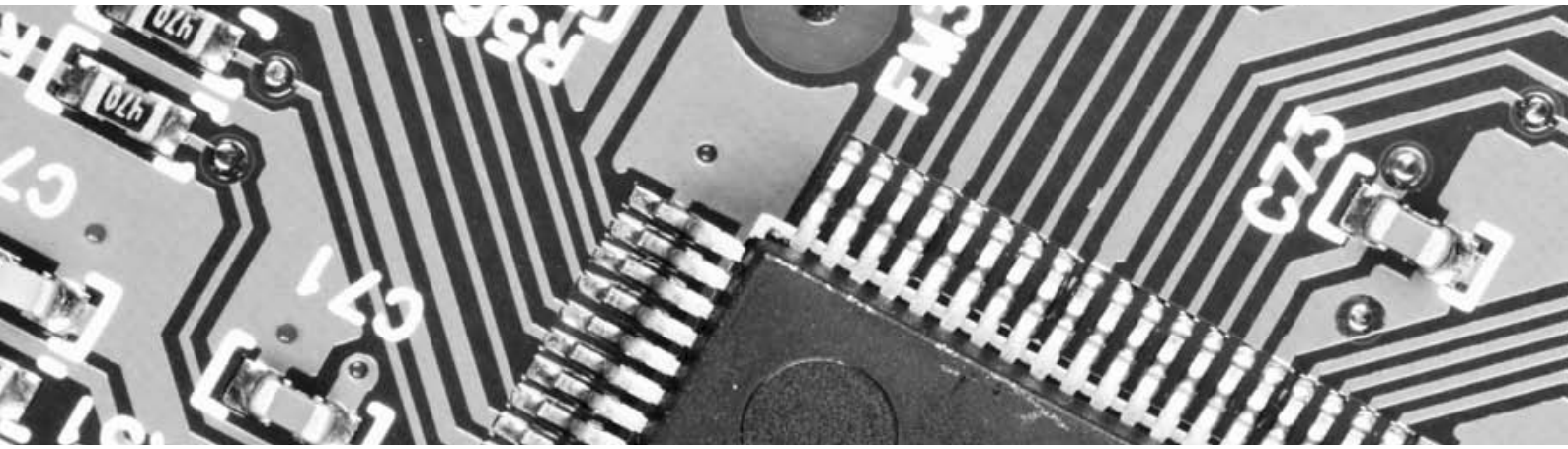
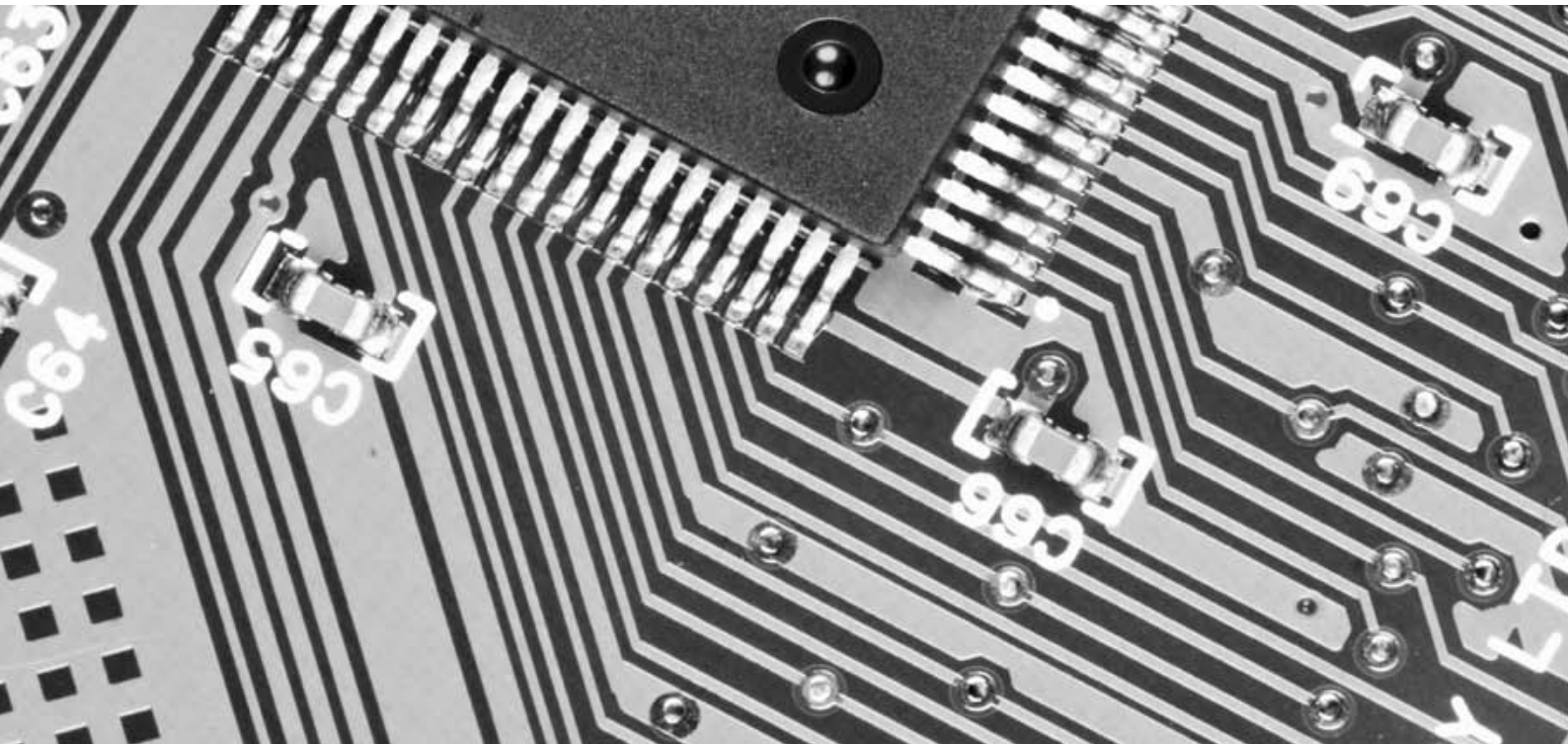
The Association of Accountants and Financial Professionals in Business

