

*Providing leadership
in a digital world*



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The Tech Faculty is the focal point for ICAEW's activities on technology and the future of the accountancy profession. The faculty's work focuses on four transformational technology trends for accountants – Artificial Intelligence, Blockchain, Cyber security and Data (ABCD).

We take a research-based approach to understanding these technologies, how they apply across different areas of the accountancy profession and what impact they may have in the future. Our work brings together leading thinkers and practitioners from business, research, technology and public policy through panel discussions, reports and lectures. Reports include *Providing leadership in a digital world*, *Artificial intelligence and the future of accountancy*, *Blockchain and the future of accountancy*, *Audit insights: cyber security*, *Big data and analytics: the impact on the accountancy profession*, and *Big data in Chinese businesses: international perspectives*.

For more information on the Tech Faculty and how to get involved, visit icaew.com/techfac, email techfac@icaew.com, or call +44 (0)20 7920 8481.

Executive summary

Digital technology is transforming businesses, economies and societies, and increasingly affecting the accountancy profession. By improving the way they work, this presents accountants with many opportunities to serve businesses and the public interest better, to deliver valuable new services and to gain access to fresh markets and networks.

But the digitalisation of the economy also raises risks of marginalisation and irrelevance if the profession fails to adapt. To maximise the opportunities and manage the risks of a fast-changing business environment, it must evolve to deliver valuable and relevant tasks, build differentiated skills and encourage responsive organisations.

While innovation will be primarily driven by individual accountants and organisations, the profession also needs to work together to ensure that it is well positioned for the future. ICAEW offers leadership and engagement to support stakeholders in three ways - as a trusted information source, an institutional partner and a hub for innovative thinking. This draws on its role as an independent and expert body, as well as its experience in encouraging change and fresh thinking in other areas of the profession.

Introduction

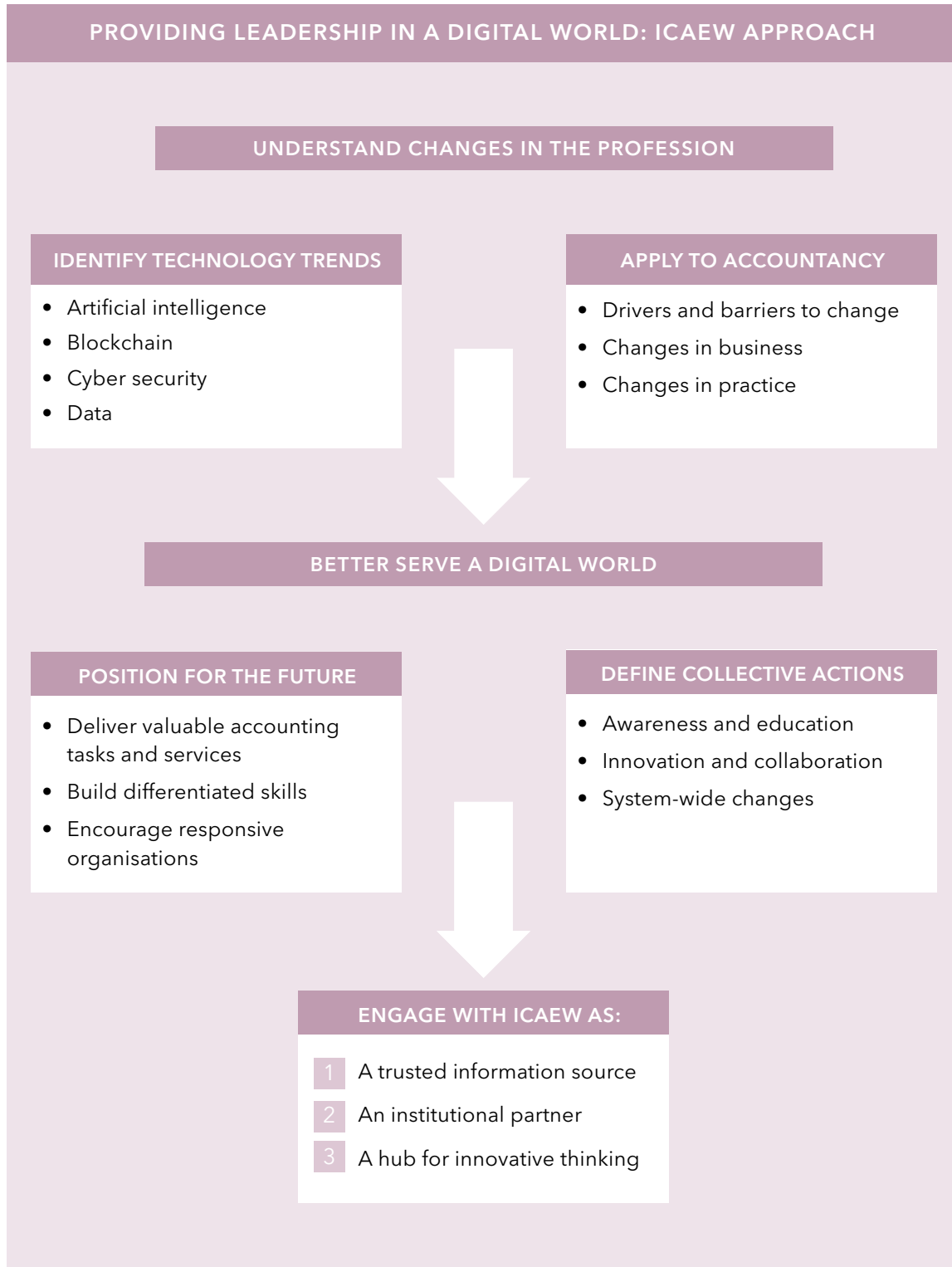
Digital technology is transforming businesses, economies and societies. The digital infrastructure is a powerful democratising force, providing access to networks and markets for many more people and businesses around the world. The nature of work is changing, as software increasingly automates tasks, freeing up people to create novel types of value. Innovative business models are emerging based on platforms and ideas of a sharing economy.

