 1.3).

FIGURE 1.3: Possible relationships between disruption caused by new technologies and their impacts



Bumpy road of adoption

So, it goes without saying that the adoption of new technologies is challenging, often requiring significant change management and, at times, a steep learning curve. Even once new technologies are adopted, professionals must learn new tactics to employ them, transforming traditional practices. The mixture of practical adoption challenges and overcoming these learning curves tends to determine the pace and extent to which different organisations, sectors and/or economies adapt, as well as whether a particular technology is likely to be widely useful.

Blockchain is a good example. It is a technology that has garnered significant attention for its potential to revolutionise accounting (and beyond). Its adoption for financial transactions, however, has been hampered by transparency issues and data privacy concerns. Despite the hype, blockchain technology has yet to gain widespread trust and acceptance in the accounting field. Current debates about the feasibility and desirability of using blockchain for bookkeeping reflect the complexities and uncertainties associated with new technologies.

‘There are many people talking about blockchain replacing bookkeepers. I have been working in the blockchain industry since 2017. The tech is just not there yet for people to actually trust blockchain to do bookkeeping and at the same time ensure that the data can be kept private. For example, if you put your data on Ethereum, everyone can read it. For many companies, this is just unacceptable. But if you go to a private blockchain, there are just a few computers running the blockchain. So actually it is not the same. It is the dilemma for the blockchain application in the finance industry.’

Asia Pacific Roundtable participant

THE ADOPTION OF NEW TECHNOLOGIES IS CHALLENGING, OFTEN REQUIRING SIGNIFICANT CHANGE MANAGEMENT AND, AT TIMES, A STEEP LEARNING CURVE.

How do we navigate our digital horizon?

This *Digital Horizons* report sets a foundation for an exploration of developments that are likely to change the near to medium-term future of accountancy and finance. This is intended to generate further discussion and debate as well as establish a basis from which we, as a profession, can responsibly lead the way on innovation, especially pertaining to the adoption of AI. When it comes to the latter, we should be mindful of the relationship between data and decision-making, how this is evolving with new capabilities and what it might mean for new and existing roles.

Drawing on findings derived from survey research and a series of roundtables, the report has three related, but distinct objectives:

- First, to understand the landscape of evolving technologies within the context of ongoing digital transformation and technology adoption amongst members.
- Second, to explore one set of technologies – artificial intelligence – in greater depth to understand member attitudes, potential uses and considerations around adaptation of existing practices.
- And third, to consider new opportunities as well as how competencies and skills might be enhanced to enable wider adoption of artificial intelligence and machine learning capabilities.



THIS *DIGITAL HORIZONS* REPORT SETS A FOUNDATION FOR AN EXPLORATION OF DEVELOPMENTS THAT ARE LIKELY TO CHANGE THE NEAR TO MEDIUM-TERM FUTURE OF ACCOUNTANCY AND FINANCE.

2. The technologies of the 'digital horizon'

Technology landscape

Patents are a good indicator of where major developments are not only occurring, but where commercial and other applications are being developed (Table 2.1). AI and big data have seen an enormous increase in activity over recent years. Other digital technologies, such as connectivity and storage facilities as provided by cloud computing have received substantial interest, as have autonomous systems such as robots and self-driving cars. The Internet of Things (IoT), on the other hand, has witnessed some fall-off in activity coinciding with divestments from some large telecommunications companies such as Vodafone and Ericsson over the last three years. This may be partially reflective of current challenges in scalability and cost, but it could also be linked simply to the relative level of maturity of the technology, which would be expected to lead to a reduction in activity. Nonetheless, the IoT remains a crucial part of our technological future, including being part of other developments, such as 'digital twins' (discussed below).

TABLE 2.1: The growth of various digital technologies, 2016–2020, measured by patents issued

	AI 718%*
	Big data 699%*
	Digital technologies 172%*
	Cloud computing 122%*
	Autonomous systems 109%*
	IoT -81%*

*Growth of technologies as percentage of total patents' average growth, 2016–2020 (WIPO 2022)

Big data

The ability to examine large, diverse sets of data to uncover hidden patterns, correlations, and insights means that big data will continue to be important. Its significance lies in its ability to provide businesses with valuable information that can be used to identify new opportunities, improve efficiency, and make informed decisions. In the accountancy profession, big data analytics is the basis of anomaly detection, identifying inconsistencies in financial statements, predicting future revenue trends, or evaluating risk factors for audits. For example, by analysing customer transaction data, an accountancy firm can identify patterns or trends that may suggest fraudulent activity.

Internet of Things

The term 'IoT' refers to a network of physical devices that communicate and interact with each other via the internet. Its significance lies in its ability to generate and collect vast amounts of data from various sources. IoT is a mature technology, but its applications continue to grow with advancements in connectivity and sensor technology. In accountancy, IoT can provide real-time data for improved decision-making. For instance, in asset management, IoT devices can track the use and condition of assets, providing accurate data for depreciation and maintenance expenses.

VR / AR

Virtual and/or augmented reality (VR/AR) provide a simulated experience (VR) or an overlay of digital information on the real world (AR). They are significant for their potential to enhance user experiences, for example in providing immersive training and visualising complex data. VR/AR is advancing rapidly, with growing commercial and consumer use. In accountancy, these technologies could revolutionise the way financial data is visualised and interacted with. For example, an auditor could use AR to overlay financial data on physical assets during an audit.

Digital twinning

A digital twin is a virtual replica of a physical system, used for simulation and analysis. This technology is crucial as it allows companies to analyse the performance of systems, predict failures, and simulate scenarios. Digital twinning is advancing and is being introduced in industries such as manufacturing and logistics. In accountancy, digital twins could be used to model a company's financial systems, allowing for scenario analysis and improved financial planning. For example, a digital twin of a company's supply chain could help accountants understand the financial impact of potential disruptions.

Computer vision

Computer vision is a sub-field of AI that enables computers to interpret and understand visual data. Its significance lies in its ability to automate tasks that require visual understanding. It's a maturing technology, finding increased use in sectors such as autonomous vehicles and healthcare. In accountancy, computer vision could automate such tasks as receipt or invoice scanning, reducing manual data entry. For instance, it can be used to read and categorise paper receipts, aiding in expense management.

Connectivity / networking

Connectivity/network technologies (eg, 5G) are the backbone of communication systems, ensuring fast, reliable and secure data transmission. They are essential for the functioning of an increasingly digital and interconnected world. Currently, 5G is being rolled out worldwide, offering significant improvements over previous generations. In accountancy, improved connectivity can enable faster data access and analysis, support remote work, and enhance the use of cloud-based accounting systems. For example, 5G could support real-time inventory tracking for accurate, up-to-date financial reporting.

Advanced robotics

The term 'advanced robotics' refers to robots capable of performing complex tasks autonomously or semi-autonomously. These robots are significant for their potential to automate tasks, increase productivity, and perform tasks beyond human capabilities. The technology is advancing rapidly, with increased use in industries such as manufacturing, healthcare and logistics. These advanced forms of machinery are different from robotic process automation (RPA) software used in accountancy, to automate manual tasks such as data entry and reconciliation including the process of closing books at the end of a financial period. By contrast, advanced robotics as used in a manufacturing process can vastly increase flows of data (such as diagnostics) and enhance operational efficiencies through regular monitoring and improvement.

Blockchain

Blockchain is a type of digital ledger technology that records transactions across multiple computers in a secure and transparent manner. Its significance lies in its ability to improve the security, transparency and efficiency of transactions. It's an evolving technology with growing adoption in areas such as finance and supply chain management. In accountancy, blockchain could revolutionise auditing by providing a verifiable and tamper-proof record of transactions. For example, a blockchain-based system could be used to track the provenance of assets, providing auditors with undeniable proof of ownership and transaction history.

Artificial intelligence & machine learning

AI and machine learning (ML) encompass systems that are capable of learning from data, making decisions, and improving over time with a level of autonomy. They are significant because they can automate complex tasks, make predictions, and provide insights based on vast amounts of data. These technologies are advanced but are still developing, with new models and methods being introduced regularly. Indeed, according to Stanford University's Artificial Intelligence Index Report 2022, global AI private investment doubled between 2020 and 2021 totalling US\$93.5bn in the latter year (Stanford 2022). AI and ML are a suite of technologies, enabled by adaptive predictive power that advance our ability to recognise and detect patterns, anticipate and forecast future scenarios, create rules to optimise outcomes, and make good decisions by applying rules. For instance, AI and ML can be used to automate invoice processing or to predict a company's performance using a range of structured and unstructured data.

Again, the growth in the number of patents issued is a proxy for growth in technological developments (Table 2.2).

TABLE 2.2: Categories of AI patent

	Deep learning: Fastest-growing technique 175%*
	Robotics and control methods: Fastest-growing functional applications 55%*
	Aerospace/avionics: Fastest-growing sector 67%*
	Smart cities: Fastest-growing application field 47%*

*Average annual growth rates, 2013–2016 (WIPO 2022)

What's the fuss about AI?

Not all technologies are equal in their potential for impact. Given the relative explosion of major announcements and public interest, a passive observer might be forgiven for assuming that AI is a new sensation. On the contrary, AI has had a long and bumpy trajectory. Tremendous conceptual and mathematical progress has been made each decade since Alan Turing proposed that machines could be programmed to think, use information and reason to solve problems. Early advances were in large part limited by lack of computing power, and the ability to store information and commands, as well as cost.

This stands in contrast to many of the other, much more recent, technologies that are cited in publications (Figure 2.1). Aside from longevity, another thing that distinguishes AI from most other technologies is the way in which it has already contributed, and will continue to contribute, to innovation in many other areas. And this impact is likely to grow with recent developments in generative AI. The potential for AI to become a general-purpose technology (GPT), enhancing productivity more broadly and, potentially, serving as a platform for future activities is a distinct possibility, according to major economists (Baily et al. 2023). Of course, major risks and obstacles persist, but in certain ways AI is special in its ability to facilitate other technological innovations, and this is in part why it should be considered as the vehicle of the digital horizon. Indeed, AI is tied to many other technologies that will have varying implications for business, and for accountancy and finance professionals in the future.

Most of the applications of AI fall outside areas that will have a direct impact on accountancy and finance as a profession. But the indirect impact may be just as significant. There has been a great deal of discussion about how AI can support drug discovery, but another significant area is in software development, where AI is likely to accelerate the pace of activity. Given that most accountants and finance professionals who currently or will interact with AI will do so via pre-packaged software applications, this is likely to present an exciting but also challenging prospect of sorting through new updates, alternative vendors, and incremental improvements.

The new kid on the block: Generative AI

OpenAI's ChatGPT is the fastest-growing technology product ever. It only took five days for it to reach a million users, surpassing all previous benchmarks by a significant margin (Figure 2.2).

FIGURE 2.1: Prevalence of mentions of various technologies in academic articles on Google Scholar

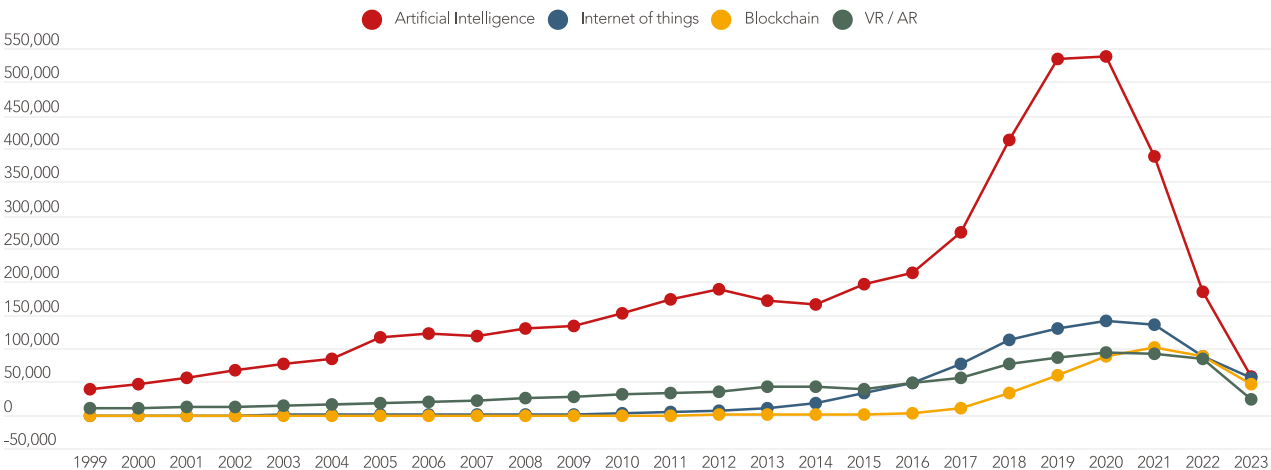
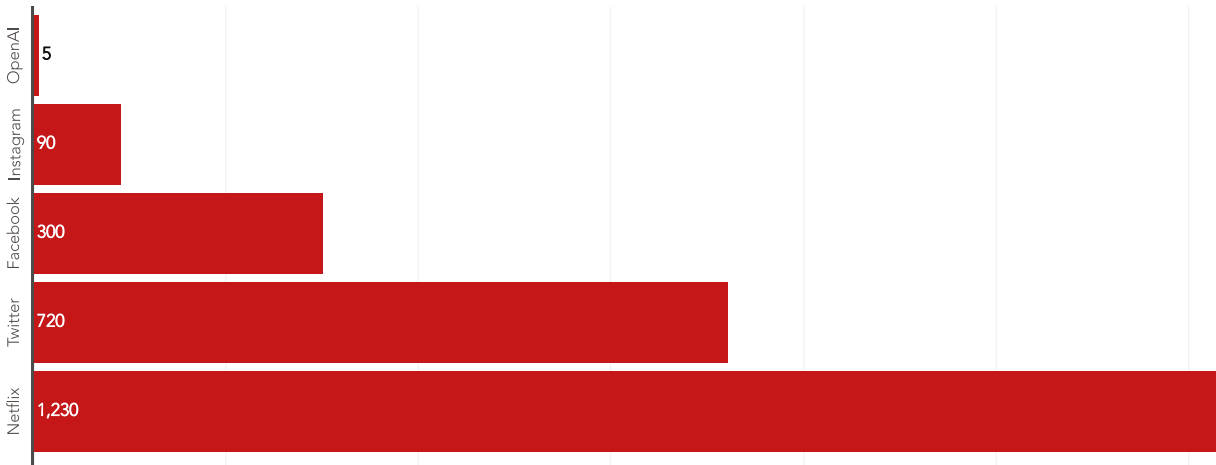


FIGURE 2.2: Time in days that various platforms took to reach one million users (approximately)



Using the Gartner Hype Cycle as a guide (Gartner n.d., Figure 2.3), within about eight weeks we observed the Technology Trigger, marked by the highly publicised release of ChatGPT on 30 November 2022, rapidly transition into the peak of expectations. The culmination of this was arguably marked by two significant sets of events related to OpenAI. The first event was OpenAI's renewed collaboration with Microsoft, depicted in a press release as a 'multiyear, multibillion-dollar investment'. The second was a series of papers announcing that ChatGPT was exceeding average human performance across a range of professional exams.

While generative AI is not an entirely new technology, the very rapid progress made in a relatively short span of time has been undeniable. Certainly, compared to the metaverse, generative AI received quicker attention from academic circles following major announcements – Facebook's initial turn to the Metaverse in 2021 vs. the public release of ChatGPT by OpenAI in 2023 (Figure 2.4).

It would be hard to argue against the observation that we have ridden to the peak of the wildest expectations in record time. Even so, there are at least a couple of complicating factors that make it more difficult to judge the speed with which it might develop from here. When compared to the more contentious metaverse,

generative AI may benefit from a higher level of maturity, ease of use, and potential applicability.

One factor is that generative AI is built upon a very long-standing field of research and development. The success of generative AI is as much to do with the development of more efficient hardware and cost-effective computing power as it is with the specific learning techniques and underlying model architecture. On top of this, generative AI was released for public consumption very early on.

'In the tech industry, we have a concept called the networking effect. That means, the more users, the more powerful the effect. So that when we talk about hype, it means there's a lot of excitement but no users. But for generative AI we can see millions of users using this every day. So I don't think it's hype.'

Asia Pacific Roundtable participant

This has not only massively expanded the training data available to OpenAI, but it has also led to an explosion of start-ups and experimentation with generative AI applications. Indeed, chatbots aimed directly at the audit market and tax professionals are already popping up.

FIGURE 2.3: Typical pattern of changing attitudes after a new technology has been launched

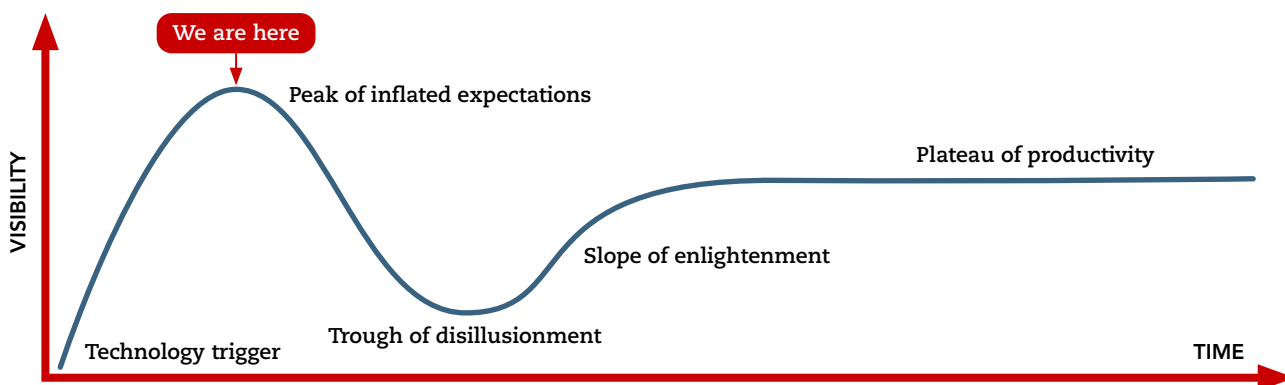
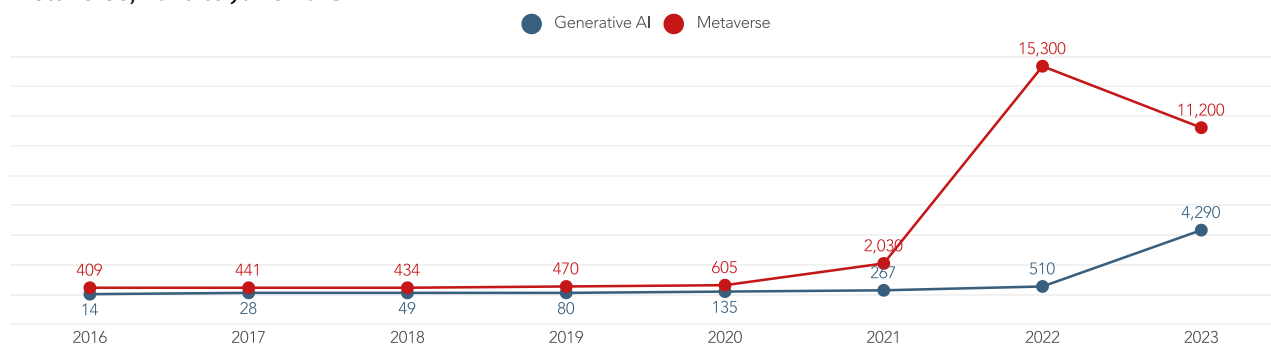


FIGURE 2.4: Comparison of number of academic articles in Google Scholar citing generative AI and the Metaverse, 2016 to June 2023



TaxGPT

For example, OpenAI has developed a specialised model, TaxGPT, embedded within the fourth iteration of its chatbot. The model was finely tuned and trained on the intricacies of US tax law. It has shown remarkable proficiency in handling tax-related queries and even producing data for tax returns. The model showcases its prowess by calculating tax deductions in highly complex scenarios with very high levels of accuracy. Variations of TaxGPT trained on local tax laws are popping up across the world.

**'Big Four' developments**

The Big Four accountancy firms are also investing heavily in AI to revolutionise their audit and tax offerings.

- In April 2023, PricewaterhouseCoopers (PwC) announced a US\$1bn investment over a three-year period to expand its AI offerings by building its relationship with Microsoft and OpenAI. The investment was made under the firm's New Equation strategy, focusing on the application of next-generation technologies to help solve complex challenges. Internally, it also announced the development of its own fine-tuned chatbot – ChatPwC.
- In 2023, KPMG also announced an expanded partnership with Microsoft as part of a US\$2bn investment in AI and cloud services over the following five years. The firm projects that this investment has the potential to produce up to US\$12 bn in revenue.
- KPMG plans to employ generative AI to support tax professionals in meeting new mandates for tax obligation disclosure by country and has provided its clients with a 'virtual assistant', powered by ChatGPT, to aid in gathering tax data, conducting analyses, and drafting reports on global tax obligations. This AI tool operates securely within KPMG's firewall, ensuring that access to client data is both restricted and safeguarded. The company's professionals are undergoing training to maximise the benefits of this innovative technology. In addition, KPMG is experimenting with the use of AI in the realm of auditing, focusing on tasks such as contract summarisation and audit committee presentation preparation. The firm is being cautious and meticulous in its adoption of AI for audit purposes, ensuring the results are certified, validated and contribute to improved audit quality.
- Deloitte and EY are likewise initiating pilot projects and services to leverage generative AI. Significant investments are being made to upgrade their tax and audit services, as well as to instruct their accountants in effective AI tool use.
- Deloitte has made some strategic acquisitions – including of HashedIn Technologies and Intellify – to bolster its AI capabilities. This is alongside established partnerships with technology behemoths such as Amazon Web Services, Google, and NVIDIA to deliver cloud and AI-based services.
- EY has welcomed use of OpenAI tools by its global tax workforce and has established an advisory council to direct its AI use. With significant partnerships including ServiceNow, Adobe and NVIDIA, the firm remains a leader in AI-powered applications.

Smaller firms are also being urged to integrate AI technology into their operations. AI can be employed for straightforward tasks such as drafting emails that are devoid of client data or confidential information. As the technology progresses, it will enable accountants to extract information more rapidly, transforming their work practices and enhancing their expertise.

Of course, the adoption of generative AI does come with some risks. Firms must take care not to exaggerate AI's capabilities and must ensure that their tools receive adequate training in various countries and functions. Despite these challenges, the potential advantages of AI in tax and audit services, such as enhanced efficiency and efficacy, make the investment justifiable for firms striving to stay ahead in a fast-paced industry. Chapter four will return to questions of adoption and the risks associated with AI.

DESPITE THESE CHALLENGES, THE POTENTIAL ADVANTAGES OF AI IN TAX AND AUDIT SERVICES, SUCH AS ENHANCED EFFICIENCY AND EFFICACY, MAKE THE INVESTMENT JUSTIFIABLE FOR FIRMS STRIVING TO STAY AHEAD IN A FAST-PACED INDUSTRY.