The global body for professional accountants



ACCOUNTANCY FUTURES ACADEMY

Digital Darwinism: thriving in the face of technology change



Acknowledgements

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An entrepreneur with over 20 years' experience within the IT industry, Andrew has extensive knowledge of communications, messaging and information systems. As CEO of Celaton he has spent the last nine years working to develop a pioneering approach to detecting and preventing bad data from getting into business systems using artificial intelligence.

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Darren is an assistant professor at Pace University, New York. He is a leading expert in the field of digital forensics and cybersecurity. He has not only developed a computer forensics program at Pace but is also a professional consultant in computer forensics and cyberlaw for the US Department of Education. Darren is current president of the US High Technology Crime Investigation Association Northeast Chapter.

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Chairman, Proxima Group Ltd

Richard's career has taken him through 20 years in technology, with IBM UK (commercial director) and latterly DEC, where he was country manager for UK and Ireland. He then switched to the business services sector for 15 years, serving as partner of Andersen Consulting (Accenture), being a core team member and president of Europe and Asia for a California-based start-up called Exult from 2000 onwards. Exult was sold by means of a merger for $670m to Hewitt of Chicago in 2004, where Richard served for a further three years as joint head of Europe. He has also served on boards of Control Circle Ltd, IBM Financial Services, Andersen Consulting Properties, Digital, Exult and Hewitt – in the UK, Ireland, the Netherlands, and India.

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Lesley has been writing about accountancy, business and technology for more years than she cares to remember, and before this, at some point in the dim and distant past, she used to be a software engineer.

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Assistant professor of accounting, Florida Atlantic University

Previously, Robert served as an assistant, then associate, professor at Old Dominion University. He earned his BA in Accounting from Michigan State University; a Master's degree in Financial Accounting from Northern Illinois University; and PhD from the University of South Florida. Robert is also a CPA. Robert has published several XBRL-related papers ranging from practitioner-based to academic and even pedagogical. His main interest is in XBRL adoption issues, but he has turned his attention to user-choice considerations. Robert is an academic member of XBRL-US.