These changes are increasingly impacting on the accountancy profession. Change, of course, is nothing new. While the task of accounting for economic activities has deep roots, the associated tools and techniques have altered radically over time, greatly increasing the efficiency, effectiveness, speed and scale of accounting tasks and relationships.

Capabilities such as cloud computing and data analytics are enabling accountants to do things even quicker, cheaper, better and with less human intervention. There are also more radical opportunities to create innovative services and different organisational models, as well as serve entirely new markets and utilise fast-growing networks.

But a digitally based economy creates challenges too. Trends like artificial intelligence and automation raise real risks of marginalisation, reduced relevance or even redundancy if the profession fails to adapt to the changing environment. So how can accountants maximise the opportunities of digital technology to better serve the economy and wider good?

ICAEW is drawing together knowledge from across the profession on the effect of technology, and leading debate on how to meet future challenges. Our approach is based on two elements. It asks how the profession needs to position itself to serve a digital world better, and how it needs to work together to achieve this. Successful positioning for the future, though, needs to be grounded in a good understanding of the present and reflection on lessons from history. We are therefore also building a strong knowledge base of how technology is changing aspects of the profession today. Our approach is shown in the following diagram.



Identify technology trends

The exponential growth in computing power is at the heart of disruptive digital trends. It enables growing leaps in computing capability in short periods of time, resulting in a very high pace of change. The development of the driverless car clearly illustrates this speed – from being unable to get more than 7 miles in a race in 2004 to advanced testing of fully autonomous vehicles planned for UK roads by the end of 2019.

Exponential growth, though, can be difficult to comprehend. There is a tendency to overestimate what is possible in the short term, as implementation issues are worked through, but to underestimate significantly what is possible in the medium term. As a result, accurate prediction is extremely difficult. However, ignoring the possibilities is also dangerous, as change can happen very quickly.

While there are many new technology capabilities that have broad application across the business and consumer environment, this report focuses on four trends that have the greatest potential to transform the accountancy profession: artificial intelligence, blockchain, cyber security and data.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) covers a range of technologies that aim to replicate human capabilities such as learning, knowing, sensing, reasoning, creating, achieving goals and generating and understanding language. Recent developments in AI have focused on machine learning techniques, which use algorithms to identify patterns in large data sets in order to learn to classify, cluster or predict things.

Machine learning algorithms are rapidly overtaking human decision-making capabilities in many areas, thanks to these key three features:

- **Large data volumes:** They can process huge amounts of data (structured and unstructured), much more than humans ever could – for example, every piece of financial regulation. This provides a stronger and more powerful basis for learning;
- **Complex and changing patterns:** They can pick up weaker or more complex patterns in data than we can. Therefore, machines may be better in environments that we find less predictable. Where feedback loops can be built into the models, they can also be highly adaptive and learn from errors or new cases; and
- **Consistency:** They can be far more consistent decision-makers. They do not suffer from tiredness or boredom. They also do not exhibit human biases and therefore provide opportunities to reduce both cognitive and socially based biases.

In the short to medium term, AI brings many opportunities for accountants to improve their efficiency, provide more insight and deliver more value to businesses. In the longer term, AI raises opportunities for much more radical change, as systems increasingly take over decision-making tasks currently done by accountants.

BLOCKCHAIN

Blockchain is the most successful and common implementation of a distributed ledger system. The name blockchain is inherently descriptive of how the technology works – new transactions are gathered together into a block and added to a chain of all previous transactions by a cryptographic process that is complex to perform, but which makes it easy to confirm that the history of all transactions is genuine.

It represents a fundamental change in how financial records are created, kept and updated. The 'Three Ps' explain what makes blockchain different from the more familiar ledgers of today, which are databases owned and run by a single party.

- **Propagation:** There are many copies of a blockchain ledger, and no master copy. All participants have access to a full copy of the ledger and all copies are identical and equivalent. No one party has control of the ledger. New transactions can be posted quickly and will propagate to all participants' copies;
- **Permanence:** With each user having their own copy of the ledger, truth is determined by consensus. Past transactions cannot be edited without the consent of the majority, meaning that blockchain records are permanent. The entire ledger is stored by each participant and can be inspected and verified; and
- **Programmability:** Some blockchains allow for program code to be stored on them, as well as ledger entries – creating automatic journal entries that execute automatically when triggered. These are known as 'smart contracts'.

Blockchain has the potential to increase the efficiency of accounting for transactions and assets. It creates a kind of 'universal entry bookkeeping', where a single entry is shared identically and permanently with every participant. This would create certainty over rights and obligations and provenance, which in turn would empower the accountancy profession to expand its scope to record more types of activity than before, and to better understand the economic reality underpinning the transactions recorded.

CYBER SECURITY

Cyber security issues affect businesses of all sizes and across all sectors. Traditional approaches to information security focused on internal controls to achieve the confidentiality, integrity and availability of data. While these controls remain important, cyber security incorporates a wider range of threats and vulnerabilities. Potential threats now come from around the world and can involve organised criminals and corporate spies, as well as disaffected or careless employees. Security weaknesses can be found throughout a supply chain, not just within a single business.