Hype and expectations

The rapid pace of technological development can lead to high expectations. Breakthroughs in areas such as AI, analytics, the IoT, and blockchain are predicted to reshape industries rapidly, promising unprecedented efficiency and capabilities. Nonetheless, practical implementation can be a complex process requiring significant investment in hardware and software, as well as training staff and reconfiguring business processes. Regulatory constraints, data security and legacy systems also pose challenges.

Therefore, while the potential of these technologies may be significant, their real-world implementation may not live up to the hype.

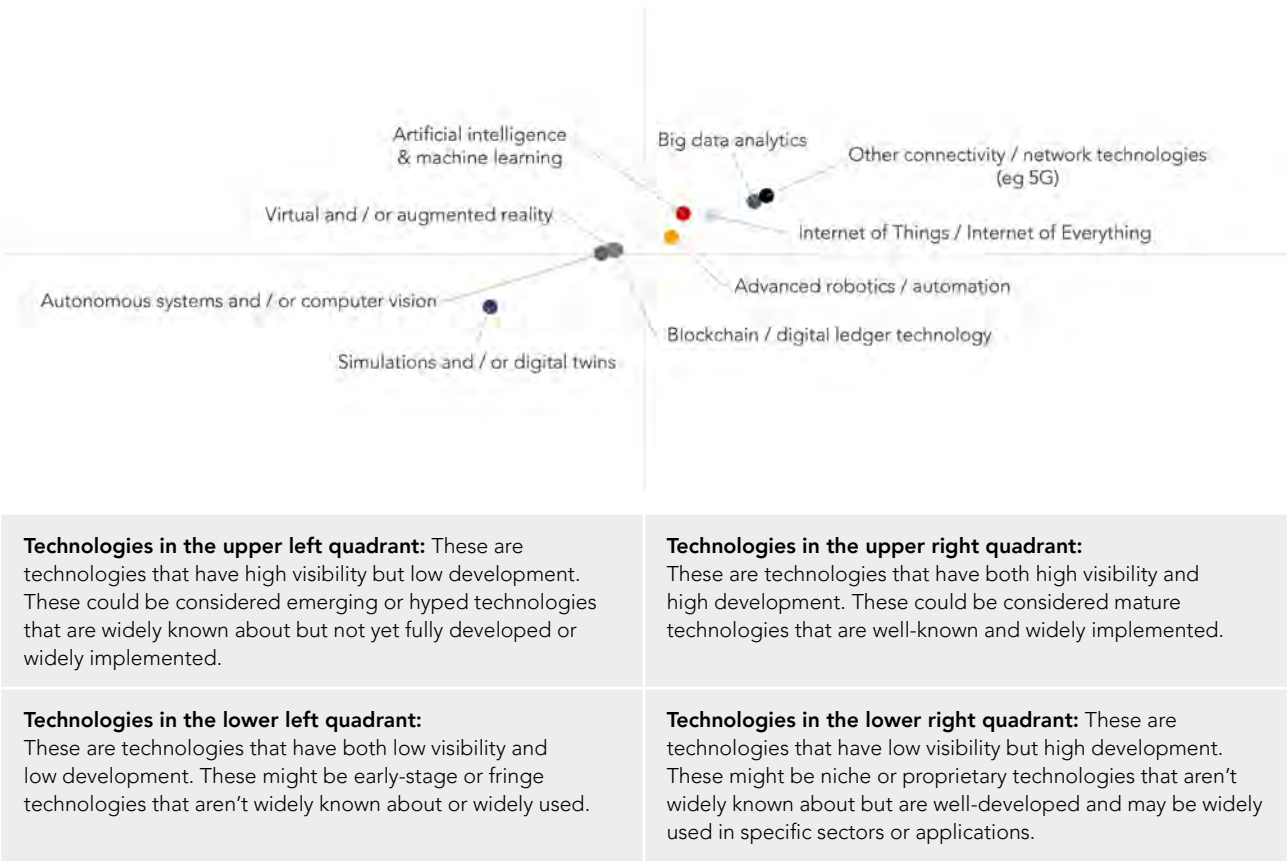
Our snapshot of ACCA members' perceptions reveals a varied landscape. While some technologies, such as big data analytics, are viewed as relatively commonplace, others, such as AI and ML, are recognised but are fighting through implementation challenges. Still others, such as more recent innovations in digital-twinning technologies, remain largely unrecognised.

There is notable variation in the perceived visibility and development of different technologies among ACCA members in our survey (Figure 2.5).

Big data analytics shows a certain level of maturity and acceptance within the field, reflected in its high visibility and development scores. This technology scores highly in both visibility and development. The high visibility suggests that ACCA members are well aware of big data analytics, its potential uses, and its implications for the accountancy profession. The moderate level of development indicates that many organisations have begun to implement big data analytics, reflecting its growing importance in data-driven decision making.

AI and ML, despite a robust visibility score, show a relatively low level of perceived development, suggesting that while the technology's potential is recognised, its readiness for implementation within organisations may not be as advanced. Moreover, this suggests that while ACCA members are aware of AI and ML and their potential impact on the profession, their organisations may still be in the early stages of adopting these technologies.

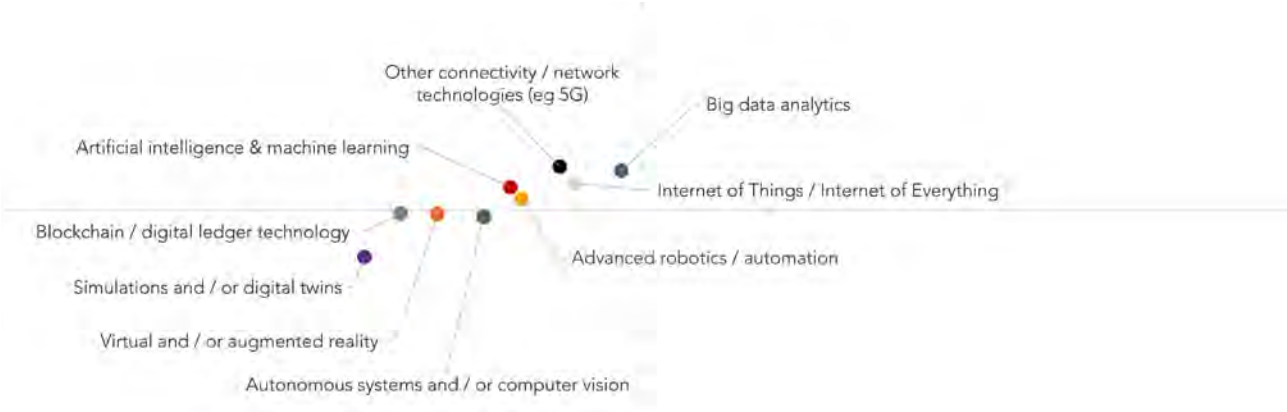
FIGURE 2.5: Relative level of visibility among respondents (vertical position) versus level of development (horizontal position) of AI technologies



This illustrates the challenge of translating awareness into implementation. Even for technologies such as AI and ML, which have high visibility, the level of development lags slightly behind their level of visibility.

The findings highlight the need for further education and training for ACCA members in emerging technologies coupled with practical exposure and experience to fully realise the potential benefits of these technologies.

FIGURE 2.6: Relative degree of perception (vertical position) versus degree of implementation (horizontal position)



The perception-implementation gap

This can be visualised as a perception-implementation gap – the difference between how common and well-developed a technology is perceived to be compared to the extent to which it is being implemented by individuals and/or organisations (Figure 2.7).

AI and ML show a significant disparity between perception and implementation among respondents, which may relate to various challenges from return on investment, technical capabilities, skills or identifying relevant uses.

Simulation/digital twin technology demonstrates both the lowest perception and implementation scores, indicating it is both less recognised and less implemented by the surveyed members.

These perception-implementation gaps reflect the challenges in adopting and implementing new technologies within organisations, even when their value and potential impact are widely discussed.

FIGURE 2.7: The gaps between perception of various technologies and implementation among ACCA members



THIS CAN BE VISUALISED AS A PERCEPTION-IMPLEMENTATION GAP – THE DIFFERENCE BETWEEN HOW COMMON AND WELLDEVELOPED A TECHNOLOGY IS PERCEIVED TO BE COMPARED TO THE EXTENT TO WHICH IT IS BEING IMPLEMENTED BY INDIVIDUALS AND/OR ORGANISATIONS.



**AS THE TECHNOLOGICAL LANDSCAPE
CONTINUES TO EVOLVE, ACCA MEMBERS
WILL NEED TO EQUIP THEMSELVES WITH
THE KNOWLEDGE AND SKILLS TO LEVERAGE
THESE TECHNOLOGIES EFFECTIVELY.**

3. Digital transformation and technology adoption

Digital transformation refers to the adoption of digital technologies by organisations to improve and optimise their operations, products and services, and engagement with customers and stakeholders (Vial, 2019).

For example, this could include transitioning from legacy IT systems to modern digital platforms like cloud computing, digitising business processes and workflows, developing digital products, services and business models to serve changing customer needs, using analytics and insights to make more informed decisions, changing organisational culture and leadership style to be more agile and collaborative, reskilling and upskilling, and collaborating digitally with partners, suppliers and stakeholders through tools like APIs, cloud platforms, etc. In other words, digital transformation consists of a range of objectives and is supported by a number of existing and developing technologies.

Technology state of play

There is notable activity amongst ACCA members when it comes to these technologies (Figure 3.1), however it is also clear that there remains a great opportunity to expand the use of some of the more widely applicable technologies such as AI and ML to enhance activities.

In particular, there is an obvious gap between larger organisations – eg big four and mid-tier accountancies and large corporates – and small and medium-sized enterprises (SMEs) and small and medium-sized practitioners (SMPs) (Figure 3.2). As we discuss challenges further, it will be worth considering whether there is not only a resources difference but also different skills challenges.

FIGURE 3.1: ACCA member respondents who have implemented various new technologies, % of total

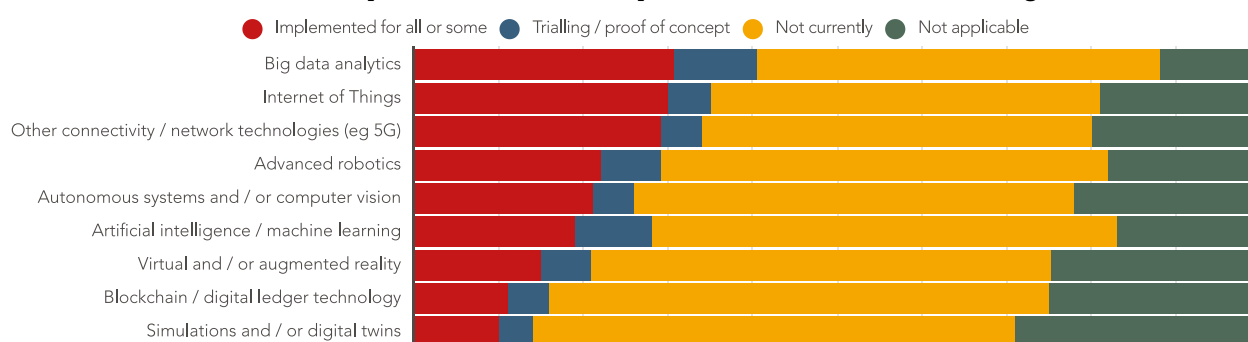
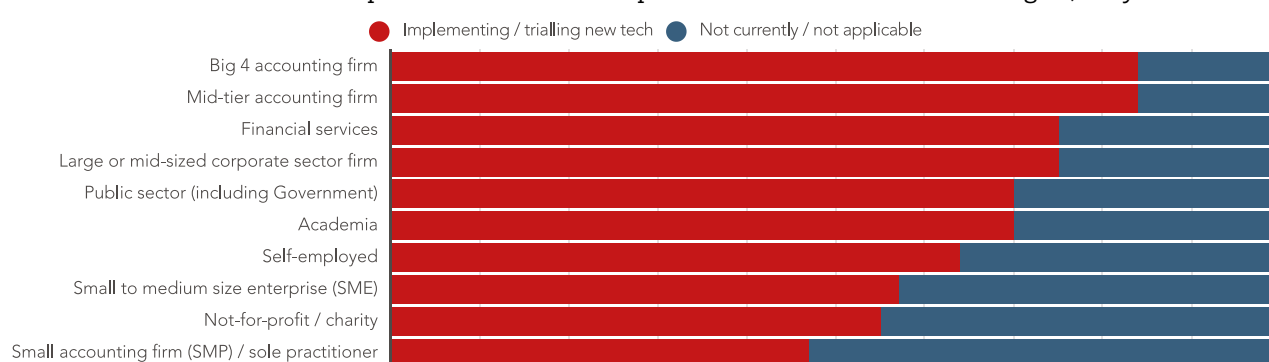


FIGURE 3.2: ACCA member respondents who have implemented various new technologies, % by sector



Financial services companies have long been at the forefront of adopting new technologies, so it is not a surprise to see relatively high levels of implementation in this sector. By contrast, not-for-profits and charities are much less likely to have the capacity to undertake such transformation.

As the technological landscape continues to evolve, ACCA members will need to equip themselves with the knowledge and skills to leverage these technologies effectively. This will not only enhance their own professional capabilities, but also enable them to drive innovation within their organisations.

Technology adoption: organisational and personal objectives

It is clear from the *Digital Horizons* survey that there is a strong sense of optimism among ACCA members about digital transformation. The benefit of digital transformation on organisational objectives, in particular, from instilling greater flexibility to improving transparency, all receive resoundingly positive responses (Table 3.1).

TABLE 3.1: Degree to which ACCA member respondents agree that technology supports organisational objectives

	Your organisation's flexibility / adaptability 78%
	The quality of your organisation's products / services 78%
	Your organisation's sustainability performance 72%
	Your organisation's transparency 72%
	Your organisation's regulatory compliance 72%

Net positive responses

In part, this may reflect a widespread sense of technological optimism, a firm belief that technology is more likely to improve human lives. Indeed, optimism bias is a well-founded phenomenon in the behavioural sciences and is often linked to areas of innovation. This bias points to the tendency of individuals to overestimate the probability of positive outcomes over negative outcomes. In practice, when confronted with more specific applications of technology in areas that directly affect individuals, this sense of optimism can be challenged.

TABLE 3.2: Degree to which ACCA member respondents agree that technology supports personal objectives

	Your productivity 85%
	Your collaboration with colleagues 76%
	Your career development 65%
	Your job security 30%

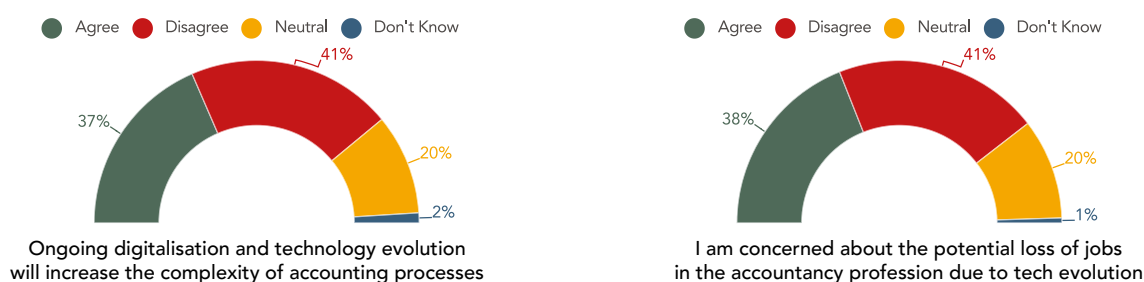
Net Positive Response

While sentiment is still broadly positive towards personal goals (Table 3.2), there is less certainty on these matters than for organisational goals. The impact on career development remains very positive, with many roundtable discussions revolving around access to learning and more flexible opportunities.

Technology adoption and personal insecurity

Attitudes to job security, while still showing a net positive response, have a greater disparity among respondents. To some extent, this should not be surprising when their range of roles and seniority levels is considered, each subject to different changes in expectation, availability, upskilling and complexity in relation to innovation. Nonetheless, there does appear to be a consistent degree of insecurity around the impact of technology on job prospects, a finding that was also reflected across career levels in the ACCA's *Global Talent Trends 2023* survey and report (Lyon 2023). Despite the recognition that technology has the potential to empower employees, this report emphasises the widespread nature of this concern as well as demand for more training related to new technologies in order to counter-act those fears.

Personal productivity and job security, while not being diametrically opposed, certainly reside on different ends of the spectrum, highlighting an important point about the relationship between 1) how we justify and prioritise technology initiatives and 2) the impact on the individual. It is only logical to expect that as individuals experience aspects of their job becoming easier and tasks being reduced or taken away, their next thought may be about their own value, the transmutability of their skills, and the security of their role (Figure 3.3).

FIGURE 3.3: Respondents' concerns about the impact of technology on their jobs

The risk of greater complexity also appears to underlie some of the concern about adopting new technologies, and perhaps about change more widely. More than one-third of respondents agreed that 'ongoing digitalisation and technology evolution will increase the complexity of accounting processes'.

Indeed, innovation often raises new requirements, which can increase complexity at least in the short term as practices and knowledge adapt. Cloud computing, for example, is now fairly widespread and often touted as essential to the implementation of more advanced applications, especially for greater analytics and intelligence capabilities. While it has made data access and storage easier, accounting for cloud-related expenses can be complex and confusing, even for seasoned accountants.

'Nowadays, everyone is basically using cloud, and the accounting for cloud-related expenses is extremely complicated, even confusing to accountants. So if they just have the numbers from AWS, Alibaba cloud, etc. it is very hard to understand what those numbers really mean.'

Asia Pacific Roundtable participant

These uncertainties are inevitable by-products of being open to innovation, but they can cause trepidation among individuals and contribute to varying levels of discomfort with upskilling and learning. Technology presents an almost paradoxical situation whereby a task can be made easier for the individual, but also more complex while one lacks the technical understanding of how a new system operates. But what this also points to – and the roundtable participant attests – is the need for domain experts who are able to interpret regulations to ensure that continually changing practices remain compliant.

In addition to this are fears for job security: 38% of survey respondents expressed concern about the 'potential loss of jobs in the accountancy profession due to tech evolution', although a similar proportion (41%) disagreed that this was a concern. Again, this reflects a certain level of uncertainty in the face of change, which can lead individuals to make broad assumptions about evolving circumstances because information is limited and predicting the future impact is difficult.

While these concerns differ in significant respects, they are connected by an imperative to adapt. This same imperative is driving change at all levels, not least amongst CFOs who are experiencing a distinct change in expectations and responsibilities, as explored in the ACCA-BDO report *Chief Value Officer: the important evolution of the CFO* (Webb 2023). This report highlights the extent to which the boundaries of the role are blurring as business demands evolve in line with a more value-driven agenda posing myriad challenges from individual mindset through to specific capabilities.

Complexity can be viewed as a short-term phenomenon – following a learning curve – or a longer-term phenomenon requiring a more fundamental change of skills and availability of roles. In the latter case, the potential mistake is to associate value with a set of existing practices or processes rather than overarching competencies and objectives.

'Having led so many change projects [I have seen] that instant closeted reaction whenever somebody says "oh, we're going to have a systems implementation". That's what I see when we talk about AI: "oh we're going to have more efficiencies, well that means that my job is gone. Therefore, I'm going to resist it and challenge it and not support it". But actually, it's just going to be about things being done differently and we can still, as accountants, add value.'

UK Roundtable participant

Resistance to change is rarely ill-intentioned, it merely reflects a heightened level of concern about how existing and trusted methods will be supplanted. It should come as no surprise that studies have shown that uncertainty is detrimental to human performance and creativity (de Berker et al, 2016). While there will always be a level of uncertainty involved in any process of transformation, however, there are means to mitigate its effects. A culture of innovation requires trust as a crucial ingredient, and this is built on transparency and effective communication. These challenges ultimately stress the importance of effective communication from the leadership to help mitigate the 'human-machine' dilemma, which places the two at odds with each other (Cleavinger and Munyon 2013).

Why adopt new technologies?

The purpose of technology should be to enhance human efficiency and effectiveness, such as improved compliance, enhanced insights, better reporting outcomes, or entirely new capabilities. The ultimate goal should be the outcome, not the mere implementation and use of technology.

‘I think sometimes people do use the term “technology as the enabler”, but in practice they sometimes look at it as the ends. The enabler is, you’re either enhancing something that’s already done by a human, or doing something that they couldn’t do before by utilising the technology. And the end is the output, that outcome as opposed to just the implementation and use of technology.’

UK Roundtable participant

Still primarily an efficiency play

At the same time, technology adoption is still primarily treated as an efficiency play by more than half of all survey respondents. Thus despite widespread optimism about the extent to which digital transformation, more broadly, can enhance things like flexibility / adaptability, quality of products or services, sustainability performance, transparency, and/or regulatory compliance, practical business constraints typically require a focus on a narrower set of goals, at least initially (Figure 3.4).

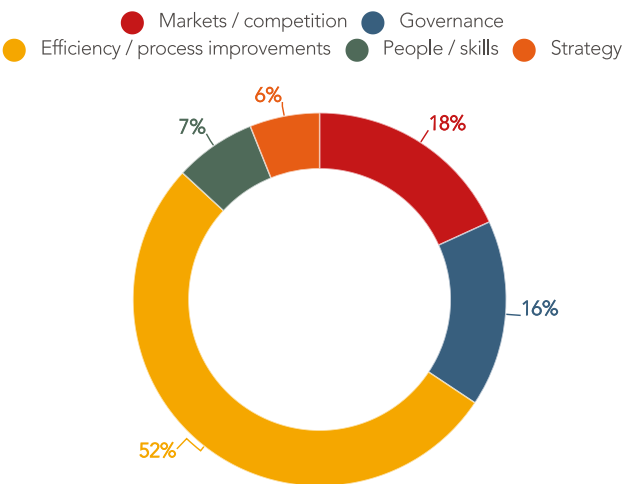
Only 18% included competition-related reasons, such as responding to customer demands, enhancing market insights, introducing 24/7 capabilities, or maintaining competitive advantage.

Governance reasons ranked in the top three for 16% of respondents, including data governance and regulation / compliance. People/skills-related reasons – including responding to employee needs or enhancing training – and strategic reasons – such as avoiding future vulnerabilities or improving collaboration with partners – were only ranked in the top three by 7% and 6% of respondents, respectively. All the rankings are shown in Table 3.3.

TABLE 3.3: The overall rankings of various objectives for ACCA respondents using new technology

OBJECTIVE	RANK
Efficiency of task(s)	1
Internal process optimisation	2
Cost savings	3
Data governance / management	4
Regulation / compliance	5
Maintaining competitive advantage	6
Responding to customer demands	7
Better process / asset visibility	8
Enhancing training / skills development	9
Improving collaboration with partners	10
Enhancing market / customer insights	11
Avoiding future strategic vulnerabilities	12
Responding to employee needs	13
Introducing 24/7 capability	14

FIGURE 3.4: The main technology-related objectives reported by ACCA respondents



NARROW OR LIMITED OBJECTIVES CAN ALSO LIMIT THE SUCCESS OR IMPACT OF A NEW INITIATIVE. SO IT IS INTERESTING TO SEE THAT A SIGNIFICANT PROPORTION OF MEMBERS VIEW TECHNOLOGIES SUCH AS AUTOMATION PRIMARILY THROUGH THE LENS OF EFFICIENCY GAINS.