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OBE, CEO, Get Through Guides

Vandana qualified as a UK chartered accountant with H. W. Fisher. She spent 10 years working in numerous countries in central and eastern Europe, initially for Ernst & Young. She went on to become the CEO of BPP International and was responsible for all training outside the UK. She was also responsible for drafting the first versions of the IFRS and ISA material for BPP. Vandana works closely with the British government to foster international trade for the UK and has given numerous presentations for/to UKTI. She founded her training and publication company for international finance and accountancy courses, 'Get Through Guides', in 2002 in Pune, India.

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David joined the Sage business in 2004 and worked there for over five years. As the online payments space grew, David spotted an opportunity to move into e-commerce by joining the Sage Pay division. David is now Cross Sell Manager, responsible for developing commercial propositions to support integrated payment adoption. David is also focused on raising awareness of integrated payments and working alongside Sage Pay's Product and R&D teams to drive further technical integration between Sage Pay and the core Sage products.

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Director of enterprise security, Trusteer

Dana has over a decade of real-world expertise in the security industry, and routinely delivers compliance and security-related presentations, white papers and webcasts. Dana holds a BSc from the Technion–Israel Institute of Technology, in addition to a number of industry and vendor certifications.

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Global futurist and CEO, Fast Future Research

Rohit advises global corporations, professional service firms, governments, international associations, the EU and the OECD on the forces, trends and developments shaping the future. He focuses in particular on emerging technologies, disruptive innovation and game-changing business models. Rohit is currently running studies on the impact of technology on the legal system over the next decade, the forces of change that could disrupt business and the science and technology developments that could shape the world over the next 50 years.

Professor Dr Désirée Van Gorp
Associate dean of degree programs, Nyenrode Business Universiteit

Désirée joined Nyenrode Business Universiteit in 1999 and currently holds the position of professor of international business strategy and associate dean of degree programs. Before joining Nyenrode she was director of international affairs at MKB-Nederland, and has worked on an advisory basis for many public and private sector organisations. Désirée is a member of ECP, a Dutch advisory board which aims to strengthen the use of ICT in Dutch business, government and civil society organisations.

About ACCA

ACCA (the Association of Chartered Certified Accountants) is the global body for professional accountants. We aim to offer business-relevant, first-choice qualifications to people of application, ability and ambition around the world who seek a rewarding career in accountancy, finance and management.

We support our 162,000 members and 428,000 students throughout their careers, providing services through a network of 89 offices and centres. Our reputation is grounded in over 100 years of providing world-class accounting and finance qualifications. We champion opportunity, diversity and integrity, and our long traditions are complemented by modern thinking, backed by a diverse, global membership. By promoting our global standards, and supporting our members wherever they work, we aim to meet the current and future needs of international business.

About IMA®

IMA® (Institute of Management Accountants), the association for accountants and financial professionals in business, is one of the largest and most respected associations focused exclusively on advancing the management accounting profession. Globally, IMA supports the profession through research, the CMA® (Certified Management Accountant) program, continuing education, networking, and advocacy of the highest ethical business practices. IMA has a global network of more than 65,000 members in 120 countries and 200 local chapter communities. IMA provides localised services through its offices in Montvale, N.J., USA; Zurich, Switzerland; Dubai, UAE; and Beijing, China.

THE ACCOUNTANCY FUTURES ACADEMY

The Accountancy Futures Academy contributes to ACCA's research and insights work with powerful visions of the future. It provides a platform to look forward, to tune into the emerging trends and discussions in the global business and policy spheres and the latest reforms facing the world of finance.

By looking to the future it helps the profession stay at the cutting edge. The Academy's work fosters fresh thinking and innovative discussions, identifies the barriers to and facilitators of tomorrow's successes, and identifies the potential strategies that will enable business and finance to navigate the choppy waters that lie ahead.

www.accaglobal.com/futures

This document makes predictions, and hopes to stimulate discussion, about a broad range of emerging and converging technologies and their potential to influence the accountancy profession.

The propositions it presents are based on available, established and emerging technologies, and the ways in which they could potentially impact on the profession over the next 5 to 10 years and beyond.