However, cyber security is not something organisations find easy to do well, for a number of reasons. For example, cyber risks are constantly evolving at a high pace and in an unpredictable manner. Complex legacy IT environments make it harder to implement good security practices in a timely manner. It is widely recognised that people are the weakest link in cyber security. Yet it is proving difficult to embed behavioural changes, despite years of investment in training and other activities.

The complex nature of cyber risk is a challenge to traditional accountancy approaches towards risk and control. Data breaches should be seen as inevitable, and businesses need to focus more on the detection of breaches, response to incidents and the resilience to keep operating in the face of attacks. Many organisations still conduct only an annual risk review, and this approach should evolve into more continuous activities, such as building intelligence about attackers, looking for real-time evidence of breaches and regularly reviewing how new innovations are impacting on cyber risk. In this sense, good cyber security is as much a way of thinking, and an organisational culture, as it is a series of effective controls.

DATA

Accounting tasks are grounded in data. Therefore, improvements in the ability to capture, process, store, analyse, visualise and share data will have particular relevance to how accountants undertake their work. Recent advances in this area are driven by two key trends: big data and data analytics.

There is no single meaning for 'big data', but, broadly speaking, it is used to refer to data with the following characteristics:

- **Volume** - very large amounts of data;
- **Variety** - new sources of data, particularly unstructured data such as text and images; and
- **Velocity** - greater emphasis on speed and real-time data.

The term 'data analytics' covers the wide range of tools available to analyse data. As well as identifying correlations, outliers, trends and exceptions, these tools typically enable more focus on granular data analysis. They also facilitate more sophisticated modelling, prediction and visualisation.

New capabilities in data enable the accountancy profession to radically improve decision-making across organisations. Many decisions, in practice, are still based on assumptions, instinct, estimates and guesswork. These trends in data can provide hard evidence for decisions, and improve their quality. The discipline, structure and ethics-based approach of accountants also mean that the profession is well placed to help improve aspects of data governance, such as data standards and quality, across other business areas.

OTHER TECHNOLOGY TRENDS

While we believe that the ABCD technologies have the potential to be the most transformative for the accountancy profession, many other areas of technology are also having a direct impact on accountants. Some key trends are highlighted below.

Automation: this refers to the use of a wide range of technologies to perform tasks which were previously done by humans. Automation can be driven by smarter software, by better integration between software and data sources, and by specific automation technologies. Robotic process automation (RPA) involves using general-purpose software - known as a 'robot' - programmed to perform rules-based, repetitive tasks previously carried out by people interacting with a computer. Processes suitable for RPA are typically high volume, low complexity and labour-intensive.

Cloud computing is the term used for the provision of computing services, such as accounting applications, over the internet. It is based on a service model rather than on the purchase of computing assets, and it helps organisations increase efficiency by allowing resources to be shared between different users. Cloud computing is closely linked to the use of mobile technology, primarily smartphones and tablets, as it allows access to internet-based services on demand, at any time and from any location.

Fintech is a term used to cover a wide range of technology-based innovations in financial services, such as new payment systems and digital banking services. New platforms can directly connect lenders and borrowers, enabling peer-to-peer lending; and algorithms can be used to recommend investments for customers directly, without human intervention - a service known as robo-advising. These and other innovations are likely to have a significant impact on the way that accountants access, move and manage business finances.

Apply to accountancy

Technology capabilities are only part of the picture. They need to be applied into a specific business context in a way that provides value. Furthermore, the pace of change in technology is typically faster than change in human behaviour. Therefore, even where capabilities exist, altering the way we do things can still be a long process.

Adoption of technology is driven by many factors, including economics, business demands, culture and human nature. It also needs to be considered in a wider context of trends such as globalisation, urbanisation, shifting demographics and the economic challenges of the post-financial crisis era.

In this section, we build understanding of how technology is being applied to the specific domain of accounting, and how it is changing what accountants do, how they work, and what successful accounting organisations look like. We start by considering what encourages or slows down change across the profession.

DRIVERS AND BARRIERS TO CHANGE

Many factors encourage the adoption of new technology in accountancy, including:

- Different business demands, eg, changes to the information that users want, when they want it and how they want it;
- Evolving expectations of staff, eg, the influence of younger generations moving into the workplace or greater tech-savviness in existing staff;
- Demands of regulators or filing authorities, eg, the need for greater standardisation of accounts presentation achieved through XML-based reporting or the shift to online filing capabilities; and
- Business benefits, eg, the return on investing in new technologies.

There are other factors which can slow down adoption, such as:

- Implementation challenges, eg, replacing legacy systems or managing complex integration issues;
- People issues, eg, changing culture and behaviour to use systems effectively;
- Regulation and accountancy standards, eg, where new methods fall outside existing standards; and
- Business costs, eg, where there are heavy costs of investing in systems.

The available digital infrastructure can also cause issues. Even in highly developed economies, large geographic areas can have poor broadband connections, severely limiting adoption of cloud-based services. In less developed economies, there are tremendous opportunities to leapfrog an entire generation of technology and move straight into cloud-based and mobile services. However, many areas still struggle to achieve basic connectivity.

Another specific challenge in accountancy is the complex ecosystem of stakeholders, including investors, regulators, standard-setters, auditors and others, who have diverse views, priorities and interests. Major changes may need actions across this ecosystem, but it can be difficult to achieve all the right incentives to drive multiple actions. The implementation of the financial reporting data standard XBRL shows the difficulty of achieving technology-driven change across this wider ecosystem. A data standard has clear benefits, such as process efficiency and enhanced data comparability. However, delivering it required many different actions: investment in systems, consideration of the impact on audit, and modifications in filing processes, as well as substantial effort in defining the standard. Individual, voluntary actions were not sufficient to drive change through the complex environment; widespread adoption was only achieved through regulatory compulsion.