These patterns broadly held true across sectors (Figure 3.5) and regions (Figure 3.6).

The dominance of efficiency as a driving narrative behind technology adoption was further demonstrated in the open responses provided by survey respondents to the question: 'what does digital transformation mean to you?'

Using sentiment analysis – a form of natural language processing that uses ML to identify and extract subjective information from source materials – it is possible to get a sense of the attitudes and emotions of a respondent.

In the context of open responses to a survey, sentiment analysis can be particularly valuable. It can automatically analyse the text responses to identify whether the sentiment expressed is positive, negative or neutral. By doing so, it provides a quantitative measure of the respondents' attitudes, opinions and perceptions, which might not be captured by closed-ended questions. Although not all entries could be categorised according to use and context, 583 unique responses were received. Word fragments – morphemes – were used to allow for closely related words, eg 'efficien' for 'efficiency' and 'efficient' (Table 3.4).

TABLE 3.4: What does 'digital transformation' mean to you? Sentiment analysis and top 20 morphemes

POSITIVE	MORPHEME	NEGATIVE
	efficien	
	process	
	auto	
	data	
	Technol	
	future	
	innovat	
	cost	
	fast	
	intel	
	operat	
	info	
	Learn	
	human	
	robot	
	decis	
	risk	
	real	
	job	
	over	

FIGURE 3.5: Technology-related objectives of ACCA respondents, grouped by sector

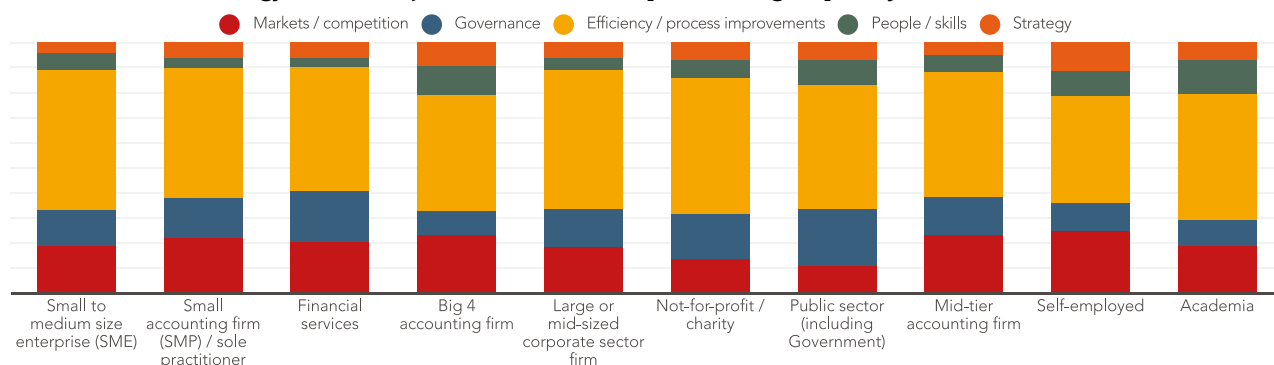
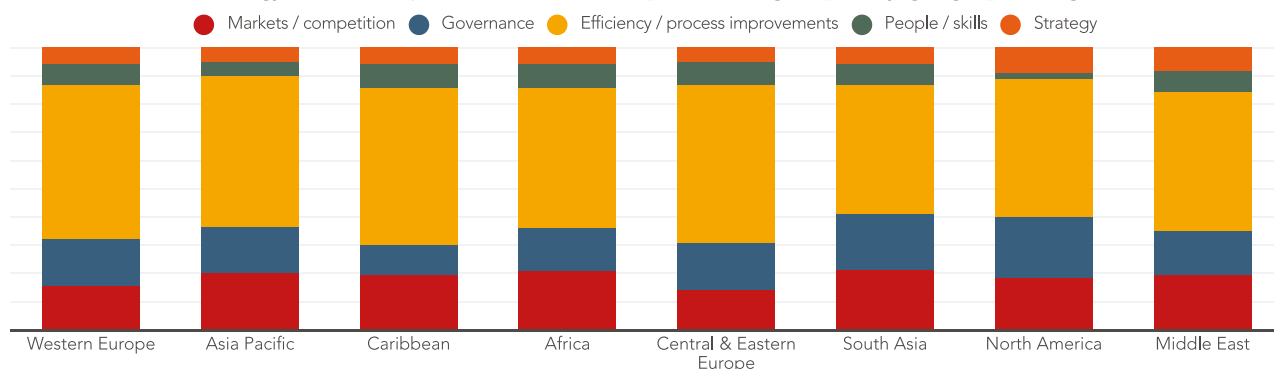


FIGURE 3.6: Technology-related objectives of ACCA respondents, grouped by geographic region



Following on from the closed-response question on technology objectives, efficiency/efficient once again proved to be the most frequent entry, with mentions almost wholly positive (92%). Similarly, allusions to words associated with process, auto and data were also frequently mentioned and overwhelmingly in a positive manner.

Mentioned less frequently were words associated with 'learning', 'human', 'risk' and 'jobs'. But while these words were less common, they also had higher levels of negative sentiment associated with them. This once again confirms the view that existing fears are largely associated with the impact of technology on individuals, as opposed to the resoundingly positive effects expected for organisations.

Successful technology adoption is not just about implementing new systems but also about enabling people to use these systems effectively and to realise their personal benefits. Hands-on experience and training are important, as is, where possible, the ability to experiment and innovate to improve existing task loads.

'We started with the word enablement and the focus was... [on] technology: how does technology enable us to do anything? But where there's the gap is when the technologies in place are to drive efficiencies, while the people need to be enabled to use the technology. All the enablement focuses on the technology. People are the essential enablers of the outcome, whereas the technology is the enabler of that process.'

UK Roundtable participant

While risk appeared relatively infrequently in the text responses, comments reflected the fact that digital transformation poses potential advancements in the ability to monitor and manage risk as well as presenting new risks that need to be considered.

'Every piece of enhancement comes with risk as well, right? Crypto has its own set of risks. Social media has its own set of risks. AI has its own set of risks, right? So we need to ... think about efficiency and effectiveness and also risk in tandem.'

North American Roundtable participant

A focus on efficiency is pervasive. It is an obvious and relatively quantifiable benefit of implementing a new system or technology, whereas other benefits may be more difficult to measure or more diffuse.

On the other hand, when considering new technology, thinking in a purely linear fashion carries distinct risks of its own and may limit understanding of potential impact. Even a simple 'point solution' intended to speed up a particular task can have more wide-ranging effects if not properly considered.



SUCCESSFUL TECHNOLOGY ADOPTION IS NOT JUST ABOUT IMPLEMENTING NEW SYSTEMS BUT ALSO ABOUT ENABLING PEOPLE TO USE THESE SYSTEMS EFFECTIVELY AND TO REALISE THEIR PERSONAL BENEFITS.

Challenges to adoption

The challenges posed by technology adoption are more diffuse than the objectives they are intended to achieve (Figure 3.7 and Table 3.5). Even so, it is clear that organisational culture remains a critical factor in the successful adoption of technology: 26% of respondents highlighted related issues among their top three technology-related challenges. This category includes employee resistance to adoption, lack of technical leadership and poor clarity on process ownership and accountability.

Employee resistance to adoption was particularly significant, garnering the second-highest response rate for an individual issue, while lack of technical leadership remains a significant challenge itself, ranking as the sixth most cited issue.

FIGURE 3.7: ACCA respondents' ranking of technology-related challenges, by category

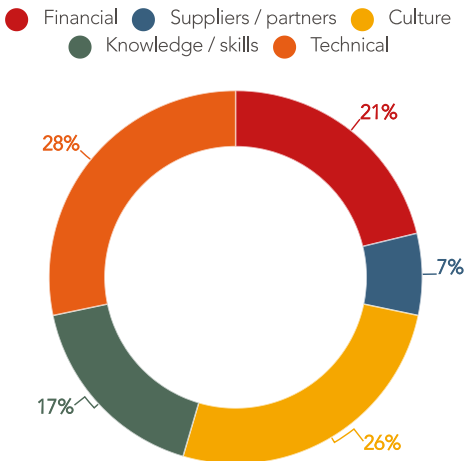


TABLE 3.5: Ranking of challenges faced by ACCA respondents when introducing new technology

CHALLENGES	RANK
High costs	1
Employee resistance to adoption	2
Data quality / migration concerns	3
Poor IT legacy systems making implementation difficult	4
Understanding how to combine with other technologies	5
Lack of technical leadership	6
Return on investment / payback	7
Identification of the processes most suited to new technology	8
Poor clarity on process ownership and accountability	9
Poor IT security to govern implementation	10
Risk of proliferation of non-standard and silo processes and weakening of controls	11
Identifying suitable partners	12
Suppliers hesitant to integrate into their client's systems	13
Lack of knowledge of the benefits of the technology	13
Vendor lock-in / fear of vendor lock-in	15
Other (respondents were asked to specify)	16
There are no challenges	17



As opposed to objectives, these challenges varied slightly by sector (Figure 3.8) and region (Figure 3.9). SMEs and SMPs, as we have previously seen, are less likely to be implementing new technologies. They are also more likely to report challenges related to knowledge / skills. While the full range of challenges is quite diverse, this is a notable distinction alongside the less surprising fact that financial constraints can also pose a challenge for these organisations. Technical and culture-related challenges are evidently widespread across a range of sectors.

Cost considerations feature significantly, and this is especially pronounced for those implementing IoT applications, where scalability and cost have long been limitations on wider adoption. By contrast, slightly fewer members implementing analytics, AI and advanced robotics reference cost as the foremost challenge. For these technologies, employee resistance tends to match or exceed cost concerns.

Future research may need to examine the components and understanding of costs in relation to technology

initiatives in greater depth. As discussed in *Transformational Journeys: Finance and the agile organisation* (Webb 2021), value is an ongoing process that requires agility and flexibility beyond traditional evaluation measures such as Net Present Value or Internal Rate of Return. Indeed, the survey data shows a complex situation whereby initial high costs are presented as a significant challenge, whereas ROI/payback is less of an immediate concern. Presumably, however, payback cannot occur without costs being recouped. As such, the problem may revolve around explaining the value case including how those initial costs are worth the spend or the ability to secure funding in the first instance. This could also feed into limitations around technical know-how and perhaps cultural challenges which also feature prominently.

Overcoming these challenges requires a strategic approach that addresses these potential challenges as part of a phased implementation to manage the transition. This incorporates employee education and training as well as support for collaboration and cross-fertilisation of teams to enhance skillsets and share best practices.

FIGURE 3.8: Technology-related challenges perceived by ACCA respondents, grouped by sector

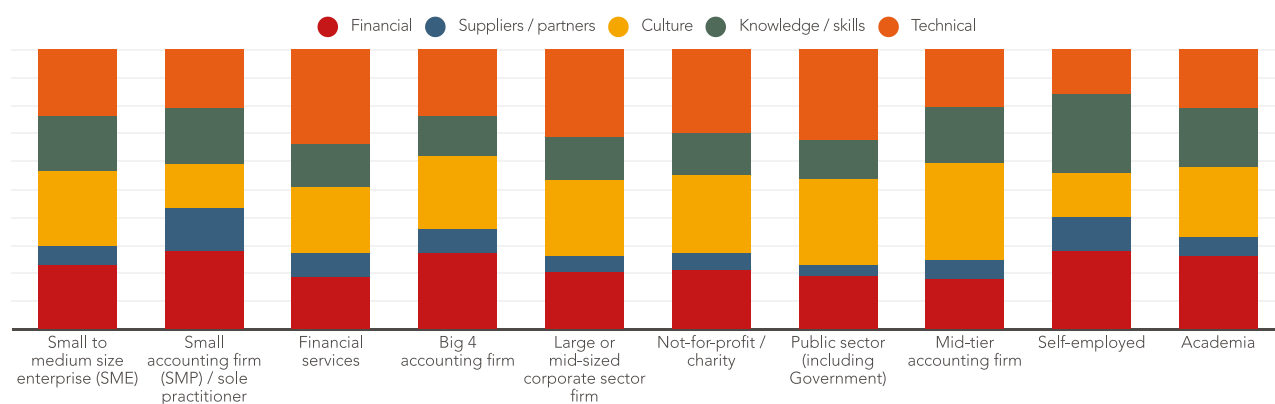
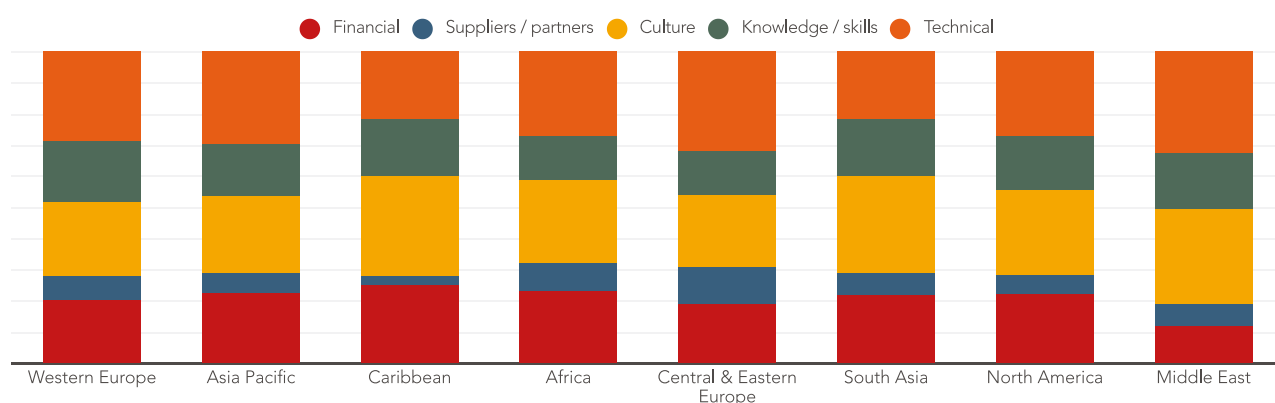


FIGURE 3.9: Technology-related challenges perceived by ACCA respondents, grouped by geographic region



Identifying potential innovator traits: commerciality, leadership, pragmatism

Digging in a bit further, our survey reveals some additional traits that distinguish innovators from those less likely to be involved in implementing new technologies. In particular, five key areas stand out:

1. Confidence in leadership and data governance also tend to coincide with the implementation of new technologies	
2. Leading implementers are more likely to focus on competitive advantage as a key objective	
3. Effective data governance principles and leadership, however, remain works in progress	
4. Implementers are more likely to balance internal, efficiency goals with competition-driven and transformative goals	
5. Strong correlation between organisational leadership and individual confidence	

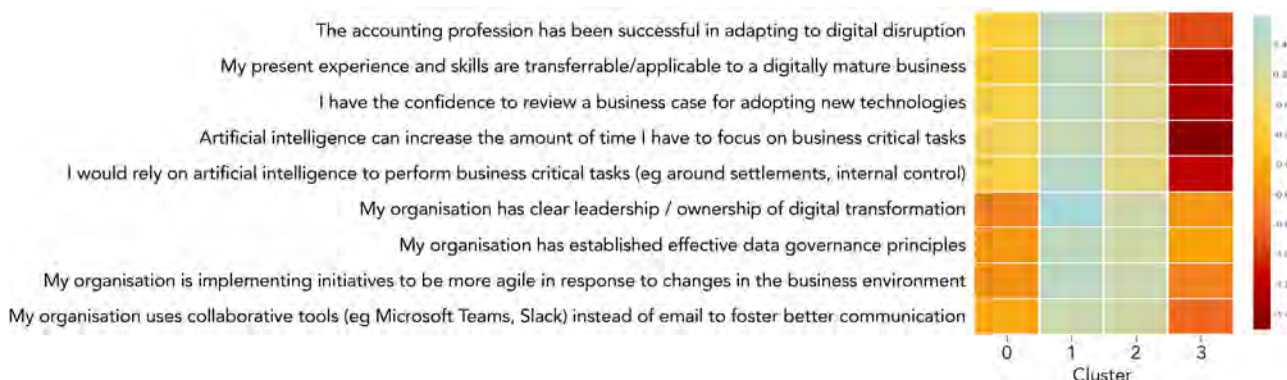
While, on average, attitudes to and expectations of new technologies are broadly positive, there are interesting variations and correlations that may help identify distinct traits that are more likely to be linked with innovative practices.

Each vertical cluster represents a group of respondents according to characteristics identified based on their responses. For ease of discussion, the clusters are named according to distinguishing characteristics:

- Cautious appraisers (Cluster 0)
- Digital optimists (Cluster 1)
- Modest adopters (Cluster 2)
- Digital sceptics (Cluster 3)

Each cluster relates to the likelihood of involvement in technology initiatives.

FIGURE 3.10: Result of applying K-means cluster analysis to Likert-scale data to identify clusters



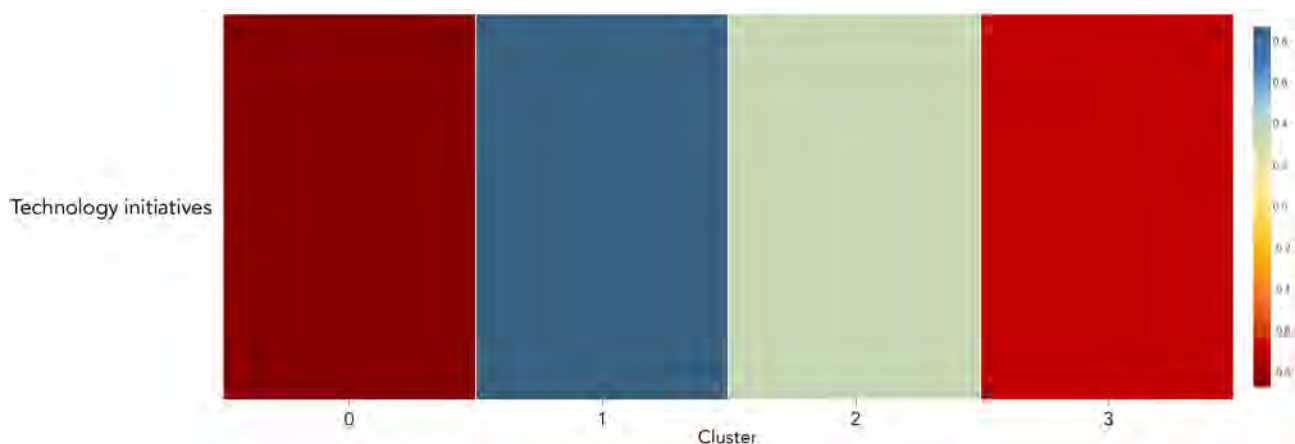
K-means cluster analysis is a popular technique used in various fields, including market research, for categorising data into distinct characteristics-based groups. When applied to survey data (using Likert scales), K-means cluster analysis provides a powerful method for understanding and analysing the responses in a more detailed manner. For example, regarding the statements all respondents were asked to respond on a scale from 'Strongly agree' to 'Strongly disagree'. In terms of the level of involvement in technology initiatives, respondents were equally asked to respond on a five-point scale indicating the extent to which technologies have been implemented or not at all.

When applying K-means cluster analysis to Likert-scale data, the aim is to partition the responses into a pre-specified number of groups. Each cluster comprises responses that are alike, implying respondents within the same cluster share similar attitudes or perceptions. From this it is possible to produce profiles that enable a better understanding of the significance of different variables and, potentially, devise more targeted methods for overcoming major differences.

It is, of course, important to note that this analysis deals with a limited sample and any relationships between variables show only correlations between responses. They are not causal factors, and we cannot make any determinative statements on this basis. The value of this analysis lies in identifying patterns to provoke further investigation, corroborate other findings, and/or generate discussion.

The analysis identified four distinct clusters (0–3) which can be seen in five 'heatmaps' (Figures 3.10, 3.11, 3.15, 3.16, and 3.17). Note that the charts show only selected variables and technologies to simplify the visual presentation.

The heatmaps range from deep blue (positive correlation) to deep red (negative correlation) with clusters shown vertically and variables presented horizontally. For example, on Figure 3.10, blue indicates a higher likelihood of agreement, whereas red indicates a lower likelihood of agreement with the statement(s).

FIGURE 3.11: Involvement in New Technology Initiatives

Cautious appraisers and digital sceptics are both extremely unlikely to be involved, at present, with a technology initiative related to AI and ML, Big Data, IoT, VR/AR, Simulations / Digital Twins, Autonomous systems / computer vision, advanced robotics, Blockchain, or Other connectivity / network technologies.

Digital Optimists are the most likely to have implemented such technologies and modest adopters are likely to be in the process of implementing or trialling new technologies.

In general, digital optimists and digital sceptics reflect the most divergent groups, where levels of trust, implementation and confidence are at opposing ends of the scale.

Leadership is paramount

Like digital sceptics, cautious appraisers represent a group of respondents that are significantly less likely to be involved in technology initiatives. What distinguishes this group is more likely to be a lack of organisational leadership and governance around digital and data. Modest adopters, by contrast, are more likely to express confidence in the levels of leadership at their organisation.

Digital optimists, on the other hand, are the most likely to agree that the accountancy profession has successfully adapted to digital disruption and that they have confidence in reviewing a business case for adopting new technologies. On top of having the highest level of involvement in technology initiatives, respondents within this cluster are more likely than average to believe that their organisation has clear digital leadership, effective data governance, and to reflect a sense of personal confidence in their own competency and skills. The fact that agreement across these variables coincides with a much higher likelihood of having implemented technology initiatives is also significant. While none of these factors can be presented as necessary prerequisites to innovation they can reasonably be considered as important features when comparing clusters.

Both digital sceptics and cautious appraisers express low levels of confidence on both fronts. Digital sceptics present a directly opposing perspective. These respondents have low levels of organisational involvement in technology initiatives low levels of both personal confidence as well as confidence in their organisation's leadership and data governance capabilities. They are significantly less likely to agree that artificial intelligence offers some benefits or demonstrate a level of trust in these technologies.

This group represents a preference towards business-as-usual. While they do not display heightened levels of concern related to the impact of technologies on the complexity of accounting processes or on job security, their position is defined by a broad sense of pessimism towards the benefits of data or new tech capabilities. The question for this group is the extent to which there might be a relationship between the low levels of personal confidence and the low levels of organisational leadership and governance around data and digital transformation.

Cautious appraisers are also the most likely to identify concerns around a lack of technical leadership (Figure 3.10) highlighting the importance of technical capabilities alongside more general leadership skills.

Indeed, in roundtable discussions and in the survey results, the subject of leadership proved to be significant. But while leadership is generally considered to be a cornerstone of successful innovation it remains quite amorphous as a concept when applied to digital transformation.

At its core, discussions around digital leadership revolved around fostering a culture of innovation, encouraging continuous learning, and being open to change. As such, alongside ownership it is a diffused practice that unites different teams and roles under an overarching strategic vision. This can inspire the confidence to embrace new tools and methodologies, such as AI and advanced analytics, which can dramatically transform processes.

Proficiency with new technologies may be a boon but not necessarily a pre-requisite.