Faye Chua
Head of Future Research, ACCA

Faye Chua is ACCA's head of future research and leads ACCA's global research and insights work that focuses on the future directions of business and the accountancy profession across a range of subjects. She has over 10 years of experience in research across different sectors of the economy and has worked in North America, Asia Pacific and Europe.

Contents

Foreword

Change is one of the few certainties in life. ACCA has a long history of exploring the impact that impending changes will have on the future of business and the accountancy profession through forward-looking and groundbreaking research. In 2012, ACCA and IMA published their report *100 Drivers of Change for the Global Accountancy Profession*, which examined the key factors that accountants and finance professionals should be thinking about as they prepare for the new opportunities and challenges that will emerge over the next 5 to 10 years. This considered the change drivers, from the environment and energy, to politics and law, and it highlighted the disruptive potential of developments in science and technology, some of which are now explored in this report.

As we head deeper into the 21st century, it is already clear that developments in digital technologies are going to affect the world even more radically over the next 20 years than in the last 20 years. Technology has already made business global. We can collaborate and share information as quickly and easily with business contacts on the other side of the world as with colleagues at the other side of the building. As new digital technologies emerge and converge they will reshape lifestyles and business activities, how economies develop, and how countries are governed, in revolutionary ways. The future will not be like the past and we will all need to adapt.

The direction of travel is clear; the details less so. The profession must anticipate the changing needs of business. It must supplement its technical expertise with a broad understanding of the application of existing and emerging technologies and the new skills that they demand. Accountants and finance professionals must be open to the changes created by big data, cloud, mobile and social platforms, and face up to the demands of cybercrime, digital service delivery and artificial intelligence. This report draws on input from the ACCA Accountancy Futures Academy and research from analysts, ACCA and IMA members and those close to the profession, to highlight the emerging challenges and opportunities. It aims to offer insights that will help accountants and business to prepare for this new world of possibilities.

Chris Gentle
Partner and head of research
Deloitte

Executive summary

Today we live in an era of 'digital Darwinism', a time where technology and society are evolving faster than many organisations can adapt to the changes. This is one of the many underlying factors that led to the demise of Blockbuster, Borders and the like.[1] Yet technological advances continue to drive economic growth.

As trusted advisers to business, accountants and finance professionals are expected to lead, not follow. The profession has historically been quick to identify and then exploit the potential of emerging technologies: from the earliest known records of commerce, to the earliest commercial computer systems. Accountants' enthusiastic use of the first programmable computers and widespread adoption of the spreadsheet helped to turn accountancy into the profession it is today, and their embracing emerging technologies will turn it into the profession it aspires to be tomorrow.

Many new technologies have the capacity to influence the future of business and the accountancy profession over the next decade and beyond. This report focuses on 10 technology trends with the potential to reshape the profession and business landscape significantly. These are developments that will change the way people live and work, and responses to them will determine the future success of individuals, organisations, and even countries.

Table ES1: Top 10 technologies

Rank	Technologies	Description
1	Mobile	Anywhere, anytime access to broadband connectivity from a range of devices, wireless networks, operating systems and applications
2	Big data	The massive quantity and variety of structured and unstructured data from internet-connected systems, devices and physical objects
3	Artificial intelligence and robotics	The broad range of machines and computer systems that demonstrate limited characteristics of intelligence
4	Cybersecurity	Protection from new forms of cyberrisk, attack, crime and terrorism caused by increased reliance on personal and professional digital devices and data
5	Educational	Trends and tools that are changing and enhancing educational achievements, developments, techniques and possibilities
6	Cloud	Internet-based technology resources – such as software applications, computing power and data storage – provided remotely as a service
7	Payment systems	New, evolving and emerging internet-enabled software applications, currencies, payment platforms, devices and services
8	Virtual and augmented reality	Technologies that use computer modelling to simulate, overlay and supplement reality and enable people to interact
9	Digital service delivery	New technologies used to provide online, interactive, self-service, business processes, software and services
10	Social	Technologies that support social interaction and are enabled by communications technology, such as the internet

1. Blockbuster is a provider of home movie and video game rental services, originally through video rental shops (both owned and franchised); Borders Group was an international book and music retailer based in the US.