The remainder of this section provides a snapshot of some of the ways that accountants are applying new technological capabilities to their work.

CHANGES IN BUSINESSES

Accountants undertake many tasks within organisations, with the main components being:

- Strategy and risk management;
- Funding, including investor relations and debt management;
- Financial management and control, including budgeting, management information and internal audit;
- Compliance, including statutory reporting and tax; and
- Accounting, including the processing of transactions and the production of accounts.

The business environment is changing quickly, with many businesses moving more and more operations online. This creates new risks to manage, such as cyber risk. The explosion of social media amplifies reputational risks, putting greater pressure on organisational resilience and response. The spread of digital disruption across industry sectors requires greater business flexibility and agility, challenging traditional approaches to strategy and risk management.

Finance systems and processes are increasingly moving online. Many businesses, especially smaller ones, are moving finance systems into the cloud to take advantage of the flexibility of the model. Finance functions have also seen compliance processes shift online, with online tax filing and the implementation of the XBRL data standard across much tax and statutory financial reporting.

Many finance functions have focused on increasing operational efficiency through automation, including RPA. We are seeing a renewed focus on shared service centres, global process hubs and outsourcing, where economies of scale justify substantial investments in extensive process automation. Small businesses are making use of the integrated functionality of some cloud-based packages and their add-on applications to move to greater self-service and automation of finance processes.

This is freeing up time and resources to spend on more advanced data analytics work, especially in areas such as internal audit. Accountants are increasingly working alongside data scientists to identify poor processes or controls failures and to focus analysis on areas of greatest risk. Some finance functions are exploring sophisticated capabilities such as AI, using machine learning to improve the accuracy of forecasts.

Innovations in financial services are also providing new products and services, as well as access to different markets. For example, crowdfunding platforms are providing alternative ways to access funding. There are online platforms which aggregate the buying and selling of debts. New sources of data offer opportunities for novel credit rating services which could help smaller businesses gain access to finance.

CHANGES IN PRACTICE

Accountants working in practice support businesses in their financial responsibilities, with key services being:

- Basic accounting services, such as bookkeeping, payroll and accounts preparation;
- Tax services, including preparation and filing of tax returns and tax advice;
- Other compliance work, such as the filing of statutory reports;
- Audit and assurance, primarily of financial information;
- Corporate finance services, such as M&A support, refinancing and insolvency services; and
- Advisory services, including finance systems implementation.

Many audit firms are investing substantially in big data and analytics to support new approaches to audit, as well as their other services. The shift to full dataset analysis means less reliance on data sampling when undertaking testing procedures. This allows for greater emphasis on spotting patterns, outliers and exceptions, and focusing audit activities on the areas of greatest risk. Machine learning techniques can improve this process further, enabling even more accurate identification of risks.

The audit process is being increasingly standardised and automated, leading to greater consistency in quality. Additional sources of data and predictive models provide opportunities to identify business risks and better plan audit activities.

The shift to online, cloud and mobile platforms significantly impacts on the way that accountants interact with others. The ability for both accountant and client to access accounting information on demand typically empowers clients and changes the nature of the relationship. Moving online also renders location increasingly irrelevant. Without the need to pass receipts, invoices and other paperwork regularly from client to accountant, the relationship can be managed with minimal, if any, physical contact. Capabilities such as Skype and Google Hangouts support this trend. As a result, accountants can attract clients from anywhere. Conversely, their clients have a far greater choice of accountant.

Furthermore, tax authorities and filing authorities around the world have embraced digital platforms and are moving their interactions increasingly online. For example, HMRC, the UK tax agency, has been at the forefront of digital filing strategies, with most tax filing now online. In future, it intends to develop greater personalisation for tax payers, including the pre-filling of essential information into online forms. Its Making Tax Digital initiative requires most businesses to have digital accounting records to support this shift.

These changes are opening up accountancy markets to fresh sources of competition and leading to far greater self-service by clients and tax payers. Traditional bookkeeping and compliance services are reducing, and the accountant's role is shifting to a more proactive and advisory one, identifying errors and helping clients to understand their financial data or to plan for the future.

Position for the future

Technology is already changing the roles of accountants, with less time spent on repetitive processes and compliance work, and more time spent working with data, or on more advisory services. This change can broadly be seen as incremental but, as technology continues to improve, more radical disruption is possible. This report takes a fundamentally positive view of the future. By focusing on its social purpose, the profession can use technology to serve people and businesses better and deliver greater value to societies and economies.

But of course, there are other possible paths. For example, some fear growing marginalisation and reduced relevance as the business environment changes radically. There are fears about the future role of accountants as AI steadily takes over many accounting tasks. There is also the threat of growing competition from other sectors, such as from technology companies.

How can the profession ensure that it is well positioned to take advantage of the opportunities and manage the risks of more radical and disruptive change? This section highlights three ways in which it needs to prepare for the future, as well as three ICAEW research projects which explore how the profession is changing.

DELIVER VALUABLE ACCOUNTING TASKS AND SERVICES

Accounting tasks are grounded in the needs of businesses and their stakeholders. If those needs change, some of the fundamental practice of accounting may need to evolve to reflect that. Where practices do not adapt, they could become increasingly irrelevant and ultimately superseded by information provided by others.

So, for example, balance sheet information could become increasingly irrelevant as corporate values reflect the growing importance of data and other intangible assets. Historic financial reporting could become marginalised by new sources of real-time information about company performance gleaned from the internet or other sources. This is already being seen with investors using many alternative sources of data, such as satellite images and social media data, to feed into predictive models about business performance.