Perhaps most importantly, digital leadership means recognising that technology is not just a matter of systems and processes, but also requires empowering teams to develop skills and adapt to new ways of working.

Almost half of our survey respondents believe that their organisation has clear leadership / ownership of digital transformation initiatives. The same number either disagree or are neutral on the statement, suggesting that there remains room for clarity and improvement within members' organisations (Figure 3.12).

Slightly more respondents agree that their organisation has established effective data governance principles, which are an important step towards proper risk management, compliance and responsible use (Figure 3.12).

As the cluster analysis demonstrates, it also turns out that these are highly significant features of innovative organisations, demonstrated by the correlation between these statements and members that are involved in the implementation of a new technology.

It is also interesting to note the significant number of respondents who believe that their organisation has clear leadership / ownership of digital transformation but do not report undertaking any initiatives. There may be a few explanations here. On the one hand, respondents may be involved in other initiatives related to unreferenced technologies. On the other hand, this may also reflect the ambiguity of terms associated with digital transformation and leadership. Digital transformation is itself an extremely broad topic that can denote a wide range of activities from digitisation to more transformative undertakings. Thus it may not always entail or require the adoption of the most advanced technologies and techniques. This observation likely also holds true for the establishment of data governance principles.

At the same time, it is clear from these charts (Figures 3.13 and 3.14) that, even for innovative organisations, data governance and leadership are still works in progress for a substantial proportion of respondents. While involvement in technology initiatives tends to coincide with higher levels of confidence on these organisational traits, it is not clear whether they precede or follow such activities. In practice, they most likely form necessary components of adoption plans.

FIGURE 3.12: Respondents' views on leadership and data governance in their organisations

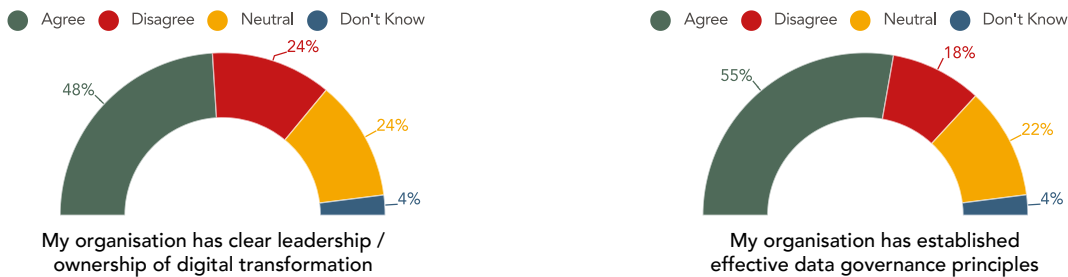


FIGURE 3.13: Agreement that 'my organisation has clear leadership/ownership of digital transformation', respondents split according to involvement in technology initiatives

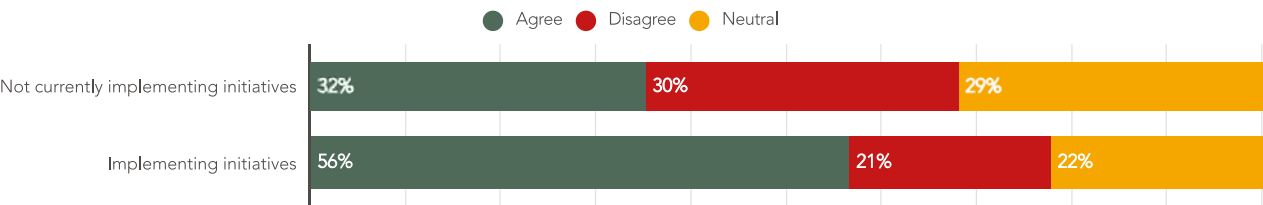
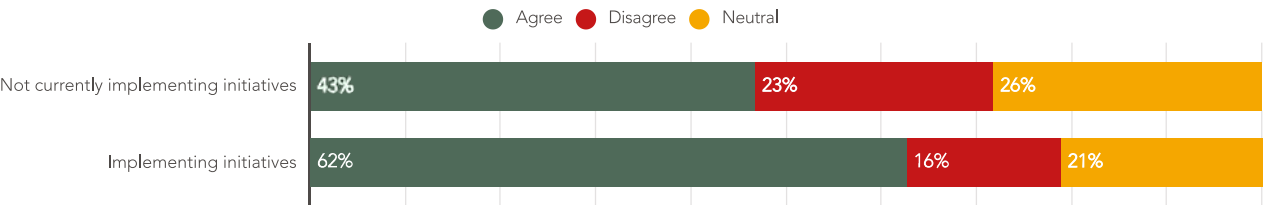


FIGURE 3.14: Agreement that 'my organisation has established effective data governance principles', respondents split according to involvement in technology initiatives



Looking towards the competitive environment

Moving back to the cluster analysis, it is notable that the two clusters most heavily involved in technology initiatives are also the most likely to link these directly to their competitive environment. Maintaining competitive advantage ranked sixth in the top technology-related objectives across the entire sample, but it appears to be much more significant for these two clusters (also Figure 3.15).

‘AI – you can use it to improve your operations, but you could also change your business model and if you’re not doing either and the rest of the landscape is, then suddenly you become non-competitive. You can’t compete, because you’re falling behind. It’s so much more sensitive now than ever, I believe, to the external environment as opposed to internal efficiencies.’

UK Roundtable participant

In addition, modest adopters are much more likely to be looking at new technologies associated with enhancing customer and market insights. Both digital optimists and modest adopters display a more outward looking perspective on the benefits of technology potentially enabling a more strategic and wider set of uses. Nonetheless, that does not come at the expense of internal considerations. For example, cost savings are also highlighted as a key objective for modest adopters alongside skills development.

Naturally, this will exclude some groups for whom competitive pressures are less significant including those working in the public sector and academia. These respondents, where they are involved in technology initiatives may be more likely to prioritise alternative objectives such as better process / asset visibility, enhancing training / skills development, and/or cost savings.

FIGURE 3.15: Objectives for technology adoption according to different clusters

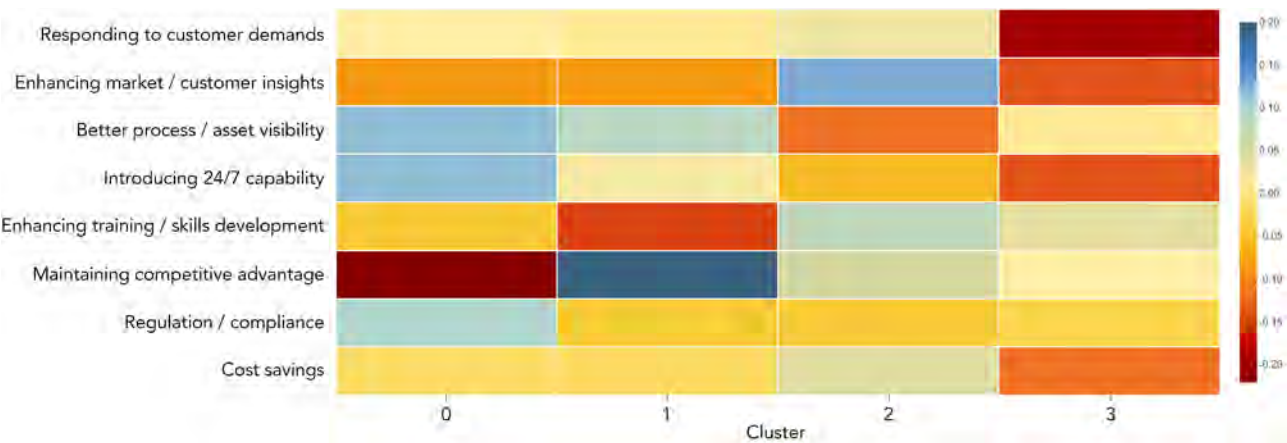


FIGURE 3.16: Maintaining competitive advantage as a top three objective when adopting technology, respondents split according to involvement in technology initiatives



Challenges persist

The challenges associated with technology adoption also vary across the clusters and while these may change they are not diminished. When looking at the challenges most closely linked with each group, it is clear that there are technical challenges at all levels of involvement and the significance of governance and security measures remain critical throughout. Moreover, cost concerns are always at the forefront of consideration.

When looking at specific groups, digital sceptics are most likely to highlight three important challenges: 1) high costs associated with adoption, 2) fear of vendor lock-in and 3) identifying suitable partners.

In line with previous traits related to low levels of personal and organisational confidence and in comparison to digital optimists and modest adopters, these are concerns that could also suggest a limited level of familiarity with the technology landscape (or options available) which serves to reinforce existing predispositions.

While cautious appraisers are most likely to face challenges around technical leadership and poor IT legacy systems, digital optimists are, perhaps unsurprisingly, the least likely to highlight these as areas of concern.

Looking across the clusters, there are several commonalities (Figure 3.18) – challenges that appear to be relatively ubiquitous including around return on investment / payback, identification of processes most suited to new technologies, and data quality / migration concerns. All these challenges are represented somewhat equally across the identified clusters. As such, they are both highly significant concerns but also those for which practical remedy may more easily be found suggested by the fact that these issues persist across groups regardless of technology implementation. *So these need not be considered challenges to adoption but ongoing, practical considerations that should and, to a larger extent, can be managed.*

FIGURE 3.17: Challenges from technology adoption according to different clusters

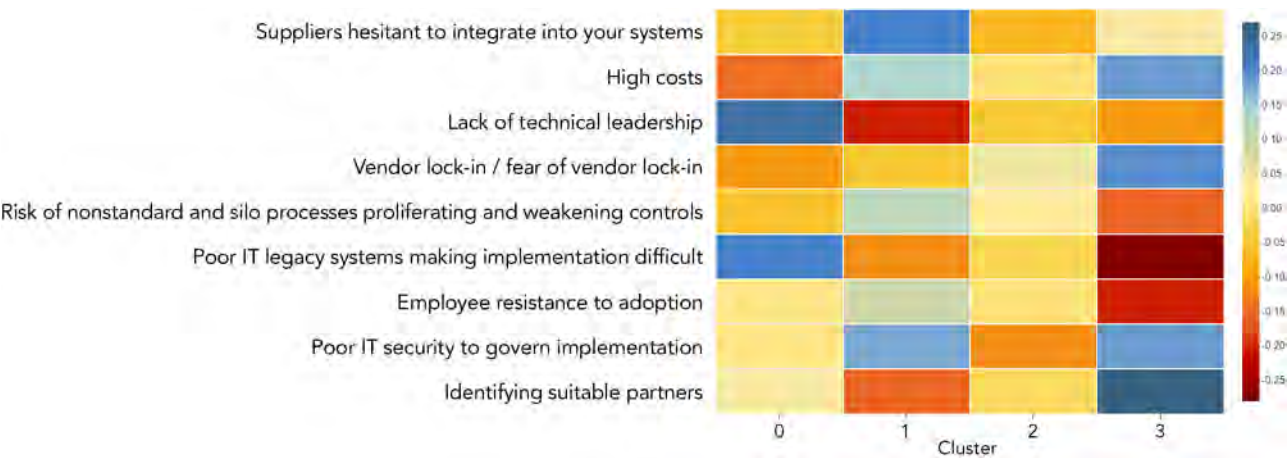
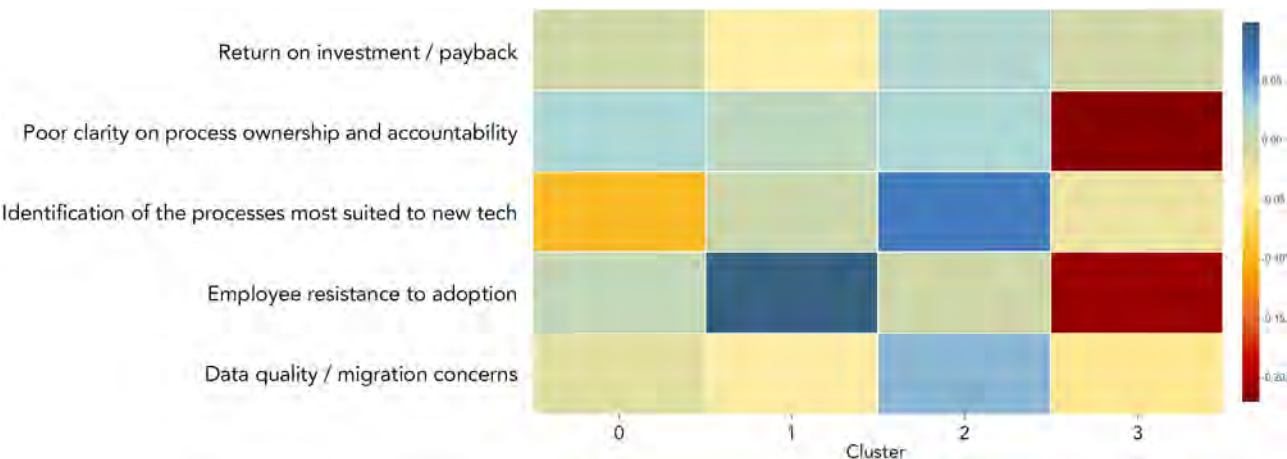


FIGURE 3.18: Common challenges from technology adoption



A foundation for growth

Replace with: A final, essential, observation is that there is no panacea to improved adoption. Indeed, having the right objectives, skills and leadership are crucial but these do not stand alone. They must be connected within an overarching strategic vision that clearly prioritises as well as connects (or balances) internal efficiency gains with more competitive and potentially transformative goals.

Reflecting on the top objectives and challenges, the dynamic between cost and value seems to rest at the core of the issue when it comes to technology adoption. On the one hand, efficiency gains are the primary objective amongst respondents while high costs are the primary challenge. For those respondents who are leading implementers, however, these are balanced by and perhaps even connected to other objectives.

This analysis suggests the importance of having an end-to-end view of process optimisation, related efficiencies, and technology reviews. This could encompass, for example, not just the AI project but an overarching view from the data lake, its basis as a single source of truth, how data is maintained and updated, and how the AI project uses these as raw materials.

This broader view also brings to the fore a wider set of challenges related to different suppliers, maintaining controls and unified processes, strengthening IT security as well as myriad costs. But it also necessitates strong technical leadership in the first instance and leads us back to the interrelatedness of technical and cultural challenges where lack of understanding can feed fear and resistance to change.

THE ADOPTION OF NEW TECHNOLOGIES CAN BE IMPETUS FOR FURTHER DEVELOPMENT, AND VERY FEW ORGANISATIONS WILL HAVE PERFECTED THIS FROM THE START. ONCE AGAIN, FLEXIBILITY AND ADAPTABILITY COME TO THE FORE IN A PROCESS OF CONTINUAL DEVELOPMENT.



4. Deeper Dive: adopting artificial intelligence

This section brings us back to a discussion about technology, and in particular the family of technologies known as artificial intelligence.

In many ways AI is simple, consisting of a data transformation – inputting data X to produce output Y, according to a model's configuration. And while it tends to sit beside automation, it can both precede and significantly enhance automation, complementing human skills and enhancing automated processes.

Most fundamentally, AI enables prediction, whether of fraudulent activity, financial performance, customer needs, emissions, or other areas. Nonetheless, human ingenuity remains essential, both for assessing needs and generating wisdom from model outputs. Ultimately, AI can support the conversion of data into value, but all models and predictions have imperfections. Though a powerful tool, AI requires human guidance and oversight to fulfil its potential.

'Even in the IT industry, in the finance department there is little automation, but in all other departments AI and all that fancy technology is more quickly coming into play. One reason is that the finance director may not want to take responsibility for [getting] something wrong, [when] something with the AI goes wrong, like when they implement the calculation of the financial statements, for example. And... for AI, sometimes the process is like a black box. You just have the input and then you get the result and then you don't know what is happening in the process. And the CFO [chief financial officer] or the finance director, they have to bear responsibility if there is some mistake. In financial reporting, that's why they feel reluctant to actually implement AI directly into the financial reporting process.'

Asia Pacific Roundtable participant

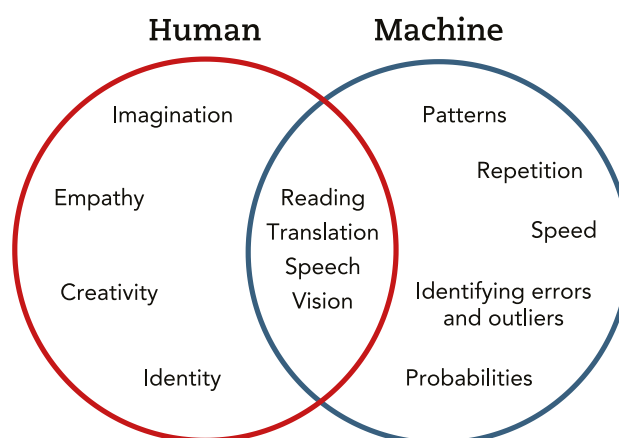
THERE'S A SAYING IN COMPUTER SCIENCE THAT AI IS EVERYTHING THAT CANNOT BE DONE YET WITH ML. IN OTHER WORDS, IT'S ALL ML.

AI: Definitions for accountancy and finance

A useful starting point for understanding the nature of AI is presented by Kate Crawford's declaration that: 'AI is neither artificial nor intelligent' (Crawford 2021). AI is built on our histories, classifications and other materials and consumes natural resources and human labour. When disentangling issues of bias and discrimination, understanding the environmental impact, and identifying impact on new and existing jobs, this is a crucial insight. As for 'intelligence', it does not have rationality independent of extensive computational training with (human) predefined rules and rewards.

Since 2016, the pace of development has been impressive. AI has been able to reach human parity in a number of areas from object recognition (2016), speech recognition (2017), reading comprehension (2018), translation (2019), conversation (2020), image captioning (2021), and question answering (2022) (Figure 4.1). Each of these developments has been possible because of the strengths of machines in learning from pre-existing data – the ability to undertake repetitive tasks, quickly and (relatively) efficiently and generate new data through the identification and reconstruction of complex patterns.

FIGURE 4.1: Overlap between human and machine capabilities



There's a saying in computer science that AI is everything that cannot be done yet with ML. In other words, it's all ML.

In colloquial terms, 'AI' is often used to refer to computer systems or machines that can perform tasks typically associated with human intelligence.

In practice, AI/ML consists of probabilistic, pattern-recognition functions that can be used for visual perception, understanding language and speech, prediction, and helping solve other data-related problems. It is also capable of performing these activities and making decisions with a certain degree of autonomy.

While automation is often grouped with AI, there is a qualitative difference. Automation can be considered to involve a relatively simple mathematical calculation, $a+b=c$, whereas AI uses probabilistic methods. Thus, there is an element of uncertainty and potential error embedded in AI.

- **Automation** relies on strict rule-based models which process information and deliver output or actions on the basis of pre-set or pre-defined rules. The application of this type of AI is best used for repetitive, repeatable and predictable tasks where there are expected outcomes.
- **ML** uses algorithms to analyse data by learning and adapting rather than being given specific, programmed instructions. The algorithms detect patterns and interpret data relationships to generate predictions or recommendations;
- **Deep learning** is a more advanced form of ML based on neural networks. It differs from normal ML in that it can be applied to larger and more complex datasets. Deep learning is used in tasks such as natural language processing, for example.

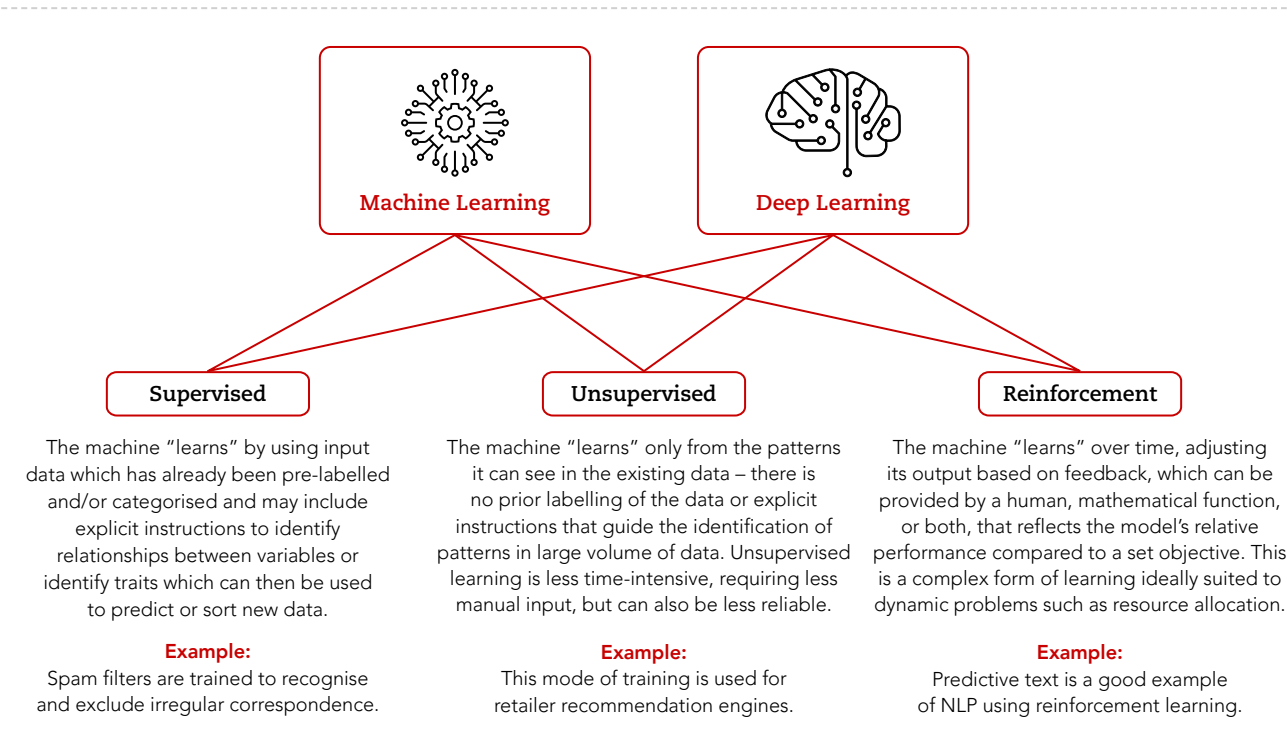
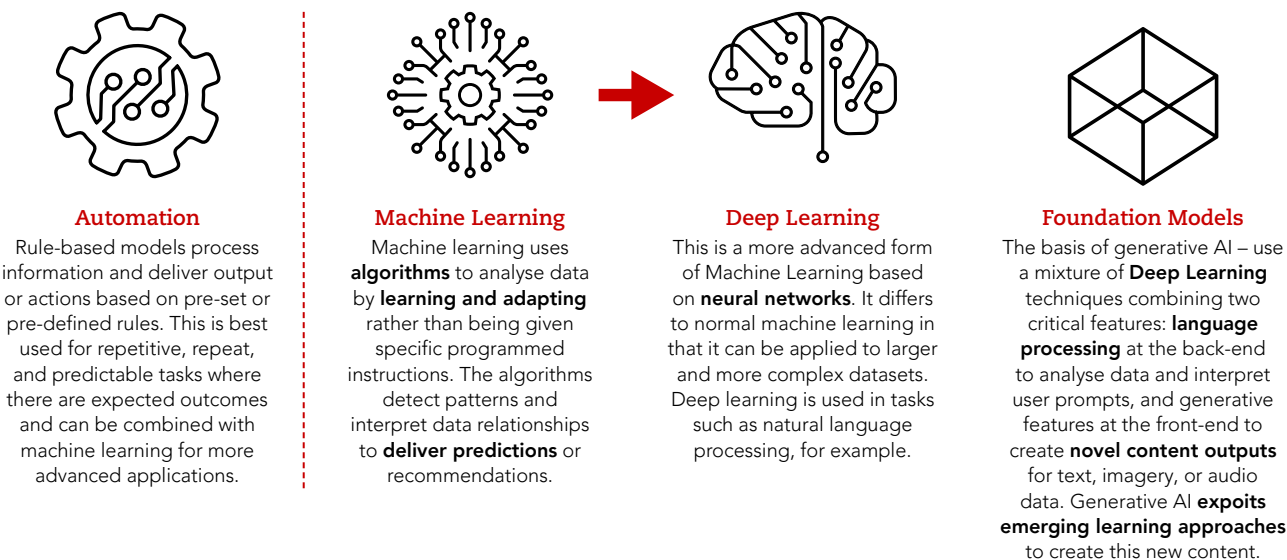
More recently, foundation models (generative AI) leverage a range of deep learning techniques combining natural language processing with generative capabilities for text, imagery or audio data. Generative AI technologies uniquely exploit novel learning approaches to create new content.