This report explores developments in all these areas in more detail. It considers the possibilities created by mutually reinforcing trends, such as those in social collaboration, mobile and cloud computing (also referred to as SoMoClo). It brings together insights from experts in these 10 areas of technology, with perspectives from experts in and around the accountancy profession.

Recent research among ACCA and IMA members indicates that accountants and finance professionals are well aware that radical changes will be wrought by many of these emerging and converging digital technologies. When over 2,100 ACCA and IMA members were asked to what extent they expect developments in technology to transform the way accountants and the finance function do business over the next 10 years, only 1% replied 'not at all'. A sizeable 81% expect change 'to some extent' or 'to a great extent' over the next decade and 18% expect 'a total transformation' (Figure ES1).

Which technologies represent the greatest challenges and opportunities for business and the accountancy profession, what must be done to prepare for these, and how soon are debatable issues. This report considers the impact that current adoption is having on business and the role of the profession; it formulates predictions for the future of each technological trend; considers the implications, opportunities and challenges that these create for the profession to then identifiy actions that accountants and finance professionals must take if they are to minimise the potential negative impacts and maximise the positive (Table ES2).

Figure ES1: Extent to which developments in technology will transform the way accountants and the finance function do business over the next 10 years (world regions)

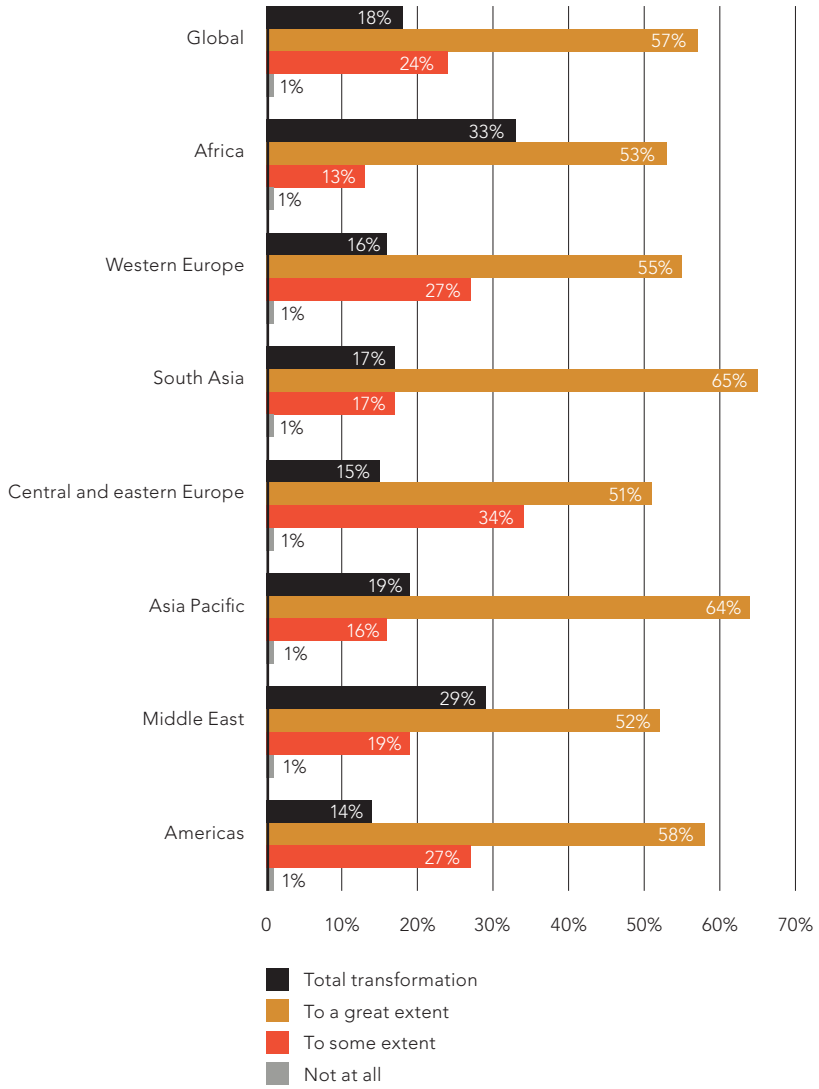
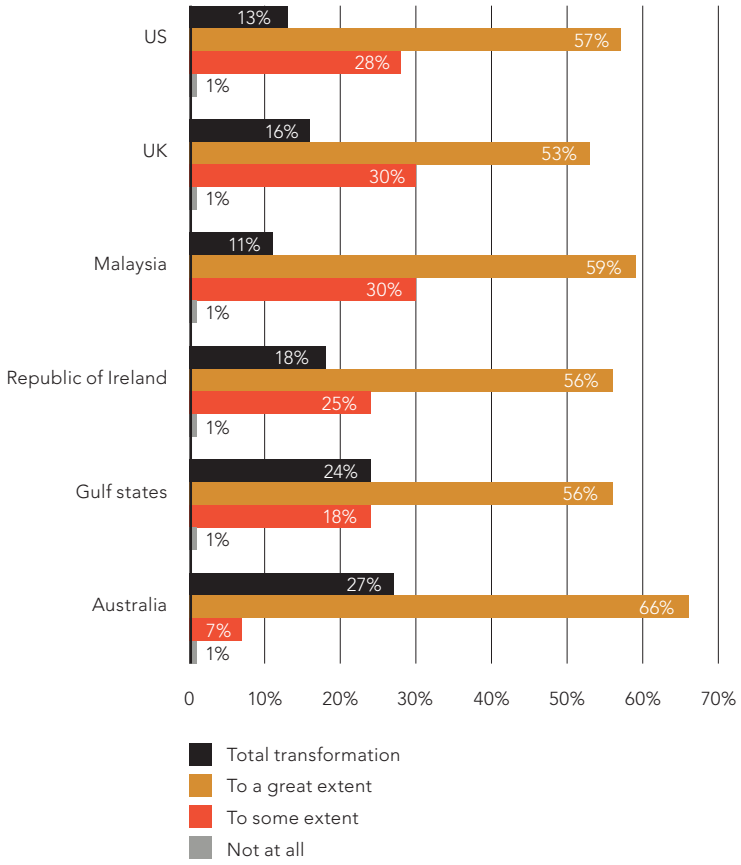