Growing use of automation, cloud computing and business process outsourcing could challenge current approaches to internal control, as more and more transactional activities take place in other organisations or through software. Widespread use of machine learning algorithms throughout business operations – which operate as ‘black boxes’, with results that cannot be unpicked – could undermine established controls and management techniques.

But the profession cannot simply defend traditional ways of doing things. Accountants can potentially exploit enhanced capabilities to improve what they do in many ways. Greater use could be made of different sources of data to bring fresh insights about customers, operations or strategy. Predictive models could play a larger part in strategy, planning and control activities, with risks and opportunities more clearly identified and understood.

Furthermore, new technologies open the way for innovative services which can add greater value to businesses. Investors and other stakeholders may want to take advantage of improved system capabilities to get more non-financial information about businesses’ performance and risk management. There are also significant opportunities to develop new audit and assurance services in areas such as non-financial information, cyber security and algorithms.

Big data, algorithms and AI generate many concerns about privacy and surveillance. Extensive use of personal information, the growth in profiling of individuals and increased selling of data can result in widespread unease in the actions of businesses, and they will need to find ways to build and retain trust in their use of data. There are also specific concerns about biased outputs from models as a result of biased data or bad design. The profession is well placed to help businesses build effective ethics and governance around technology to manage these risks.

There is also the prospect of accessing entirely new markets and better supporting accounting and financial services around the world. Digital technology is a great democratising force, enabling low-cost or even free access to platforms and services for anyone with an internet connection. It is at the heart of financial inclusion initiatives and will enable many more people to access financial and accounting resources and advice. Accountants have tremendous opportunities to work alongside digital platforms to deliver advice and services to these markets in all kinds of innovative ways.

ICAEW RESEARCH ON THE DIGITALISATION OF TAX - CHANGING TASKS AND SERVICES

The digitalisation of tax has the potential to be revolutionary, considering not only how taxpayers complete their filings, but what is taxed, and how the authority can use powerful data pipelines to complete and audit taxes without a filing being made. This ICAEW research project brings together case studies from 12 countries to learn from their digitalisation journeys and highlight key lessons, the range of policy goals and common barriers to adoption.

Inverting the tax flow is a common feature of tax digitalisation projects, using existing data and data from third parties to pre-populate tax returns, rather than relying on the taxpayer to provide all the data. This changes the way that tax is done, with less work required for filing and more emphasis on checking data, picking up errors and challenging tax authorities. This will have a significant impact on the profession as the accounting service in this context is likely to look quite different to current data gathering and filing activities. For example, the accountant could become more of an advocate for the client, where pre-population has been incorrect or resulted in the wrong outcome.

BUILD DIFFERENTIATED SKILLS

While accounting tasks are likely to remain central to organisational success, it is not necessarily the case that accountants will still be needed to do them. Automation and AI threaten to take over many basic tasks, and accountants need to position themselves with the skills to deliver higher-value services.

Through sophisticated machine learning algorithms and improved capabilities in natural language processing it is becoming possible to automate work that is based on knowledge and patterns, not simply the application of rules. On this basis, many argue that software will increasingly replace many types of accounting work, such as in audit testing, compliance and bookkeeping. This presents significant challenges to the future shape, size and role of the profession.

But accountants have always been subject to pressures of automation. The profession has grown by being flexible, embracing the chance to eliminate manual work and focusing on higher-value tasks, such as advisory work. This approach will be essential, as accountants see their time freed up from more manual or basic tasks. As a result they will need to concentrate on areas which remain difficult to automate, such as where human judgement or a deep understanding of the business environment is required or where tasks depend on the knowledge and application of highly complex rules. Specialist or niche products are also difficult to automate on the basis of economic return and therefore present good ways to develop differentiated skills.

Accountants working in businesses have the chance to extend their influence across organisations. As data becomes increasingly important to business success, their deep skills around financial data and qualities such as professional scepticism, integrity and ethics could have broader application across other types of data.

However, are traditional accounting skills enough to enable a leading role in a data-centric economy? The exploitation of data requires three broad sets of skills:

- Technical data skills, such as knowledge of data formats, flows and issues of quality;
- Statistical skills and the ability to use algorithms to build models; and
- Domain knowledge to interpret data in the context of the specific organisation.

Accountants have strong domain knowledge around financial data. But to provide greater leadership on the exploitation of data, accountants will need stronger technical skills around data, and greater understanding of statistics to challenge the method, assumptions and output of predictive models. Different skills may also be needed to support existing or innovative services. Greater emphasis on audit analytics, for example, will require stronger IT and data knowledge in auditors. New assurance services in areas such as cyber security will require further domain knowledge.

Furthermore, accountants will need a mindset and attitude which enables them to embrace opportunities. This is especially important given the difficulty in predicting how technology may evolve and be applied across businesses. The environment will increasingly demand personal characteristics such as flexibility, collaboration and openness to change. It will also require a willingness to learn and acquire fresh skills throughout a career.

ICAEW RESEARCH ON BIG DATA IN CHINESE BUSINESSES - CHANGING SKILLS

Big data presents many opportunities for accountants to provide new analysis and insights and contribute more value to businesses. Furthermore, the discipline and attention to detail that is fundamental in accounting can greatly help organisations to build better data governance across all functions. This is a difficult task in practice, but it underpins success with big data.