How do machines ‘learn’?

ML and deep learning both use a variety of learning techniques to produce their analysis (Figure 4.2).

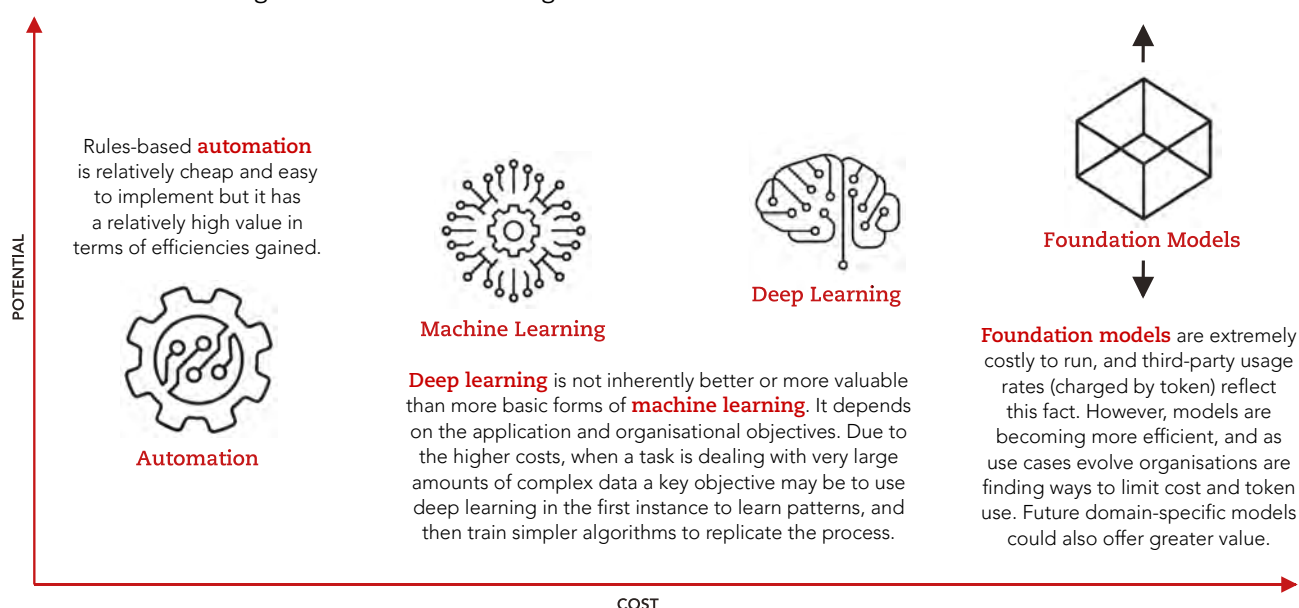
FIGURE 4.2: Types of AI



Not all types of AI are equally applicable or desirable in every situation. Selection can depend on a number of factors, including suitability for the task, cost and technical knowledge. Moving from left to right across Figure 4.2, the requirements for computing power rise substantially and, along with them, cost. As models become more efficient, accessibility will increase. Nonetheless, for the vast majority of statistical applications, common ML algorithms

are likely to be sufficient. The various technologies have a range of advantages, depending on use (Figure 4.3).

Deep learning, on the other hand, becomes more important when dealing with massive volumes of transactions and different types of data (imagery, text, etc). Here, the adoption of more complex and powerful forms of AI is required to enhance operations and identify complex patterns.

FIGURE 4.3: Advantages of different technologies

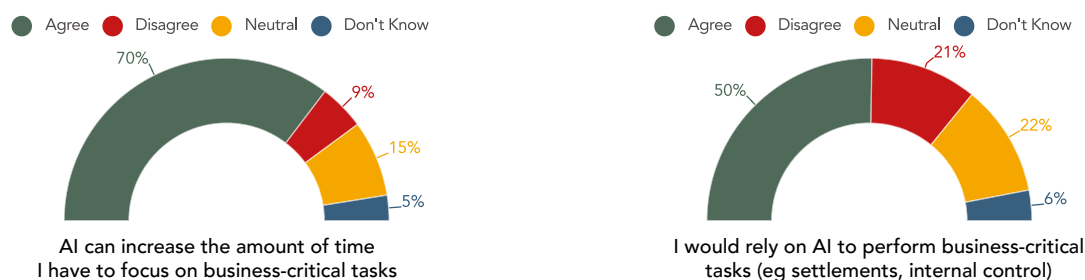
Cost is not the only factor. It is important to have clear objectives to be able to select the most appropriate tool. Simple forms of automation may be suitable for enhancing efficiency, enabling a shift in focus to higher-level objectives, different types of data, and / or measures of performance. More advanced forms of AI may create more novel opportunities requiring critical and lateral thinking, a strategic mindset, domain expertise and supporting specialisms.

Trusting AI

Roundtable discussions revealed a range of views on the extent to which AI should be relied upon, although there was a general sense of optimism about the capacity of AI to bring meaningful change (Figure 4.4). Attitudes ranged from advocating its use across all applicable tasks to more limited, 'point' applications. In all cases, participants advocated a level of human oversight and involvement. To an extent, these differences hinged on each individual's interpretation of the level of development and technical capabilities of AI, as well as a debate on the need to reconceptualise what can be considered to be 'business critical'.

Almost three-quarters (70%) of ACCA members taking part in the survey expressed a belief in the ability of AI to increase the amount of time available to them for focusing on business-critical tasks. Reflecting the discussion on efficiency gains, this group viewed the benefits as accruing to their personal ability to manage their own time better with some respondents, discussed below, keen to use this capability to re-focus on high-level tasks.

More surprisingly, half (50%) of all respondents would be willing to rely on AI to perform business-critical tasks. This group argued for a need to reframe existing tasks and examine the processes behind all workflows to determine processes amenable to automation or that could benefit from introducing new data sources and more complex decision-making tools. This group represented a variety of different approaches, united by a willingness to cast a more critical eye on existing processes and, in many cases, orient towards strategic tasks.

FIGURE 4.4: Levels of trust in AI

Roundtable discussions provided a deeper level of understanding about these positions. For a start, discussions broadly centred on some key tasks for which there was general agreement that AI would have a different impact on each.

- **Transaction posting** – Tasks such as journal entries and adjustments will be significantly impacted as many of these processes are already automated or have the potential for automation.
- **Routine reporting and ad hoc analytics** – The preparation of routine reports and ad hoc analytics is another area that will be changed. AI's ability to learn how transactions are aggregated can help automate processes, including the preparation of financial statements.
- **Insight generation** – The creation of insights for senior management and stakeholders can be supported by AI-powered business intelligence tools, but interpreting the meaning behind the numbers is less likely to involve AI as this task requires a level of creativity and contextual understanding of day-to-day activities, a skill that AI does not currently possess.
- **Regulatory reporting** – Accountants play a pivotal role in providing numbers to regulators. This task is expected to be partially affected as much of regulatory reporting can be automated similarly to routine reporting. Even so, meeting regulatory requirements also involves a certain degree of creativity in understanding and interpreting regulations, designing appropriate reporting mechanisms, and generating insights. Thus, AI will have only a limited impact on this aspect.

Some differences reflected debates on how to assess what should be considered business critical, thus helping to explain both the broad levels of trust in AI and the different levels of willingness to accept risk as systems develop.

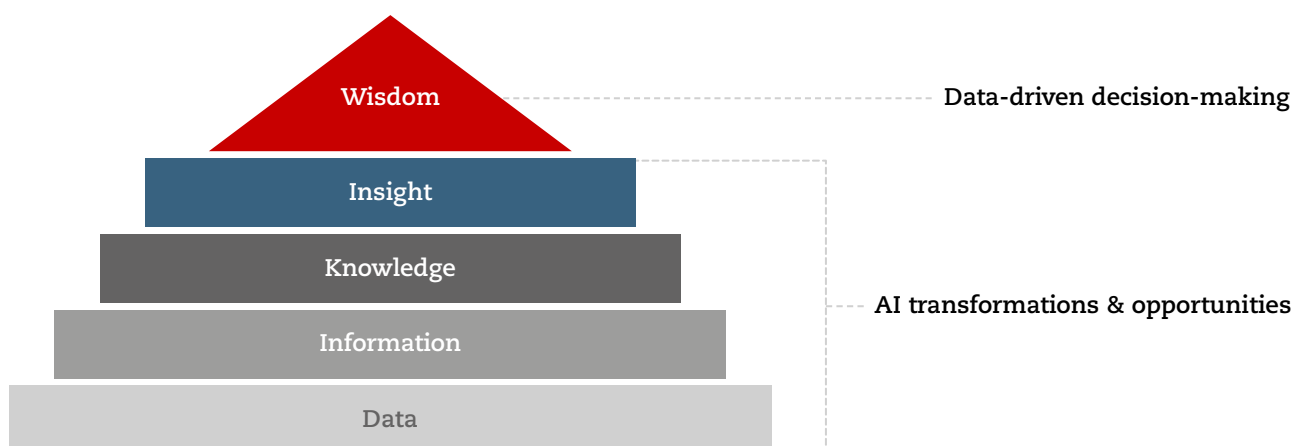
'Relying on artificial intelligence, that phrase would make me nervous. ... What we call artificial intelligence allows you to unlock that efficiency and helps eliminate what's currently opportunity cost where you're not able to do things that you probably should so ... the word "rely" probably is the one that puts me off.'

North American Roundtable participant

'For me personally, I think that [AI] would probably be more accurate [when used for] settlements and internal controls, over time. But it's this human trust element that's missing. I've seen it before, that the human will trust an incompetent human more than an intelligent machine. It's a bizarre thing. I don't know why. Is it a transparency issue? An understanding of how? I think the future is around this network of experts who are creating these solutions. It isn't ... finance. There has to be this collective coalition, where you're all contributing and opening the transparency on all of this and that's getting filtered through the business.'

UK Roundtable participant

FIGURE 4.5: The steps from accumulating data to generating wisdom and making considered decisions



To the extent that AI might help eliminate human errors and delays in payments there was general interest. Even so, discussions also emphasised that AI cannot fully replace critical thinking and human oversight.

‘[For] some business-critical tasks [eg] settlements, in a fully digital environment where transactions are happening in the millions, you want to take away that human element that leads to delays in aggregating and vetting the actual payments due to the supplier. You want AI to be able to make simple mathematical calculations based on all the transactions and have controls to be able to mitigate overpayment or underpayment. These are things that can be implemented within an AI solution and what that means is you ultimately give yourself a lot more time to focus on [matters] where you cannot improve the existing processes. How can I focus more on key KPIs [key performance indicators] that are more ... [likely to be] driving revenue and operational efficiency, which are some of the critical tasks. I would say that AI can only replace these things to some extent because it still requires some form of strategic thinking and involvement.’

North American Roundtable participant

Many roundtable participants also expressed concerns about the transparency and reliability of AI systems, raising questions about the use of open-source rather than proprietary models. It was suggested that full trust can only be established if the underlying code and algorithms used can be verified by users.

‘I think it depends on who developed the AI. If it is open source and I can check the code, I will ask my data scientist to check the code. I tend to have more confidence in that. But sometimes AI is not open source. So you don’t know what’s happening in the process. For that I cannot rely on [it] to perform important business tasks because I can outsource the task, but I cannot outsource the responsibility.’

Asia Pacific Roundtable participant

The fact is that AI is (just) a means of data transformation. It entails a process, or set of processes, to turn information inputs into a specified output or set of outputs. The black box nature of some models means that this lack of transparency can lead to reluctance to implement AI in critical processes such as financial reporting, where any error can have significant repercussions.

Discussions on the extent to which AI can be trusted or relied on for critical tasks largely centred on the ability to establish effective oversight and manage risks. The idea is not to replace the human but to improve processes while maintaining an attitude of professional scepticism.

‘In the airline industry we have pilots using autopilots ... would we consider that business critical? They typically don’t use it for landing the plane or taking off. But ... it just goes to show that AI has been with us for far longer than most people would realise. We use artificial intelligence for different aspects of our lives. It could be as simple as just running the spell-check on the document... Increasing that span to include business-critical tasks, particularly those that are mundane and repetitive, where AI has shown that it can perform such activities better than humans, I would have no problem relying on AI. There’ll definitely need to be controls in place to identify or detect issues when things go wrong.’

African Roundtable participant

‘[AI] can be used in auditing to enhance audits. For example, you do sampling, so let the AI do the sampling. But ... professional scepticism ... has to remain with the human being.’

African Roundtable participant

AI: Evolution or revolution?

There is general agreement that technology, particularly AI, has the potential to make processes more efficient and effective. There is less consensus, however, about the purpose of pursuing efficiency gains and the extent to which it might be necessary to take a more transformational approach.

Most ACCA members who took part in our global roundtables agreed that the output and goals of the accountancy and finance profession are not fundamentally changing. Instead, they predominantly stressed that technologies such as AI consist of tools that should enhance their ability to do their jobs better and faster.

To a significant extent, AI is viewed as part of a longer evolution of existing processes. From this perspective, the potential of AI is primarily in making the industry more efficient, something accountants have been working on for the past 15–20 years. In this sense, advancements in AI are not dissimilar to previous transitions, such as the move from Excel to business intelligence (BI) tools and from manual inputting to Visual Basic for Applications (VBA) and robotic process automation (RPA).

'I think AI is in accounting and finances more around the efficiency and improving our ability to do work. ... I don't think AI itself is going to change accounting and finance as a profession... [It won't change] the output, what we're trying to do. It won't drive change in that area itself ...[for example, in] identifying inconsistencies and journal entries, etc. That's what an audit function is trying to do... that's not changing what finance professionals or [accountancy] professionals are trying to do – it's how we can be more effective, efficient at it.'

North American Roundtable participant

'We had people who could ...write VBA code that could do very similar [things] to what our RPAs are doing. We can just do it faster. We can do it with a little bit more agility now. I don't think it's changing what we're trying to do. I think it's just making us more efficient at what we're trying to do.'

North American Roundtable participant

On the other hand, some participants called for a more radical rethinking of the significance of AI. This group challenged the gradual, evolutionary perspective, suggesting that the profession may be limiting itself by viewing AI as just a more powerful version of existing tools instead of recognising its unique potential for transforming their work beyond the existing frameworks.

'Do we view it as a more powerful, efficient tool? We, as a profession, are unable to see beyond Excel. I'm being very controversial here, because I think AI as a tool can do a lot more than RPA, can do a lot more than what we are using it for. Are we not being creative enough to use these tools, as a profession?'

UK Roundtable participant

A third group expressed a middle ground, reflecting on the shifting of roles within the profession and emphasising the need for soft skills, such as networking and influencing skills, alongside technical knowledge. From this point of view, as technology automates more tasks, the role of finance professionals is expected to shift towards using outputs to influence decisions, necessitating both technical and soft skills.

'I think the input and the output is pretty much the same but the way in which this process works is going to be considerably quicker and then the role of the accountant and the finance professional will slightly change. If they're not doing the analysis manually, they have to be using that output to network, collaborate, influence and drive decisions, which is a lot more [a matter of] "soft" as opposed to the "hard" skills. But it doesn't mean you can do without the technical knowledge because somebody needs to know that too.'

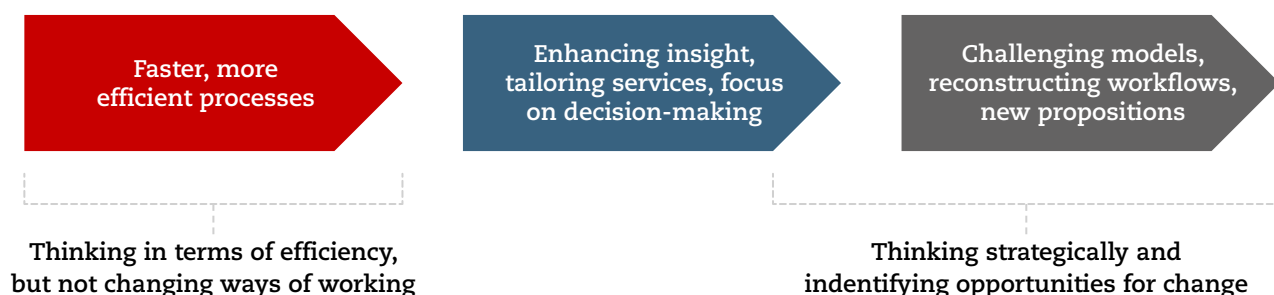
UK Roundtable participant

This introduces three distinct ways in which AI can be approached but which may also represent a progression from efficiency considerations to a more strategic approach. While efficiency gains are an obvious advantage of automation in accountancy, the benefits of automation go beyond tactical efficiencies.

'Value-driven agendas require human creativity... and AI is always ... an efficiency play because it is using the existing human knowledge and human data. I think the way AI can be used in a value-driven agenda is...essentially [to] drive better efficiency rather than driving more strategic or more creative aspects of business, of organisations.'

North American Roundtable participant

FIGURE 4.6: Three positions on the potential value of AI



One of the key strategic advantages of automation in accounting is the shift from reactive to proactive accounting. With automation, accountants can focus more closely on analysing data and providing strategic insights rather than merely recording transactions.

Thus, as we explore the evolving landscape of new technologies in accountancy, it is important to think beyond efficiency. The acceleration of business will also amplify demands on the finance department. While the motto 'do less, better' might hold appeal, the reality might require the ability to 'do more, differently'. To genuinely harness technology as an enabler, it might be necessary to reconstruct tasks to make this possible, realising the role that technology plays as an enabler of human capabilities but also as a converter of value (Figure 4.7).

Efficiency and process improvements may be necessary starting points but while efficiency may be an end-goal signifying the potential for cost savings, it can also be viewed in a more transformative way, providing the ability to take on new responsibilities.

Focusing exclusively on efficiency gains risks falling into a practice of conservation, explicitly or implicitly. Prioritising incremental gains or setting high standards for return on investment may create an obstacle to experimentation and the ability to harness technologies such as AI.

Striking a balance between these more discrete, narrow goals and larger, strategic shifts poses a real challenge and, potentially, a shift in mindset that moves beyond simple data-driven decision-making.

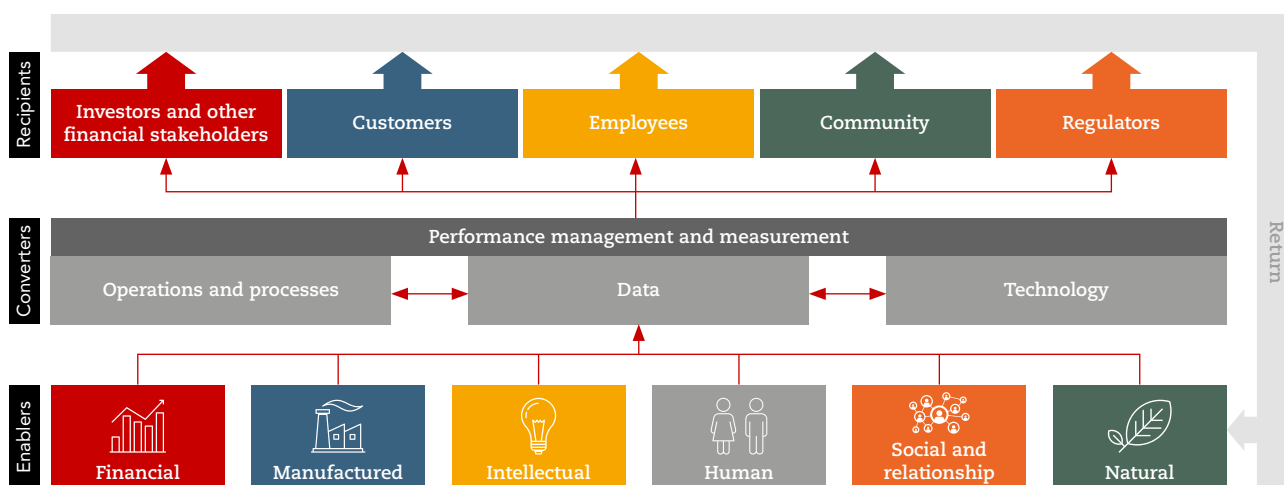
The mindset challenge may require moving from an immediate problem-solving perspective to a back-solving perspective, ie, 'if this were true, what steps might we need to take to achieve it?'

Implementing machine learning in practice: Example – Three UK

There are numerous challenges in undertaking a ML initiative from understanding the process, empowering collaboration at different stages of the project life cycle, maintaining a realistic perspective on risk (and the potential for failure), and ensuring effective oversight.

Alec Manning, FCCA, and the data science team at telecommunications company Three UK have been exploring ways of improving the firm's own internal processes through the application of ML within a secure cloud-based architecture. For example, when identifying potential fraud risk at month end the task can typically entail a lengthy process consisting of numerous databases and many hours of manual filtering and identification (Figure 4.8).

FIGURE 4.7: Organisational relationships and creation of value



When devising a solution, they followed a strict set of processes³ designed to build in oversight from ethical and regulatory standpoints and to help guide the project from scoping through to the deployment stages (Figure 4.9).

In the first instance, discussions are held with stakeholders to understand needs, expectations and problems they want to solve. This can include requirements gathering, setting project objectives, and understanding business context. The team then identifies specific methods, tools, technologies and data sources that will be required.

Establishing trust and oversight is the next step. This involves an assessment of ethical concerns that might arise during the project, such as user privacy, data security and

biases. The aim is to anticipate these issues and develop strategies to handle them and set up a regular reporting stream to the firm's data protection office. Subsequently, the business case is made, which entails estimating the potential business value of the project, eg cost savings, increased revenue, improved decision-making, or other benefits. Following the value assessment, tasks and features are prioritised and ranked against other projects. This ensures that the most valuable or business-critical projects are supported.

Project planning involves developing a detailed project plan, outlining the project's timeline, resources, milestones and deliverables. This serves as a roadmap for the project, guiding the team's work.

FIGURE 4.8: Using manual processes to detect fraud risk

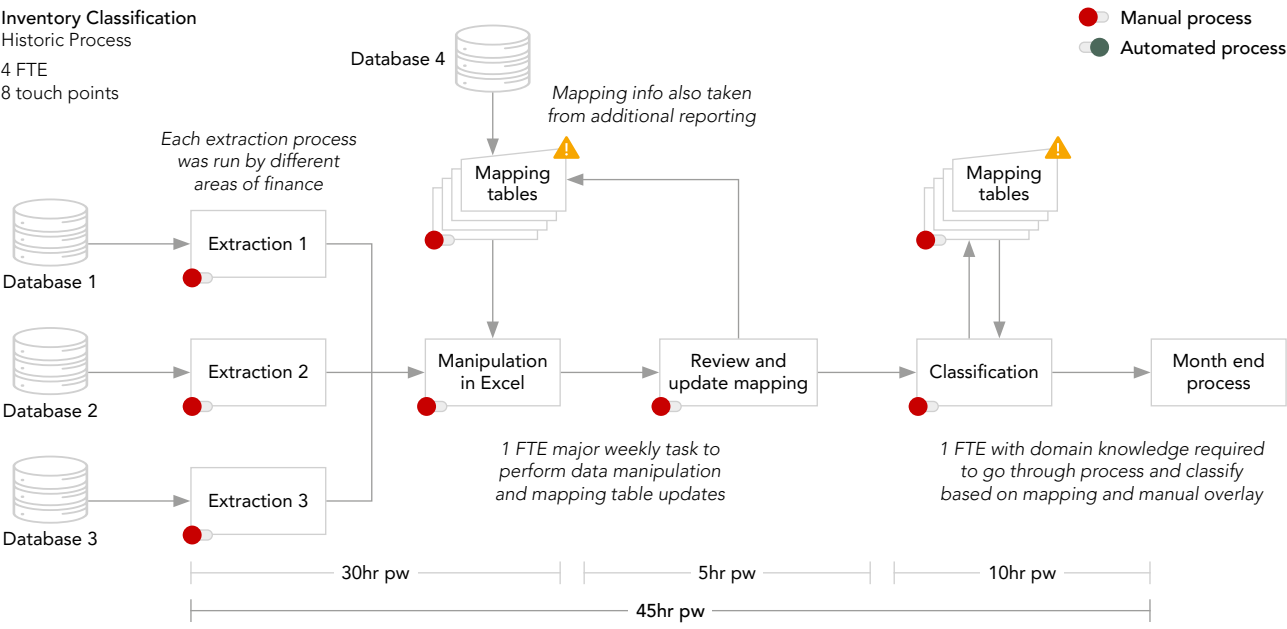
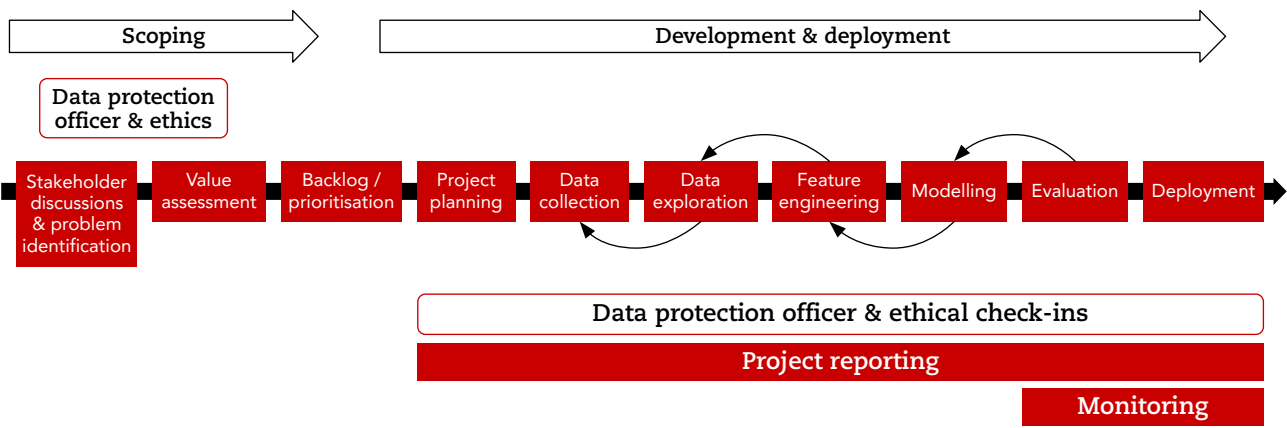


FIGURE 4.9: Stages in project development at Three UK



3 Figures 4.7, 4.8, and 4.9 contributed by Alec Manning, FCCA, MSc, Principal Data Scientist at Three UK.

The development stage requires sourcing and collecting the data that will be used in the project. This could come from a variety of sources, such as databases, public datasets or APIs.

Exploratory data analysis is also undertaken to understand the data's characteristics, identify patterns, spot anomalies, test hypotheses and check assumptions. At this stage, also, regular contact is needed with the wider business and data protection officer (DPO). The data is manipulated to create features that will be useful for making predictions, eg data cleaning, normalisation, transformation and the creation of derived variables.

The data science models are then built and trained, which could involve choosing the appropriate algorithm, setting up the training process, tuning hyper-parameters and validating the model.

The performance of the model(s) is assessed continuously. This could involve metrics such as accuracy, precision, recall, or the area under the return-on-capital (ROC) curve,

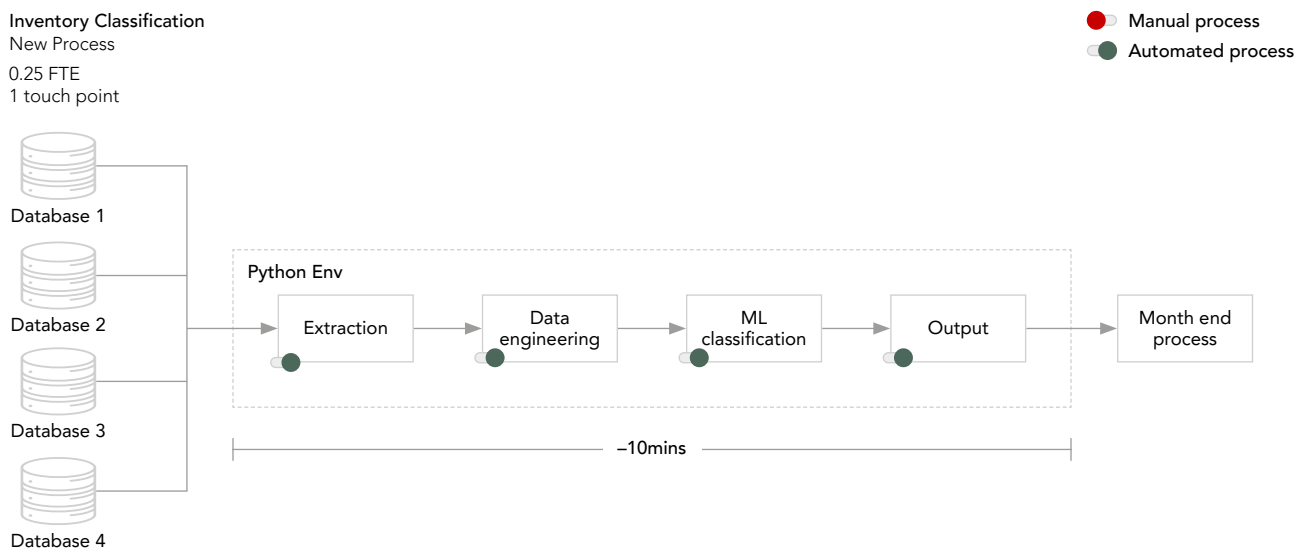
depending on the specific task. The goal is to ensure that the model meets the performance requirements set during the scoping phase. There is also the complex task of articulating these results to others in the business in a way that resonates with them and ensures understanding of what drives the model, and how pulling certain levers can influence the output.

The final models are deployed into a production environment, where they can provide predictions on new data. This could involve setting up a server to host the model, integrating the model with existing systems, or setting up a process for updating and retraining the model.

The result was a complete overhaul of the previous set of manual processes resulting in significant time-saving and greater accuracy through the use of machine learning classification (Figure 4.10).

So, what if the final reporting stage could also be fully automated? This brings us back to the potential of generative AI.

FIGURE 4.10: Using AI to detect fraud risk



How are models assessed?

- 1. Accuracy:** Accuracy measures the overall correctness of the model's predictions and is calculated as the ratio of correct predictions to the total number of predictions. While accuracy is a commonly used metric, it may not be suitable for imbalanced datasets where the classes are unevenly distributed.
- 2. Precision:** Precision measures the proportion of correctly predicted positive instances out of all instances predicted as positive. It focuses on the accuracy of positive predictions and is useful when the cost of false positives is high (eg in medical diagnosis).
- 3. Recall (sensitivity or true positive rate):** Recall measures the proportion of correctly predicted positive instances out of all actual positive instances. It focuses on capturing all positive instances and is useful when the cost of false negatives is high (eg in fraud detection).
- 4. Area under the ROC curve (AUC-ROC):** AUC-ROC measures the model's ability to discriminate between positive and negative instances across different probability thresholds. It provides an aggregated measure of the model's performance and is commonly used for binary classification problems.

Putting generative AI into practice

‘But what are the acceptable uses? I will consider it when using non-confidential information and upload it to generative AI and ask its opinion. But if you upload confidential information that would be a problem. The information will be leaked [as] when Samsung Electronics’ engineers uploaded confidential programming code to check with GPT and that code is now available in the database for everybody.’

Asia Pacific Roundtable participant

Generative AI models are widely touted for their ability to summarise or interpret large amounts of text quickly, allowing users to interact with PDF files, for example. Within accountancy and finance, tools such as ‘Claude’ from Anthropic are becoming increasingly powerful and have a wide range of applications such as helping to summarise and interpret accounting standards (Figure 4.11).

It is worth noting that some models perform better than others at certain tasks. For example, models can be designed to improve management of the risk of

Model performance

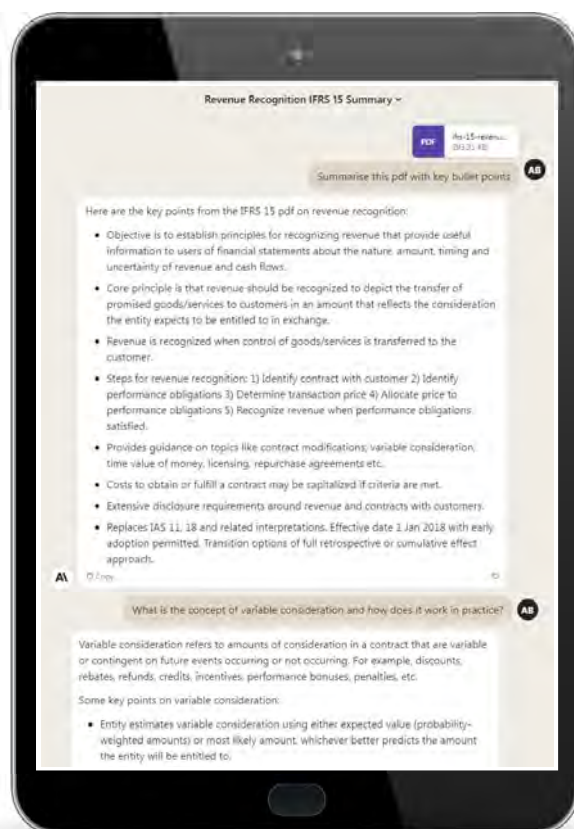
Model performance can depend on technical features such as the size of the model’s context window.

A context window refers to the number of words around a target word that are used to provide context. For instance, in the sentence “The cat sat on the mat”, if “sat” is chosen as the target word and we have a context window size of 2, then the context would be “The”, “cat”, “on”, and “the”. Claude 2 has the largest, current, context window of any generative AI model, which roughly equates to the length of a short novel like *Catcher in the Rye*. This leads to improved performance on summarisation tasks over some other models.

inaccuracy or increase the amount of information that it can hold in its memory while responding to user queries.

Nonetheless, hallucinations⁴ remain a feature of all models that must be appropriately managed. Fine-tuned models, such as TaxGPT and others, will present more reliable models for niche purposes, capable of generating accurate results with a lower risk of hallucination.

FIGURE 4.11: Claude 2 is a ChatGPT alternative that also offers the ability to interface directly with PDF files uploaded by the user



4 An ‘hallucination’ occurs when a chatbot produces a result that is inconsistent with the input data.

Generative AI web applications serve as an excellent interface for interacting with models. But, if the goal is to integrate generative AI into a data pipeline or within a software framework, turning to an application programming interface (API) and using within a secure data architecture such as Microsoft's Azure or Databricks (among others) is necessary. These will ensure that internal and proprietary data remains confidential and is not returned to the developer for training purposes. They also allow the building of proprietary applications and fine-tuning of language models to suit user needs (Figure 4.12).

FIGURE 4.12: Microsoft Azure AI is one example of an environment that offers a range of capabilities to business users



Generative AI's inability to discern truth must be a determining factor when deciding on acceptable use cases. These should be limited to cases where:

	It is possible / relatively simple to check or correct outputs
	Where there is a clear source of truth such as within the training data or in original documents
	Where the generative capabilities are being used for creative or inspirational purposes

Thus, there remains the potential for generative AI to be used for limited reporting purposes, creating text summaries or integration of documents, facilitating research, interacting with documents, and enhancing risk articulation. In essence, the choice between the web interface and the API largely depends on the specific use-case and the level of integration needed.

As we look ahead, the future of generative AI presents intriguing possibilities. These systems may mature into valuable instruments for accountancy and finance professionals, aiding in the execution of in-depth financial analysis and offering tailored, context-sensitive recommendations.

'There is a role that these large language models can play in... individual pieces of workflows, but they may not play the role of the entire workflow ... in its entirety....I think about... junior level work. These large language models are likely to have an impact, particularly anything that can be framed as [a] kind of content generation or summarisation or review. So... when you think about generating a report, writing a report, there is a stage of that where large language models can play a role, either in...reducing the total time it takes to write that report or write sections of it, or the review stage, improving the quality.'

UK Roundtable Participant

One of the very significant possibilities raised by generative AI is that it could enable much greater access to AI capabilities through its ability to generate code (Figure 4.13). Code interpreter, based on GPT4, takes this a step further and could signal the coming of much more powerful low and no code software that can help users take advantage of ML models without advanced programming knowledge. Nonetheless, advanced uses based on large datasets or access to external sources are currently limited and depend on plugins that may vary in reliability.

In the interim, finance professionals can harness the capabilities of generative AI to optimise use of time, generate personal and task-based efficiencies, and experiment with unexplored avenues. This blend of human expertise and AI technology could lead to significant advancements in the world of finance.

FIGURE 4.13: Some of the top use cases suggested by Microsoft Azure AI



Caution and patience

Discussion about potential uses has already been very lively. Table 4.1 summarises some of the functions that have been discussed in relation to the use of generative AI. The point here, however, is that each application entails serious challenges and risks without the use of models that have been specifically trained on and/or fine-tuned for the particular purpose or on the most relevant and recent data. For each of these purposes, accuracy and reliability are essential. General models (such as ChatGPT) are unlikely to be sufficient without further training and development and access to the most recent source data. Thus, generative AI may offer support in these areas but not a comprehensive solution.

Moreover, in many of these use cases, more established and effective forms of ML can be applied. The fact that generative AI is more widely accessible given that it allows users to interact with the model in natural language is

both a boon and a major risk factor as it encourages users to use a generalist tool where a specialist knowledge is required. It remains important to have the requisite understanding and skill set to undertake any application of AI within a professional setting.

‘You can talk about state of development, but I think it might be impossible for us to completely eliminate some of these risks. So ultimately [there] has to be a decision to accept some of those risks. ...one example is talking about self-driving cars: if we find out that self-driving cars are 100 times safer than human drivers, it doesn’t mean occasionally they wouldn’t have accidents, but we could accept the risk. We’ve moved significantly forward from where we were. So yes, stage of development is important, but even in the mass trust stage there will still be risks that need to be accepted.’

African Roundtable participant

TABLE 4.1: Possible uses of generative AI technology and associated risks and challenges

DISCUSSED USES	EXAMPLE(S)	RISKS / CHALLENGES
Searching, retrieving, and offering answers on an organisation’s internal data	Financial reports, dashboards, competitive analysis, accounting procedures, risk analysis, audit reports	Data quality, cost, privacy / data protection
Referencing accounting rules and standards, documentation	Answering specific questions about accounting standards such as International Financial Reporting Standards (IFRS) or generally accepted accounting principles (GAAP), software as a service (SaaS) applications in development / start-ups	Incomplete or inaccurate information, depends on using an API to gain access to latest information, credibility, hallucinations, context window limitations
Tracking economic and competitive trends	Providing valuable insight into market trends and competitor performance	Incomplete or inaccurate information, relevance, reliability, depends on using an API within a protected environment to gain access to latest information and ensure privacy of data inputs, sparsity of information for some organisations / sectors / regions increases chances of hallucination
Digitisation of invoices	Data extraction, process automation, error detection and data analysis	Inaccuracy, error checking / effective and adapted prompting, formatting
Synthetic data for scenarios / simulations	Help creating synthetic datasets for scenario planning, simulations, robustness tests, etc.	Cost, capacity
Risk management	Creating risk profiles for clients / sectors / geographies, extracting data from conversations, interactions, documents	Inaccurate or incomplete information, hallucinations
Data analysis / financial analysis	Help learning analysis tools and methods, facilitate speed and coverage of analysis	Lacks domain knowledge, best uses require (at least minimal) coding skills
Financial reporting, forecasting and planning	Analysing historic data, market trends and business strategy to create accurate financial projections for revenue, expenses and capital expenditures. Helping to analyse business cases, conducting sensitivity analysis, and assessing the feasibility of a strategic investment	Incomplete or inaccurate information, relevance, reliability, depends on using an API within a protected environment to gain access to latest information and ensure privacy of data inputs

Changing how we interact with technology: should you learn ‘prompt engineering’?

As previously mentioned, generative AI has the potential of changing the way in which we interact with technology and the excitement about ‘prompt engineering’ is a potential example of this.

What is prompt engineering? Consider using a sophisticated calculator. If you input the right formula or equation, the calculator gives you the result you need. The process of creating that perfect formula is similar to prompt engineering. The difference is the use of language.

In AI, a ‘prompt’ is essentially a specific instruction or question that you feed into an AI model to get the desired output. So, prompt engineering is the art of designing or refining these questions or instructions to get the most useful or accurate responses from the AI.

For instance, if you were using an AI tool to analyse a company’s financial data, the prompt ‘Analyse the company’s financials’ might give you a general overview. But, if you engineer the prompt to be more specific, eg ‘Provide a year-on-year comparison of the company’s gross profit margins’, the AI is likely to give you a more detailed and relevant response.

The emergence of prompt engineering in the AI landscape has been marked by significant interest as businesses rapidly explore how generative AI can assist in their operational frameworks. A critical component of this intricate AI puzzle is the requirement for core knowledge or domain expertise.

The art of prompt engineering is simple yet potent; the right amalgamation of characters can shape model outputs to achieve the desired results. Its efficacy relies on a well-structured, comprehensive dataset and most importantly, an individual with significant domain expertise. The value of an expert within a specific field is essential to the crafting of detailed prompts. An expert’s ability to critically assess, modify and adapt the AI outputs to meet evolving needs and requirements is of immense value to organisations. A purely prompt-focused engineer, in contrast, may only be capable of executing smaller, highly specific tasks under explicit instruction, and will probably struggle when dealing with innovation or adaptation.

The question remains as to whether prompt engineering is a critical skill for the future, or whether it will be a passing phenomenon unique to the developing state of generative AI. Whatever the future scenario, the benefit of understanding prompt engineering is that it provides insight into how generative AI and large language models (LLMs) work. This understanding may well hold value beyond the application of the particular skill.

Prompt engineering

While courses on effective prompt engineering are proliferating, any good prompt requires a clear instruction, additional context to guide the model, and guidance as to what the output should look like.

Good prompts generally take into account factors such as the following.

- **Clarity:** The prompt must clearly state what is needed. Vague prompts can lead to broad or off-topic responses from the AI model. If you want a specific type of response, your prompt must clearly ask for it.
- **Specificity:** The more specific the prompt, the better the AI will be able to generate a targeted response. This might include specifying the desired format for the answer, the type of information required, or the context that should frame the answer.
- **Context:** Providing relevant background or context can help the AI understand what you’re asking and generate a more appropriate response. This might involve explaining the scenario or situation you’re asking about or defining any uncommon terms or concepts.
- **Directness:** It’s often helpful to ask the AI directly to do what you want, such as ‘Write a summary of the following text’ or ‘Translate the following English sentence into French’.
- **Language:** Using correct grammar, punctuation and spelling not only makes the prompt easier for the AI to understand, but also sets an example for the kind of language you expect in the response.

Ethical accountability

From data leaks in blockchain transactions to mistakes in AI-driven financial reporting, risks will evolve, and it will be important to remain attentive to this and to how risks can be assessed and mitigated.

It is also important to remember that some applications are still developing, so proper and regular testing and oversight are also needed to ensure that we are not left vulnerable to a range of uncertainties that will only become clear over time.

Even the performance of models should not be expected to remain stable. Some researchers have suggested that the performance – including specific mathematical capabilities – of certain LLMs, including ChatGPT, have actually deteriorated over just a few months (Chen et al. 2023). The reasons for this are less clear: some explanations link it to training emphasis where developers have focused training on certain textual capabilities to the detriment of others, while other explanations focus on the extent to which models have begun to consume lower-quality training data, including data produced by other LLMs. In the worst-case scenario, models trained exclusively on data generated by other LLMs degenerate and collapse over time (Shumailov et al. 2023).

Different uses will also mean that certain risks are more prominent than others, so specific applications will need to be appropriately addressed also taking into account developing standards and regulations. At the core, these are likely to revolve around existing restrictions stemming from data protection and privacy laws and law protecting equality, anti-discrimination and human rights. In particular, this could mean transparency around the use of AI, the right to opt out, understand AI-based decisions, and not be unfairly impacted by those decisions.