This ICAEW research project, carried out in conjunction with the Shanghai National Accounting Institute and Inspur, focuses on the skills that accountants need in order to deliver these contributions. The research emphasises that accountants must build more capabilities in IT and data to work effectively with data and technology specialists. However, these IT skills also need to be complemented by strong business knowledge, so that accountants can identify the right questions to ask, can understand how data can help to answer them, and can interpret the results in the specific business context.

ENCOURAGE RESPONSIVE ORGANISATIONS

Improved technology capabilities open up fresh possibilities in organisational models which will likely result in greater competition. But predicting success in this fast-changing environment will be difficult, and good accounting organisations will need to be highly responsive and flexible if they are to thrive. For example, organisational models will need to exploit trends such as automation and globalisation to maximise efficiencies and minimise costs. But they will also need to attract and retain increasingly high-skilled employees who may have more choice in career paths and different attitudes to employment. This could lead to alternative models which emphasise employee empowerment, engagement and flexibility.

Are successful organisations likely to be big or small? On the one hand, the economics favour big organisations. They concentrate power and encourage economies of scale in processing information. Data-driven services are improved by having more data, rewarding those in possession of large data sources. The economics of network effects leads to a small number of dominant platforms, as most users want to be on the biggest network. Using data to understand customers and personalise services also enables large organisations to reduce the advantage that some small organisations get from more direct customer contact.

Therefore, the growing importance of data and technology-driven services could favour large organisations. They have the resources to invest in robust and resilient infrastructures, as well as the skills and talent they need. They have economies of scale and can potentially take more risks.

But digital technology is also a democratising force, connecting anyone with internet access. The openness of systems and the low cost of using many platforms and applications can therefore aid smaller organisations. The digital infrastructure facilitates business models with few staff and other physical assets, lowering the costs of starting up businesses and entering markets. Smaller organisations can be more responsive, innovative and specialised. There are also options to build more flexible networks of specialists rather than full-service firms, or for greater collaboration and cooperation across and between organisations.

There is unlikely to be a one-size-fits-all solution, with instead different models competing and collaborating depending on the context. We see this approach today in financial services markets. There are many start-ups which are developing fintech solutions. Large technology companies are also developing offerings, especially around payments and consumer credit. In some cases, they are competing directly with the large incumbent banks, and potentially taking some market share. But in other cases, banks are partnering with or buying up start-ups with good ideas. As a result, we see a developing ecosystem of big and small companies, sometimes competing and sometimes partnering to provide innovative customer services.

ICAEW RESEARCH ON FINTECH INNOVATION - RESPONSIVE ORGANISATIONS

Research consistently identifies London and Singapore as excellent hubs for fintech activity. This research project, in collaboration with the Institute of Singapore Chartered Accountants, highlights the drivers and barriers for fintech innovation, based on experience in these two cities.

The research highlights the need for innovating companies to have access to capital, growing markets and high-quality talent. But it also underlines the importance of regulators and governments in creating the right conditions for innovation, and the benefits of hubs in bringing all these elements together in one place.

Define collective actions

Individual accountants and organisations will define their own responses to the changing business environment, developing their services, skills and organisational models accordingly. But there is a limit to what individual actions can achieve. There are areas of common interest and opportunities to share knowledge for mutual benefit. Deep changes may also require system-wide actions.

As a result, there is an important role for cooperation between different stakeholders, including:

- Accountants working in business and practice
- Users of accounting information
- Employers in business and practice
- Professional bodies
- Accounting and business software providers
- Researchers and educators
- Standard-setters
- Regulators, filing bodies and governments.

Specific actions will vary depending on the area, such as tax, reporting or audit. But there are some common themes.

AWARENESS AND EDUCATION

The first theme is education and raising general awareness of technology trends. This is critical to help accountants prepare and position themselves for new challenges, and covers all aspects of education:

- Ensuring that accounting qualifications and training programmes equip accountants with the skills and knowledge that they need;
- Providing ongoing training and education so that accountants can acquire fresh skills and capabilities throughout their careers; and
- Sharing knowledge and raising general awareness of changing practices, opportunities and risks.

These activities also help organisations understand the benefits and risks of technologies and manage their strategy and operations accordingly. Furthermore, businesses, policymakers, regulators and others need to appreciate what is changing so that they can make good decisions.

For example, as use of analytics and AI increases across the audit profession, there are significant benefits to sharing knowledge and experience of these changes. This sharing needs to include smaller practices, which may have to build up their own proficiency in the area; businesses that are buying audit services; audit standard-setters; and training providers, if auditors need different skills in the future.

In addition, the profession needs to support accountants in building the soft skills and personal characteristics which will underpin future success. It must encourage them to engage with technology and think laterally about its use. Efforts to broaden access to the profession and encourage diversity will be an important enabler in this context, as will initiatives which enable accountants to share knowledge and experience directly with one another.

INNOVATION AND COLLABORATION

Innovation in accountancy is primarily driven by business needs and market forces. Finance functions innovate to provide greater value to businesses. Accountancy practices innovate due to competition in the market and the need to provide value to clients.

But innovation can sometimes be helped by collaboration. In the early stages of product development, before competition sets in, working together can help to develop markets, test ideas and set standards. Shared solutions can be useful where mutual benefits outweigh the possibility for competitive advantage. Common platforms can reduce the investment required by individual organisations so that change becomes economically viable. They also enable a degree of integration between different players that ultimately benefits all. Furthermore, failure to collaborate can hamper innovation, as there may be multiple competing platforms or frameworks, with no clear path to follow.