This suggests several serious risks that must be carefully addressed when considering the adoption of AI or ML:

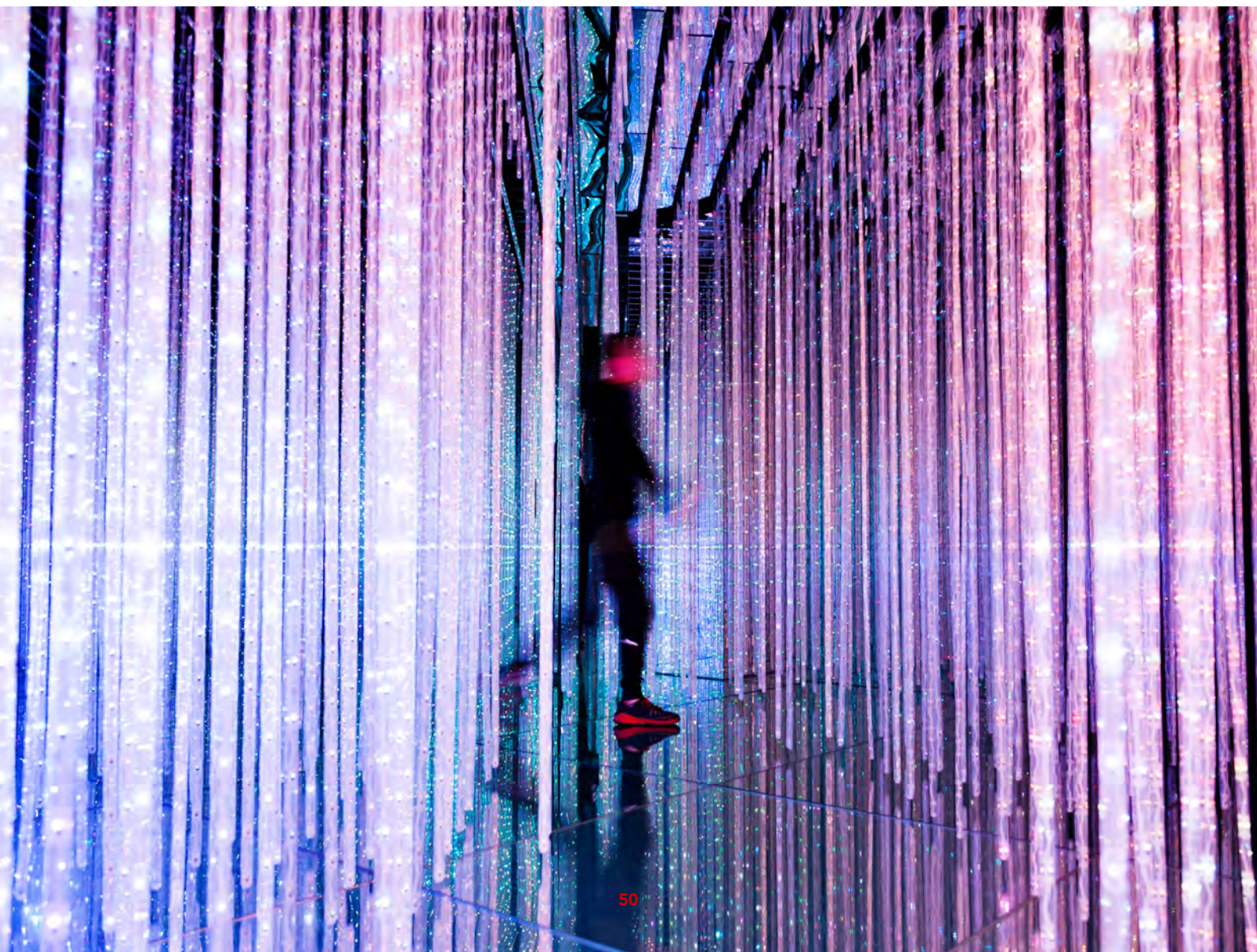
- **Explainability and transparency:** AI systems, particularly deep learning models, are often complex and difficult to interpret. This lack of transparency can lead to the concealment of the decision-making processes and obscure the inherent logic of these technologies. When users fail to understand how an AI system arrives at its conclusions, it can lead to scepticism and resistance to this technology. This lack of trust can hinder the adoption of AI, which ultimately slows down technological progress. As our 2020 report – Explainable AI: Putting the user at the core – attests, explainability is a crucial capability that can enhance value capture, boost ROI, and enhance services.
- **Bias and discrimination:** AI systems are not devoid of biases. Biased training data can inadvertently perpetuate and amplify societal prejudices. Poor algorithmic design or ‘drift’⁵ can also result in discrimination. Quality training data is critical, but bias is endemic. Understanding how to manage and counter negative biases is essential.
- **Privacy concerns and security risks:** with the ability to collect and analyse vast amounts of data, AI technologies pose significant privacy and security risks. Data protection regulations and secure data handling practices are crucial to mitigate these privacy risks. AI can be a double-edged sword in the realm of cybersecurity. While it can enhance security measures, it can also be harnessed by cyberattackers to increase the sophistication of their attacks. Therefore, organisations must prioritise robust cybersecurity measures when deploying AI technologies.
- **Legal and regulatory challenges:** the advent of AI technologies necessitates the development of new legal frameworks and regulations. These should address unique issues arising from AI technologies, including liability and intellectual property rights. Legal systems must evolve to keep pace with technological advancements and protect the rights of all stakeholders. The question of liability and copyright in AI is a significant challenge. When an AI system makes a mistake, who is to blame? Is it the developer, the user, or the machine itself? When data or work is used to ‘train’ a model, what rights do individuals have to protect their intellectual property? These unresolved questions pose a significant risk for organisations using AI, adding a layer of uncertainty to AI deployments. The pace of development means that these conversations are occurring urgently with different countries proposing distinct approaches to regulation. Uncertainty about future regulatory frameworks and discrepancies across jurisdictions make planning for AI initiatives challenging.

5 When the statistical properties of data used to train an ML system change, this ‘drift’ causes the system to become less reliable.

- **Inaccuracy and misinformation:** AI systems are fundamentally probabilistic, meaning they analyse data and produce a response according to patterns and statistical correlations, but they are not always entirely accurate. One example is known as AI hallucinations, where AI systems confidently assert claims that are simply untrue.
- **The magnification effect:** one of the unique risks of AI is the magnification effect. While human workers might make a handful of mistakes daily, a bot handling vastly more amounts of data could substantially amplify any single error. Therefore, robust testing, validation and monitoring processes can help developers identify and fix such issues before they multiply.
- **Unintended consequences:** as the application of AI increases, unexpected issues may arise, requiring a swift and effective response. Hence, organisations must maintain a flexible and adaptive approach when deploying AI.

'[For the accountancy] profession, generative AI might be one of the biggest risks. It has the ability to generate new data, new information from old information... [for] cosmetic accounting, it's the next level. It has potentially made the auditors' job a little more difficult and we should begin to sound the wake-up call on what...we [can] use to counter bad data. Think about billionaires being cloned to make them say things that they did not. That could change financial markets. The CEO coming out to announce something that's not true based [on] generative AI, targeted by a bad actor. It means people will make buy or sell decisions based [on] bad information. It's a wake-up call for organisations and government institutions to start thinking of laws to regulate and check these excesses. Right now the use cases are evolving towards monetisation. So how can I use this ... fast to help drive my bottom line? That could mean a lot of things that we can't even comprehend right now. So it's a wake-up call.'

North American Roundtable participant

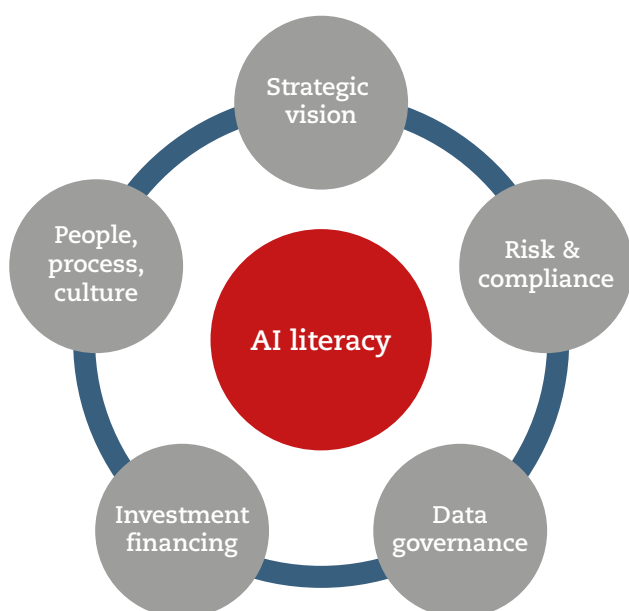


5. What does this mean for finance teams?

AI literacy supports future accountability

For AI, we believe there is a circle of accountability that establishes the core practices required to ensure ethical adoption (Figure 5.1).

FIGURE 5.1: The AI circle of accountability



- **Strategic vision:** Aligning the capabilities of AI to the strategy of the organisation.
- **People, process, culture:** Sharing AI best practices across the organisation.
- **Risk and compliance:** Ensuring risk professionals collaborate with technology teams to govern AI.
- **Investment financing:** AI investment entails uncertainty; financial flexibility to support experimentation is key.
- **Data governance:** Data governance is key in ensuring the ethical use of AI and compliance with legal requirements.

At the heart of the circle is **AI literacy**: understanding the different types of AI models and how they work as well as the associated benefits and risks these present to the organisation. Importantly, this includes the understanding that the accuracy of an AI model may deteriorate over time.

‘With finance business partners, where you would be working with the business to provide the numbers in a manner they can understand and digest, I think the same should be applied to AI. ... artificial intelligence could be explained in very [simple] terms, as opposed to talking about the statistical models and identifying the limitations of it and the dependencies of it. People are fearful of even the words “artificial intelligence”. Artificial intelligence is 100% dependent on the data it is learning from. And now if you can understand that concept you know that it’s limited. It isn’t creative. It’s just another tool, another piece of software that’s doing something particularly impressive. I think that accountants could particularly play a role in that and they could break down the barriers with the business by acting as a business partner by simplifying the concepts and keeping away from... the terminology and statistical modelling and thinking.’

UK Roundtable participant

Surrounding this central requirement are core practices related to five key areas.

- **Strategic vision:** understanding the capabilities of AI and having a clear strategic vision of how AI will be used to meet the objectives of the organisation.

Specific skills are often the focus when considering the impact of new technologies. Nonetheless, every discussion should begin with a strategic direction that helps set out a roadmap for where a particular technology provides value. In technology circles, this is often defined in problem statements. Being able to identify the right problem statements is crucial, and that means being able to eliminate those problem statements for which technology is unlikely or unable to provide a solution or for which solutions are too complex or costly to build.

- **People, process, culture:** driving a transparent and collaborative culture across the organisation that shares best practices and seeks to improve AI adoption continually through stakeholder engagement.

‘The role is becoming less siloed and more network based and more collaborative and more of a coalition. [Speaking] about ...impact analysis as a change practitioner – you do your impact analysis and you work with different parts of the business to understand how to incorporate that into a view as opposed to just working on a spreadsheet in the corner, talking about costs and benefits, I think is the way forward.’

UK Roundtable Participant

- **Risk and compliance:** a strong relationship must be established between risk and audit professionals and technology / innovation teams within the organisation, to govern AI use appropriately.

‘There’s an element of systematic risk that’s introduced. And so the design of automated techniques, be they analytics based or machine learning based, whatever they might be, becomes much more of a challenge. We touched [earlier in the roundtable discussion] on QA [quality assurance] of process versus QA of outputs... it depends on which level, which dimension you’re looking, because an output on one dimension is a process for another. So for firms that are using analytics tooling, how and to what degree are they leveraging best practices established in the tech world for QA? You know, code review, pair programming, documented diffs that are being committed? These are the things that, if I were a regulator, I would be expecting firms to be demonstrating to me.’

UK Roundtable participant

- **Investment mindset:** investment in AI initiatives entails a high degree of uncertainty across the project life cycle, demanding continual monitoring and oversight of related costs and benefits, as well as the flexibility to support experimentation financially. This may require non-linear thinking or going beyond purely data-driven justifications to identifying interdependencies, improving cross-functional collaboration and enhancing understanding of systemic impacts.

‘From a financial perspective, the cost of developing ChatGPT, [the developers] spent billions of dollars to hire engineers with PhD’s in computer science to develop [that] AI. Many AI companies are losing money, they’re not making a single dollar. So I’m happy to have straight cost accounting rules to make sure that the AI investment justifies the cost. AI engineers are very expensive. I think there are two angles. One is that you look at the revenue generation angle. You make use of this AI to generate X amount of money by collecting revenue or subscription fees from

users. The other angle is cost saving, [for example] if you are using this AI, you can help our company to save this amount of money every month.’

Asia Pacific Roundtable participant

- **Data governance:** finance professionals have a key role to play in effective data governance, ensuring good data quality, suitability, accuracy and compliance with legal and regulatory requirements.

The adoption of AI models inevitably introduces ethical considerations and challenges. Finance teams have a critical role to play in helping ensure that AI models are used ethically and effectively across the organisation. The circle of accountability (Figure 5.1) requires that finance professionals keep up to date with the latest developments in AI technologies and, secondly, actively collaborate across the organisation with those teams who are driving innovative solutions around this emerging technology.

‘As accountants we have a huge role to play given that we do have some ... statistical background. But the challenge that our profession inherently has is looking at innovative ways to do what we are doing... There is that barrier even though we can understand mathematically how to apply some of AI principles to what we are doing. We are not innovative enough to think beyond the box to apply. How do I use AI, for example, to analyse a set of journal entries and find out fraud. That’s a use case for AI. But do we think like that? I’m not sure whether we have the training to think like that. So that’s kind of the chasm that we need to cross.’

North American Roundtable participant

This is also a foundation for building trust. Trust remains a significant barrier to adopting new technology. People tend to trust humans more than machines, even when machines can perform tasks more efficiently or accurately. Overcoming this trust barrier requires clear communication about the limitations and dependencies of AI and other technologies.

‘Whenever there’s talk about changes and the future and efficiencies, just that word ,,prompts people to panic and think that they’re going to lose their jobs. But maybe we can help them see that there’s an opportunity. As soon as you get that negative reaction [people] can sabotage the change that’s ahead and not embrace it. People aren’t embracing it because perhaps their understanding is that [they will] lose their job and they don’t want to change and develop their skills. So that’s where I think we have to try and turn around that message. It’s also about what it can do for you, not just what it’s going to do for the business.’

UK Roundtable participant

Will AI displace accountancy and finance jobs?

The potential for AI-driven automation to lead to job losses is a persistent concern. In March 2023, a report released by Goldman Sachs ranked accountants and bookkeepers among the top professions expected to be affected by the spread of AI. The *Future of Jobs* report by the World Economic Forum (WEF) has reflected a similar perspective over the past several years.

These reports highlight an important reality. As AI technologies continue to develop and become more efficient, it is crucial for the workforce to adapt and acquire new skills to remain relevant in the changing landscape. This will ensure that the potential negative consequences of automation are mitigated and that the workforce remains adaptable and prepared for the changing landscape.

On the other hand, the WEF's *Future of Jobs 2023* report (WEF 2023) highlights another important trend: that the pace of automation has been significantly slower than was expected in previous versions of the survey. Not only has the pace of automation been slower than expected (a meagre 1% increase since 2020), but estimations in the expected level of automation have also receded slightly (from 47% of tasks to 42% of tasks), according to the report. This probably reflects some practical and economic realities that could put pressure on many of the gloomiest forecasts. Put simply, there are varying levels of cost, effort and skill associated with automation. Moreover, automating one job in its entirety may mean a shifting of responsibility and oversight to another area of the business, which is then subject to increased demands.

Domain expertise is and will remain absolutely crucial. The adoption of AI increases rather than decreases the importance of experts – such as finance and/or risk professionals – to oversee critical processes and functions. AI may offer helpful support and productivity boosts, but it will not be able to replace the ability to think critically and take into account a broad array of contextual factors when making decisions, even when made on the basis of AI-driven insights. Judgement is key. While some tasks can be automated it does not mean that they should or will be automated. Different organisations are likely to find their own balance in this regard, depending on their sector, objectives, business model, values and compliance with local regulations.

'The future of the accountants is more about how they will do it as opposed to what they do... The role of the accountant, from what I've seen in different organisations, is they're in a really good position. The CFO is generally next to the CEO [chief executive officer]. ... the finance function has accountants who are part of membership bodies which are governed and there's lots of ethics and principles that they adhere to. It's a ... governed profession. Historically, it seemed like they have not had the soft skills as much as other functions and so in the future [accountancy] will need more focus on the soft skills, alongside more dependency on machines during the data analysis phase. But then everybody's looking to move into this space. We've got chief information officers, we've got chief data officers. They all want a place at this party but I think we're in the best position to do it and repurposing how we function or how we do our role is the key to maintaining that.'

UK Roundtable participant

ACCA reports such as *Transformational Journeys* (Evetts et al. 2021), *Accounting for a Better World* (ACCA 2022), *Chief Value Officer* (Webb 2023a), *Integrative Thinking* (Machado and Chen 2023) and *Accounting for Society's Values* (Webb 2023b), in addition to ACCA's upcoming report on *Just Transition* all highlight the fact that expectations for the finance profession are dramatically shifting. To address these changing expectations effectively and meet future demands, the way in which finance is practised may also need to change. Different forms of AI, from basic rules-based automation to foundation models, are enablers helping to manage growing task loads and work with non-financial data to give a better understanding of the challenges that lie ahead.

There is the alternative possibility that increasing workloads pose a more immediate threat to the profession if the benefits of AI and automation are not taken seriously. As different elements of performance evolve, the amount of work required is unlikely to decrease.

AS AI TECHNOLOGIES CONTINUE TO DEVELOP AND BECOME MORE EFFICIENT, IT IS CRUCIAL FOR THE WORKFORCE TO ADAPT AND ACQUIRE NEW SKILLS TO REMAIN RELEVANT IN THE CHANGING LANDSCAPE.

Future avenues

How we conceive 'value' is central to these discussions. Technology – and AI specifically – is a crucial converter of value, helping us to use our resources more effectively to achieve a range of objectives. Technology can support this shift to a more value-driven agenda.

'What I'm thinking about the value-driven agenda is thinking more about the... the triple bottom line. I've got some specific use cases of how we've implemented AI to monitor CO2 emissions for people's planned travels. It looks at all the bookings, it looks at the flights and it can give a calculation on the CO2 emissions, which we then have to manage to hit the targets we've committed to as an organisation. Without the AI, it would have been incredibly expensive and difficult. Another case is we have people travelling to a specific country in the Far East and they have vendors which are blacklisted because of ways that they've been operating and it blocks everybody's spending with that particular vendor. It lists them all so you're not supporting known organisations that are trading in this specific country, which I thought was pretty fascinating. And again, it's driving value that isn't specific to our outcome as an organisation, but it's the bigger picture. And I think that's how AI is supporting this from a more global value as opposed to our profit. You know the CO2 emissions ...[are] used as a...green target and it's always great to put on your reports and ...get recognition.'

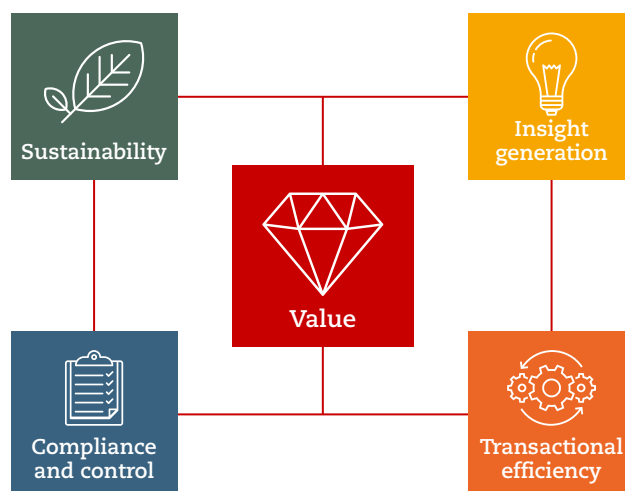
UK Roundtable participant

Dr. Clare Walsh, Director of Education at the Institute of Analytics, points to two areas where accountancy and finance professionals' expertise is likely to be in demand moving forwards: sustainability reporting and algorithm auditing. As new legislation requiring mandatory carbon reporting is applied there will be a growing need for professionals with financial and accountancy expertise to take on important roles in measuring and disclosing organisations' environmental impacts. This includes carefully tracking the sustainability practices of suppliers, analysing how customers use products and services, and modelling the environmental impact of goods and services, including their disposal.

Environmental impact data will need to adhere to consistent international standards, creating a reporting process similar to mandatory financial reporting. This presents an opportunity for accountants, auditors, financial analysts and other finance professionals to apply their skills in measurement, data analysis, reporting and assurance to the emerging field of sustainability accounting. Their expertise will be invaluable in developing rigorous carbon and environmental footprinting models, verifying emissions data, assessing disclosure risks, and ensuring organisations transition toward meeting mandatory sustainability reporting requirements. By leveraging their financial reporting skill sets, finance professionals can play a crucial role in supporting the accelerated transition toward robust, standardised environmental reporting across sectors and creating genuine value (Figure 5.2).

At the same time, while the adoption of technology should not be considered as an end itself, it can have an independent impact on the business environment.

FIGURE 5.2: The components of value



An AI or algorithm audit is the process of reviewing and evaluating ML models and algorithms to assess their performance, fairness, transparency and compliance with regulations. In the UK, the Centre for Data, Ethics, and Inclusion (CDEI) has suggested that AI assurance could prove to be an important growth area in the future, contributing up to £42 bn to the economy by 2035.