There are many models for collaboration. It can be driven from the top down, if clear opportunities are identified. However, in many cases, it is a bottom-up process, with interested parties choosing to work together in a focused way to achieve a specific goal. Specific examples include:

- Open or common data standards, such as XBRL;
- Frameworks to underpin new services, such as assurance models over sustainability reporting or other forms of reporting; and
- User groups for software systems, enabling the sharing of experience and providing communications channels between software houses and users, or between software developers and governments or regulators.

ACHIEVING SYSTEM-WIDE CHANGE

There are occasions when stronger intervention is required, such as when amendments to standards or regulations are needed. In these cases, regulators and standard-setters have a key role in driving change. But they require support from many other parties.

In particular, there needs to be evidence and a case for change or continuity. This can be provided by accountants working in the relevant area. The academic community can develop radical thinking about the theory of accounting and build independent, robust evidence on specific cases. Professional bodies can collate evidence about the practical experience and implications of change, as well as convene different interest groups to debate and coordinate actions.

Consideration also needs to be given to how to incentivise diverse stakeholders. Is regulatory compulsion needed? Will the market encourage adoption? Are software providers incentivised to invest in any required software development? Building good understanding of how change has happened in the past can provide useful insight into what works in specific circumstances.

ICAEW leadership and support

Accountants have tremendous opportunities from the shift towards a digitally based economy, as well as profound challenges. ICAEW is leading and supporting the profession in this process of change, based on two core principles.

- Actions should be demand-led and based on the needs of different stakeholders.
- There are many areas of potential activity, so prioritisation is an important step.

Our involvement therefore focuses on areas in which ICAEW can bring particular value based on its experience and its position as an independent and expert body. This leads to three specific offers of engagement as:

1. a trusted information source
2. an institutional partner
3. a hub for innovative thinking.

1. TRUSTED INFORMATION SOURCE

It is vital to provide tangible support to accountants and help them build confidence in new technology capabilities and their practical application. This support can be based on established methods, such as publications, lectures, online content and webinars. It may also be possible to facilitate knowledge sharing and peer learning, which can be a particularly powerful form of learning.

Trust underpins successful information and knowledge sharing, especially in a field which is highly technical. ICAEW adds particular value by retaining independence and acting as a trusted information source and facilitator. While working with the technology industry enables us to benefit from its expertise and experience, independence and trust must always be retained.

Therefore, ICAEW's first offer of engagement is to build on the existing work of its specialist Tech Faculty, based on the needs of members for further information, support and knowledge sharing.

THE TECH FACULTY AS A TRUSTED INFORMATION SOURCE

The Tech Faculty (previously the IT Faculty) has been part of ICAEW since 1991 and it provides independent guidance to its members on many aspects of IT, from cloud computing to cyber security. It aims to demystify trends and help members make best use of technology, through practical guidance and a broad community. It also undertakes research and publishes thought leadership on how technology is changing the profession.

2. INSTITUTIONAL PARTNER

The profession needs to ensure that it has the right institutional framework to support the kind of collective actions highlighted. This means that regulators and standard-setters, for example, need to be able to appreciate technology-driven changes, and respond to a quickly evolving environment. Qualification bodies and training providers need to be well connected to the needs of businesses to ensure new generations of accountants are learning the right things.

This demands an approach based on collaboration and partnership between institutions. ICAEW has deep understanding of business, accountancy and finance which can be brought to bear to help drive change and identify barriers.

Therefore, ICAEW's second offer of engagement is to partner with other organisations to share the knowledge and experience of members, facilitate collaboration and help to resolve practical issues.

INSTITUTIONAL PARTNERSHIPS AND RESEARCH

To build understanding of how the profession is changing around the world, ICAEW works closely with a range of international partners, including the Shanghai National Accounting Institute, the Chinese technology company Inspur, and the Institute of Singapore Chartered Accountants.

We have also collaborated with many institutions on cyber security to build understanding of the issues, contribute the experience of members to the debate and share knowledge of good practices. This has included working with the UK National Cyber Security Centre, other professional and regulatory bodies, such as the Law Society and the Takeover Panel, and the largest audit firms.

3. HUB FOR INNOVATIVE THINKING

The profession also needs to encourage fresh thinking about some of the challenges highlighted in this report. How can accountants serve the public interest better? What are the higher-value tasks that can replace automated tasks? How do novel platforms enable accountants to engage with other markets? What capabilities do new competitors bring to the marketplace?

To generate this fresh thinking, a systematic approach is needed which can bring together stakeholders and encourage thought-provoking discussions. This could involve diverse groups sharing distinctive perspectives to spark ideas. Alternatively, it could involve focused thinking among experts to identify opportunities for change.

Therefore, ICAEW's third offer of engagement is to work with experts and leading thinkers across and beyond accountancy to explore the changing business environment and the resulting opportunities and risks for the profession.

INNOVATIVE THINKING ACROSS THE PROFESSION

ICAEW initiatives such as AuditFutures demonstrate diverse stakeholder engagement that generates ideas and specific projects to catalyse change. AuditFutures brings together representatives from accountancy firms, academia, think tanks and other professions to collaborate and share ideas about the future of the profession. The themes of the initiative include educating for the future, AI and blockchain, the future of work and the firm, and design thinking and innovation in the profession.

The Tech Faculty's work on the efficient and safe use of spreadsheets, through its Twenty Principles project, Spreadsheet Capability Framework and Financial Modelling Code, is a further illustration of expert thinking which encourages accountants to focus on higher-value analysis.

Next steps: engage with us

We welcome feedback on the ideas presented in this report, views on the main priorities for future activities and approaches from relevant stakeholders on our three offers of engagement.

To get involved visit icaew.com/techleadership, contact techfac@icaew.com or phone +44 (0)20 7920 8481.