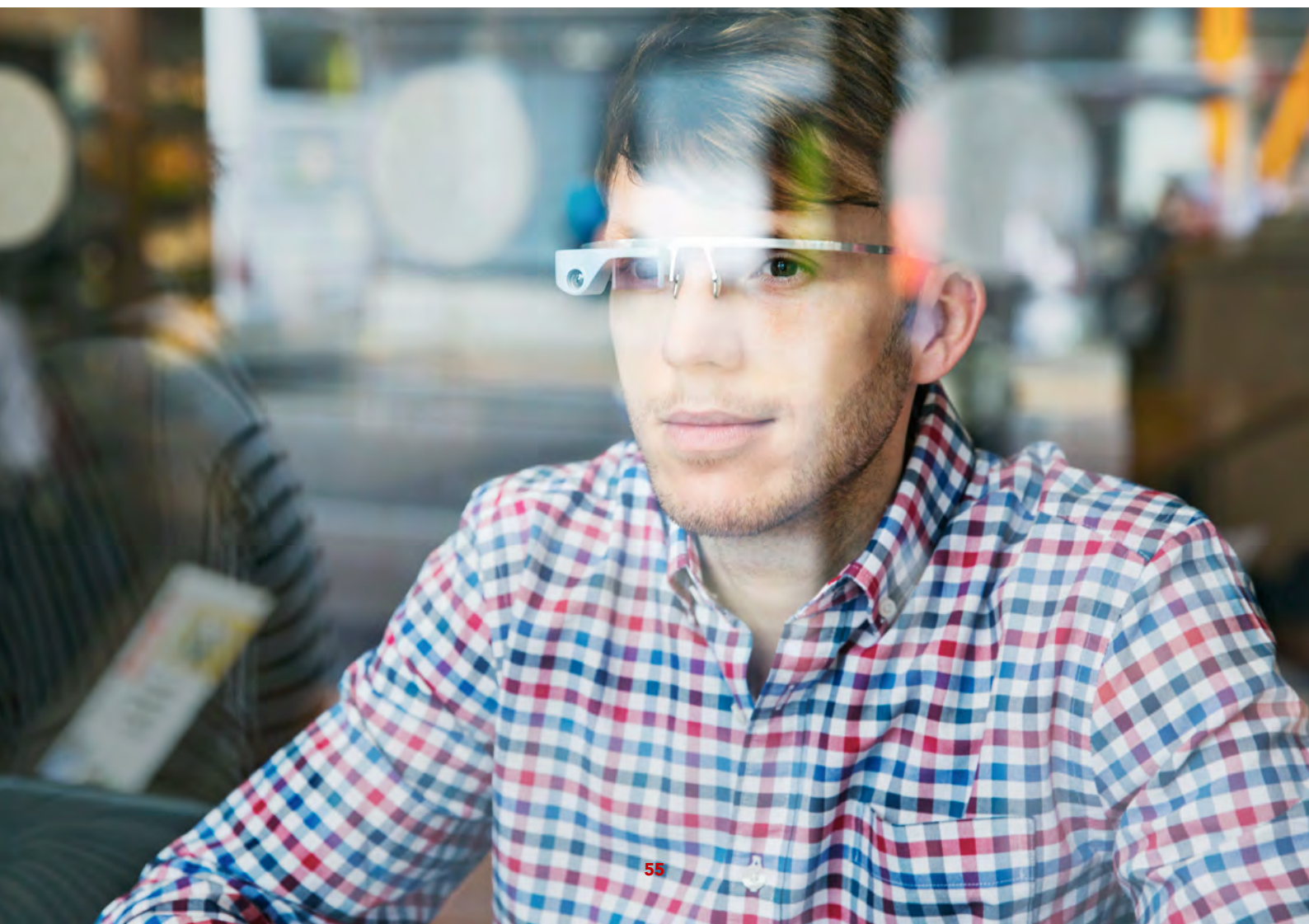
- Like a financial audit, an AI audit aims to provide independent verification of claims made for an AI system's outputs and overall reliability. Auditors examine factors such as data quality, model robustness and monitoring procedures.
- As with a QA audit, the focus is on identifying risks, biases and inconsistencies that could damage service delivery and outcomes. Auditors look at training data, model metrics and real-world performance.
- Drawing on compliance audits, algorithm audits evaluate adherence to ethical AI principles and relevant laws. Auditors review such areas as data privacy, discrimination and transparency.
- As in IS/IT audits, the emphasis is on security, governance and proper documentation. Auditors ensure rigorous access controls, change management and model lineage.
- As in operational audits, the reviewing process flows, roles and controls provide insights into an AI system's real-world implementation.

An AI audit blends elements of verifying accuracy, probing risks, assessing fairness, and ensuring accountability – relying on many of the same principles that underpin traditional assurance engagements. A risk-based, professionally sceptical approach remains crucial.

The future of the finance profession lies in helping business and society work through these challenges. But ultimately, a better future entails a combination of domain experts all working towards a collective goal.

'I'm a big believer in multidisciplinary audit teams of the future. You know what you're seeing at the moment is the accelerating adoption and impact of analytics in the broader audit space, particularly around process assurance. You know the three-way match, but more data points, more nuance, more coverage over process...Where you've got automated scripts or models that are running year after year, you need a particular technical skill set to build and manage that. They need to collaborate with people that can speak the same language but are working on other aspects.'

UK Roundtable Participant



6. Skills for the future

Member practices and training intentions

Skills form part of the foundation of effective implementation and help manage some of the challenges of employee resistance to adoption, remedying shortfalls in know-how, setting appropriate objectives and identifying opportunities.

Unsurprisingly, there are significant differences between those tools in now common use and those for which members are most keen on further training (Figure 6.1).

Advanced analytics tools and RPA / automated workflow tools have the greatest difference in ranking, both with a 10-place rise between their current ranking and their expected future ranking. Although they are not highly used at present (ranked 11th and 13th respectively), they top the list for requiring further training (ranked 1st and 3rd). This suggests an awareness of both a large skills gap and the potential these tools hold.

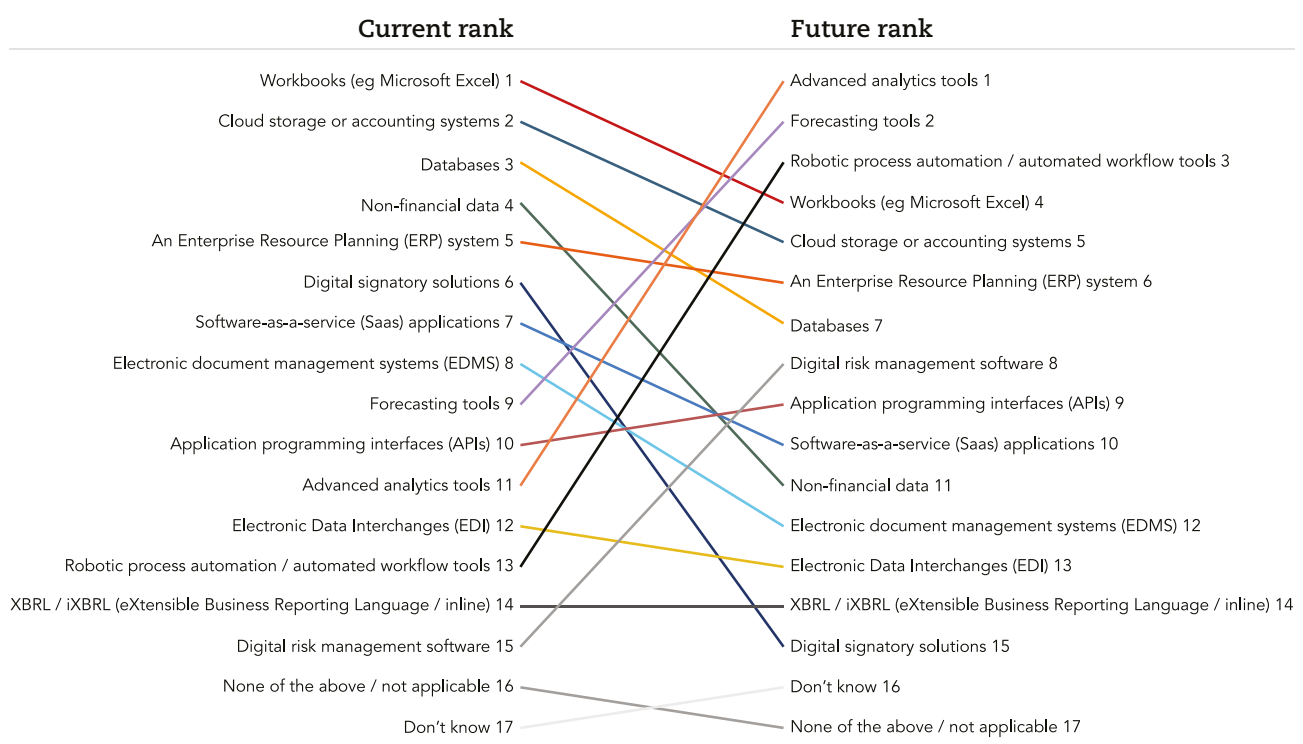
Similarly, forecasting tools are also in greater demand for future training: 9th in current use but ranked 2nd in training needs, indicating a desire to improve skills with forecasting tools, even though they are not the most frequently used technologies now.

By contrast, digital signatory applications show a significant discrepancy in the opposite direction, with their use ranking at 6th place but with a need for training ranking 15th. This suggests that although widely used, there is less perceived need for further training, possibly because they are quite easy to use or understand or because people have already received sufficient training.

In general, tools with a higher use ranking but lower training need ranking are probably relatively easy to use or understand. Conversely, tools with a lower use ranking but higher training-need ranking (such as 'advanced analytics tools' and 'RPA') might be more complex or less familiar, leading to a greater perceived need for training. These tools might also be seen as increasingly important for the future of the profession, leading to a desire for more training even if current use is low.

The data also reveals some potential blind spots that are, nonetheless, implicitly acknowledged in the desire for further training. Application programming interfaces (APIs), for example, are increasingly indispensable for data sourcing, management and analytics, enabling the use of more diverse data and more advanced ML models.

FIGURE 6.1: Comparison ranking of current skills against future skills requirements



Data literacy for decision-making

Data skills have long been an important part of the accountant's arsenal, but the skills involved will become both more complex and of a higher standard. For example, it will be necessary to understand new formats, types of database, basic coding languages and IT architecture for storage, management and manipulation. Processes must reflect this understanding, and sharing best practice from such areas as data science is important.

At the same time, this should not be an end goal. As we have seen, developments in AI are helping lower the barrier to learning and use of more advanced analytics techniques, for example. Using these responsibly and safely require not just data but also AI literacy to effectively manage the potential risks associated with use in different domains. But it also raises some potentially interesting observations regarding future needs and skills on the side of 1) data manipulation and analytics and 2) using insights derived from data to make decisions.

In the first instance, these developments underscore the need for a foundation of data literacy, which involves understanding what data is relevant, how it can add value, and how it can inform and shape decisions in line with the business strategy and goals. By understanding and mining insights from data, accountants can help businesses create better strategies, mitigate risks and drive growth. This is an evolution of the existing skill set to reflect changing capabilities, but it is not a complete shift.

'The credibility of the data is something that is so important. Going into what we all start off learning when we start our studies, it's understanding what's credible, mak[ing] sure the governance is there so that we're capturing accurate data and we're not using data that is not accurate, for whatever reason, to inform ... strategies and behaviours.'

UK Roundtable participant

'Things like learning data, analytics techniques, a lot of modelling techniques, these are crucial. The basic skill I always preach to people is SQL [structured query language]: just learning SQL, because everyone is moving from the manual database system to a more relational database system. So if you need data, how do you write basic SQL queries to be able to generate the reports that you need to make a business decision or informed business decision? That's just part of the skill set.'

North American Roundtable participant

Data literacy can be broken down into four sequential elements – accessing data, processing and summarising data, analysing data, and predicting future trends based on data. Each requires a different set of skills and mastering them will help accountants maximise the value they derive from data.

Moreover, while accountants may not need to become coding experts, understanding how code works can be helpful in combination with existing business knowledge. Having the ability to interpret what a particular piece of code means from a business perspective rather than solely from a technical perspective is a potential game-changer, aiding audit processes and business decision-making.

'Maybe I can share some[thing] about the stages of data literacy in the IT company experience. The first stage is access to data, so they expect me to know how to use APIs to download the data myself. If I have to ask a developer to download external data, they will be upset because it costs them time. They also expect me to use SQL or other internal databases to download data. So I need some basic coding skills. It is not that hard. I think people can learn in a few weeks if they really put in the energy. Second, is to summarise the data. My colleagues expect me to be able to summarise the financial data and present with some visualisation. Even in IT companies, where many people have strong mathematics, they still need good visualisation. Pictures can say a thousand words. You can deliver a very powerful message. The third stage is to analyse the data. They actually expect me to go beyond accounting and finance to actually go into data analytics and data science to analyse the data. The last stage is the most difficult one. They expect me to predict what is going to happen based on the data. That is the most difficult part, but it is the most valuable part.'

Asia Pacific Roundtable participant

Second, it will be necessary to understand the basics of AI and ML. While finance professionals don't need to be programming experts, a basic understanding of how AI works, what it can and can't do, and how it can be applied is crucial.

One of the key challenges in adopting AI and ML is translating business problems into problems that AI can solve. This requires a shift in thinking, moving beyond traditional accountancy practices to explore innovative ways of leveraging these technologies.

‘History does not always repeat itself. So even if you have really powerful AI models with a lot of data, even with that you cannot wholly predict the future. So that task of doing the prediction based only on financial data is actually very difficult. So for that I have to work with other departments because they can bring in some insight from the users’ perspective, the product perspective, and combine it with the financial perspective. Then we can make a better prediction.’

Asia Pacific Roundtable participant

But data literacy is and will remain dependent on business understanding and this necessitates more than just enhanced data skills.

‘As an accountant, I think you have to understand what makes the business tick, and sometimes people can be overwhelmed with data because they’re not understanding what they’re seeing and whether it can drive performance or whether it’s just interesting data, and they can get swamped. So I think in terms of literacy, it’s about understanding what is relevant and what is not and what can add value and inform and shape decisions. Make sure it’s relevant to the business strategy, the business goals and be able to define that.’

UK Roundtable participant

As a result, communication and decision-making skills are increasingly valuable. In the AI era, one of the most valuable skills is the ability to translate complex data and processes into simple and reliable insights. This requires excellent analytical and communication skills. While there may be less demand for inputting data and summarisation in the future, but interpretation of numbers remains a critical task that requires human and domain expertise.

‘Yes, I do think that [there will] be new opportunities. For summarising data, most AI, even some packages in Excel, can actually summarise the data but when it comes to interpreting the numbers... IT guys... don’t always understand the numbers. They don’t know how those numbers are being calculated. So they still need financial experts to help them.’

Asia Pacific Roundtable participant

Data-driven decision-making is often presented as the pinnacle of modern business decision-making. And it should play an important role in any modern organisation. But it is not sufficient. First, the focus on data may yield diminishing returns. As previously discussed, there are circumstances in which more (quality) data can help produce a better model, but application and need are the foremost concerns. There is a cost to gathering more data, and beyond a certain point, more data may not necessarily lead to better decisions. Second, the implication is that this process is relatively autonomous whereas the reality requires a healthy dose of human ingenuity, critical thinking, creativity and reason to interpret and generate wisdom derived from data.

It is important to get the fundamentals in place before more advanced capabilities can be properly harnessed. Certainly, there has been a great deal of discussion around the import of data science skills for accountancy professionals in the future. As we have seen, when it comes to adopting AI or ML, this realm offers useful frameworks as well as imparts valuable skills in this regard. Moreover, there are aspects of data science that can enhance existing data literacy and skills (including around data modelling, for example).

However, the next stage of exploration may require a view beyond data science to the decision sciences. This is an avenue that requires further examination moving forwards as many of the benefits of AI discussed in this report mean that decision-making prowess will be at least as, and potentially more, important than the underlying data skills. Decision scientists focus on using data analysis to inform specific business decisions. Their objective is to generate actionable insights, working closely with stakeholders to ensure analyses are tailored to the decision at hand. While data scientists ensure high quality data and modelling, decision scientists synthesise broader insights for business strategy. Both roles are critical of course, data scientists enable robust products and ongoing optimisation, while decision scientists empower nimble decision making to drive business growth. This presents two related and different pathways for future development, which may also point to ways in which future progression of roles may occur.

The basis of advanced analytics: data modelling

Courtney Robinson, ACCA member, Aston Business School DBA Candidate, Director, CTR Consulting

'Data literacy is the ability to actually understand and mine insights from data and being able to make more impactful business decisions. Being able to actually build the right foundations to really mine those insights from the data is necessary. So how do you store the different data tables in such a way that [they present] in a repeatable schema? That's where a lot of the data literacy steps comes into play: being able to not just mine the data, transform the data, clean the data and analyse the data to mine those useful insights. And that will mean getting different skill sets at different stages of the life cycle.'

North American Roundtable Participant

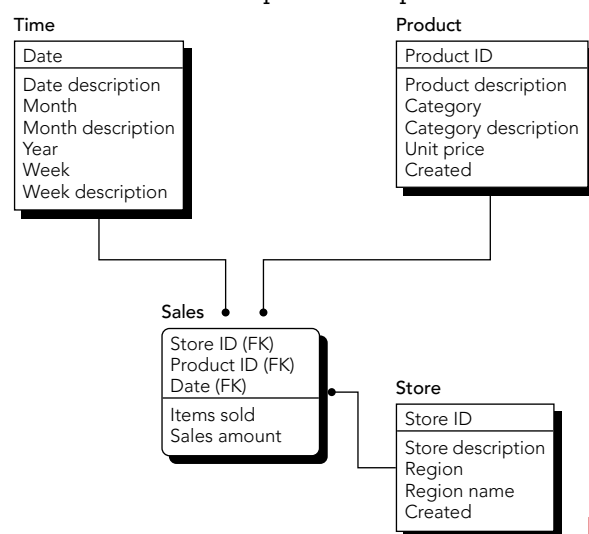
Accountants have traditionally leaned on Excel for their data management and analysis, employing a consolidated 'One Big Table' approach to their data. This method has served well for uncomplicated, smaller datasets, but it stumbles in the face of larger, more complex data, exceeding Excel's typical limit of around one million rows. Today, the field necessitates exploring more robust alternatives, especially for handling advanced analytics.

Data modelling (including dimensional modelling) involves creating a structured representation of data and its relationships within a specific domain (Figure 6.2). It necessitates organising and defining the data

structure, rules and constraints for easier understanding, analysis and efficient management. Data modelling aims to develop a conceptual and logical model encapsulating the essential aspects of data and their interconnections.

Having a visual representation aids stakeholders in comprehending data requirements, identifying dependencies, and ensuring data integrity.

FIGURE 6.2: An example of a simple data model

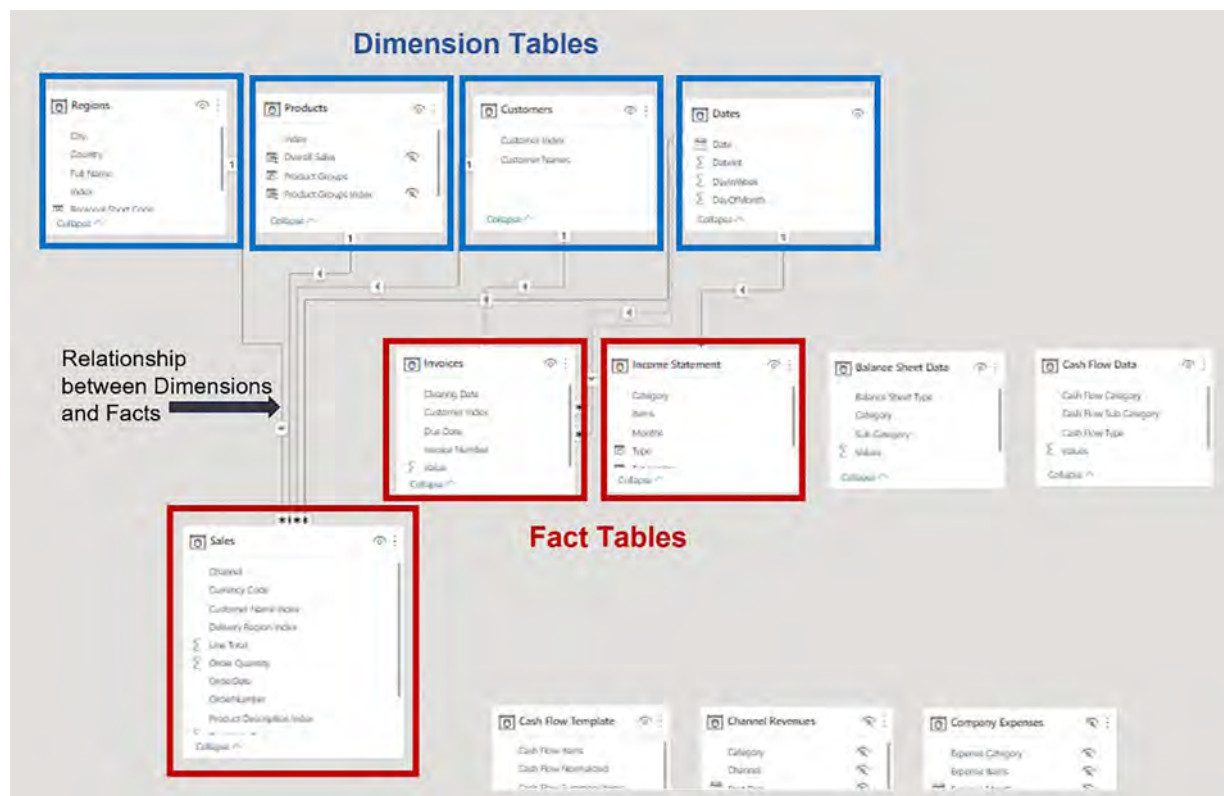


The basis of advanced analytics: data modelling (cont.)

Given their business knowledge, reporting and analysis expertise, accountants should contribute to the data modelling process (Figure 6.3). Here, they can define the conceptual model and play an active role in validating it regularly.

- **Requirement analysis** involves understanding business needs, identifying the purpose of the data model, and setting the scope and boundaries of the modelling project.
- **Conceptual data modelling** involves creating a high-level data representation using concepts and relationships, irrespective of specific technologies or implementations. Techniques such as entity-relationship diagrams (ERDs) can identify entities, attributes and their relationships.
- **Logical data modelling** translates the conceptual model into a more detailed, technology-agnostic representation, including defining tables, columns, data types, relationships, constraints, and other details.
- **Physical data modelling** considers the specific database or technology requirements. It transforms the logical model into a physical implementation, determining storage structures, indexing or partitioning.
- **Data model validation** requires stakeholders and subject matter experts to review and validate the data model to ensure its accuracy, completeness and alignment with business needs.
- **Data model documentation** is the final step, involving documenting all data model aspects, from purpose and entities to attributes, relationships and constraints. This document will be a 'reference' for developers, analysts, and other stakeholders.

FIGURE 6.3: Example of a dimensional model (for traditional reporting and analysis)



Data and analytics engineers employ an innovative additional technique – Dimension modelling.

Dimension tables (eg time/date, products, store, employee) offer contextual information and serve as attributes for 'fact' tables, containing measurable data points such as sales or expenses. Dimension modelling enriches financial and operational data analysis, offering a more in-depth perspective.

7. Towards the digital horizon

The digital horizon represents another turn of the cycle, another revolution in a longstanding history of innovation. As with previous cycles, while new capabilities will transform some tasks, the importance of finance professionals is unlikely to diminish.

Most of this report has centred on AI, a technology that has a uniquely broad appeal and is at the forefront of (often heated) debate across boardrooms, classrooms, regulatory bodies and in the public sphere. Further analyses will explore other technologies that are likely to present opportunities and the potential for disruption, but the AI story persists. Alongside big standalone technologies, we will also be monitoring the potential of data fabrics and vector databases, and other AI-related developments.

The broad optimism towards AI among the surveyed ACCA members underscores a desire to learn and adapt. Although just under one-fifth report the implementation of AI within their organisation, and another 8% are trialling initiatives, there are clearly great aspirations and a considerable opportunity to leverage these new capabilities. At the same time, this perception–implementation gap also raises the question as to why expectations are so far ahead of practice. In part, this may just demonstrate the initial stage in the life cycle of any new, exciting technology. Nonetheless, there are practical uses that are being missed amid the hype. And these should be the focus moving forward.

As we move in this direction, the practice of accountability will require a level of AI literacy that make it vital for finance professionals to understand the capabilities, limitations and potential applications of AI within their specific domains. Marrying technical skill sets with strategic understanding will be absolutely essential to harness the true potential of technologies such as AI and to establish a foundation for effective communication and collaboration across teams.

Leading innovators tend to have a more external focus, viewing technology as a competitive advantage rather than purely an internal efficiency tool, suggesting the need for a broader perspective on how technology can be used strategically to transform an organisation and its value proposition. This is even more important given the recognition that limited technical knowledge, ability to map and identify processes, and lack of a systems approach create roadblocks to successful innovation.



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