For more information on the Tech Faculty, visit icaew.com/techfac

ICAEW resources

ICAEW RESEARCH AND THOUGHT LEADERSHIP

Artificial intelligence and the future of accountancy: this report outlines recent developments in AI, the strengths and weaknesses of the technology, and the short-, medium- and long-term implications for the profession.

Blockchain and the future of accountancy: this report explains blockchain technology and considers how it could impact on accounting and audit activities.

Audit Insights: Cyber security series: completed over five years, this series of reports draws on the experience of the largest audit firms to track the response of boards to cyber risks, the key challenges in implementing good security and the changing regulatory agenda.

Big data and analytics: impact on the accountancy profession: This report highlights how new technologies have led to new capabilities in data, and considers what businesses and accountants need to do to make best use of them.

Big data in Chinese businesses: this research project explores eight case studies of Chinese businesses using big data, to understand the real benefits that it can bring, the practical challenges in getting value from data, and the implications for finance functions and accountants.

Fintech innovation: perspectives from London and Singapore: this research project builds on experience in two leading fintech hubs, London and Singapore, to identify the key drivers for successful innovation.

Digitalisation of tax: international perspectives: this collection of 12 international case studies highlights the different approaches taken to the digitalisation of tax around the world, and draws some common lessons from them.

New technologies, ethics and accountability: this report explores how ethics and accountability can help to build greater confidence in new technologies, and highlights key implications for businesses, policymakers and the accountancy profession.

Digital transformation in finance functions: ASEAN and UK perspectives: this report provides a rare insight into how digital transformation is being managed in practice across a range of different business settings and highlights pertinent considerations for leaders undertaking their own transformation projects.

Spreadsheet competency framework: this framework – developed by a group of experts in the field, facilitated by ICAEW – provides a structure for assessing ability and proficiency when using spreadsheets.

Twenty principles for good spreadsheet practice: these principles aim to reduce the amount of time wasted and the number of (sometimes costly) errors caused by businesses (including accountancy practices) as a consequence of how they and their employees use spreadsheets.

Financial modelling code: while there are modelling methodologies and standards aplenty, these are often overly prescriptive or organisation-specific. ICAEW's Excel Community has taken half a dozen methodologies and pared them down to the commonly held, widely accepted beliefs about what constitutes good modelling.

ICAEW KNOW-HOW

The Tech Faculty's Tech Essentials guides include:

- Automating your practice
- Robotic Process Automation
- Blockchain
- Cryptocurrencies
- Cyber recovery
- 10 steps to cyber security for smaller firms
- GDPR
- Data analytics
- Audit tech
- Fintech
- The Internet of Things

Other useful resources include:

- Robotic process automation in finance
- Data analytics for external auditors
- Audit insights: data analytics
- How do you audit a robot?

ICAEW RESOURCES HUBS

icaew.com/artificialintelligence

icaew.com/blockchain

icaew.com/cyber

icaew.com/data

icaew.com/fintech

icaew.com/ethicsandtech

icaew.com/excel

STAY AHEAD WITH ICAEW THOUGHT LEADERSHIP

ICAEW is required by its Royal Charter to advance the theory and practice of accountancy in all its aspects. One way we do this is through papers published in our ICAEW Thought Leadership series. Some papers are more practical in nature and aimed at helping members do their work, others consider how law and standards might develop for the future professional.



Artificial intelligence and the future of accountancy

ASKING INTELLIGENT QUESTIONS

AI brings many opportunities for accountants to improve their efficiency, provide additional insight and deliver more value to businesses. But, what is the long-term vision for AI and accountancy and how can artificial and human intelligence work together?

[icaew.com/Alreport](https://www.icaew.com/Alreport)



Blockchain and the future of accountancy

EXAMINING IMPACT AND POTENTIAL

Blockchain has the potential to increase the efficiency of the process of accounting for transactions and assets, operating as a system of universal entry bookkeeping. The paper explains how the technology differs from the familiar, and how these features drive the potential applications of blockchain.

[icaew.com/blockchainreport](https://www.icaew.com/blockchainreport)



Audit insights: Cyber security

COPING WITH INCREASING COMPLEXITY

Many businesses have onerous and complex legacy IT environments with fragmented and non-standardised systems. These present challenges and make good cyber security much harder. What can businesses do to cope with this complexity and be safe?

[icaew.com/Alcyber](https://www.icaew.com/Alcyber)



Big data and analytics: the impact on the accountancy profession

INFORMING DECISION MAKERS

There has been a lot of talk about big data and analytics in recent years, but what is really new about it? What's creating big data? What are the opportunities and risks, and how do we exploit it?

[icaew.com/bigdatareport](https://www.icaew.com/bigdatareport)

[icaew.com/thoughtleadership](https://www.icaew.com/thoughtleadership)

ICAEW TECH FACULTY

ICAEW's Tech Faculty is a leading authority on technology and the finance profession. It provides its members with information that allows them to make the best possible use of tech and keep up to date with tech issues and developments. Membership is open to finance professionals with an interest in technology - to join visit [icaew.com/jointechfac](https://www.icaew.com/jointechfac)

There are over 1.8m chartered accountants and students around the world – talented, ethical and committed professionals who use their expertise to ensure we have a successful and sustainable future.

Over 181,500 of these are ICAEW Chartered Accountants and students. We train, develop and support each one of them so that they have the knowledge and values to help build local and global economies that are sustainable, accountable and fair.

We've been at the heart of the accountancy profession since we were founded in 1880 to ensure trust in business. We share our knowledge and insight with governments, regulators and business leaders worldwide as we believe accountancy is a force for positive economic change across the world.

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