Figure ES2: Extent to which developments in technology will transform the way accountants and the finance function do business over the next 10 years (specific countries)



AGENTS OF CHANGE

The accountancy profession is uniquely well positioned to influence decisions on the adoption of technology. But there are many different types of organisation, many different types of accountant, and many different factors that can potentially impact on their capacity to be a driver for change.

As part of this research, ACCA and IMA asked their members about their influence on technology decisions. Within their own businesses and practices 73% of accountants and finance professionals indicated that they influence technology decisions to some extent or to a great extent. Influence appears to be greatest among CFOs, where this figure rises to 98%. More than 50% of respondents provide advice to their external clients on the use of technologies in their business, with those at director and partner level reporting the greatest influence.

Looking ahead, it seems as if the future potential of the accountancy profession to influence technology decision-making will be determined by a complex mixture of factors. Clearly this includes regional variations and the organisational roles and responsibilities of each accountant. It also includes the extent to which each accountant is currently involved in technology-related decisions and how involved they aspire to be.

Accountants and finance professionals have a significant role to play in the increasingly connected and interconnected ecosystem that will emerge as the 10 technologies in this report come together to create the 'new normal'.

Table ES2: Analysis framework for the 2012–13 ACCA–IMA study of technology trends

Technologies	Key impacts and implications	Action imperatives
Important technologies shaping the next decade – and beyond	Critical issues for business and the profession	Key response strategies
■ Mobile ■ Big data ■ Artificial intelligence and robotics ■ Cybersecurity ■ Educational technologies ■ Cloud ■ Payment systems ■ Virtual and augmented reality ■ Digital service delivery ■ Social technologies	■ Faster and easier access to technology resources ■ A more connected world and workforce ■ Opportunity to automate more business processes and services ■ De-skilling of the accountancy profession ■ Vast amounts of data ■ Enhanced compliance and decision-making ■ New ethical challenges relating to data gathering and analysis ■ More transparency ■ New routes to investment ■ Innovation in services, delivery and business models ■ Level playing field for big and small entities ■ Greater productivity and efficiency ■ Faster and smarter period-end processes ■ New areas of risk ■ Challenges to data security and sovereignty ■ Challenges to traditional role of the profession ■ Expectation of access to IT resources 24/7, on any device, anywhere ■ Separation of skill and expertise from professionals	■ Explore new ways of establishing costs ■ Prepare for changing working patterns ■ Keep watching brief on many emerging technologies ■ Assess risks and address security ■ Plan timing for adoption and implementation ■ Develop change management skills ■ Enhance data analysis and interpretation skills ■ Recruit digital natives ■ Establish a broader and more strategic remit for finance ■ Understand technology market conditions/ planning/risks ■ Explore potential of process automation ■ Introduce better controls and education to enforce governance ■ Use technology to add value ■ Anticipate new regulation ■ Learn enough to know which questions to ask to gain insights ■ Adapt to meet changing business needs ■ Apply human brakes and overrides ■ Manage expectations of internal and external customers

'Companies have to constantly think how they can exploit technology. Otherwise they will soon find themselves irrelevant.'

VANDANA SAXENA PORIA OBE, CEO, GET THROUGH GUIDES

'The finance profession will remain absolutely pivotal as advisers.'

DAVID SMART, CROSS SELL MANAGER, SAGE PAGE

Introduction

Technology is advancing – sometimes in a pervasive and disruptive manner.

This report presents the top 10 technology trends that will have the most impact on the accountancy profession and across the globe. It draws on extensive consultation with experts in the fields of accountancy and technology, academics, members of ACCA's Accountancy Futures Academy and the wider membership of ACCA and the Institute of Management Accountants (IMA).

The 10 technology trends that will have the potential to significantly reshape the business and accountancy landscape, ranked by their standard score are shown in Table I1.

Table I1: The 10 technology trends

Rank	Technologies	Standard score
1	Mobile	86
2	Big data	67
3	Artificial intelligence and robotics	60
4	Cybersecurity	60
5	Educational technologies	60
6	Cloud	59
7	Payment systems	59
8	Virtual and augmented reality	59
9	Digital service delivery	52
10	Social technologies	37

AN ERA OF OPPORTUNITY

Accountants have always exploited emerging technologies to help them to complete their tasks more accurately, quickly or simply: from the incised clay tablets of the Sumerian scribes, through the adding machines of the 19th century, to the calculators and computers of the 20th century. All these technological developments were simple by comparison with the myriad technologies that are now rapidly reshaping the worlds of business and accountancy.

SoMoClo is the acronym for the social, mobile and cloud bundle: collaborative, on-the-go technologies that are converging. In the 21st century, technological advances will change the ways in which people consume information technology resources, share knowledge and experiences, and access products and services. At the same time, SoMoClo is also underpinning and influencing developments in big data, cybersecurity and artificial intelligence.

As valued advisers to the organisations with and for whom they work, accountants must maintain awareness of a broad range of technologies and trends. Finance professionals need to consider the challenges and opportunities created by new and emerging technologies, then use their analytical and problem-solving skills to assess the potential influence of these technologies, in order to provide the insights needed to guide and set vision and direction, as well as tactical and strategic business decisions. This will ensure that businesses reap the true benefits.

In 1963, Leon C. Megginson, a professor of management at Louisiana State University, noted that according to Charles Darwin's *On the Origin of Species*, it is not the strongest of the species that survives, nor the most intelligent, but the one that is most adaptable to change.

DIGITAL DARWINISM – THE SHIFTING BUSINESS LANDSCAPE

The world has entered what some regard as an era of 'digital Darwinism' where technology is evolving too fast for many individuals and organisations to adapt to the changes. As the rate of change accelerates, people, businesses and entire countries are struggling to stay aware of the latest technological developments, let alone understand them well enough to exploit them – and the rapid rate of change is unlikely to slow down.

All this change is underpinned by the internet and the growing availability of affordable broadband access, which will be critical to the future of developed and developing nations. It has already led to a democratisation of knowledge and technology: moving power from the hands of the few to the fingertips of the many – and changed the main drivers for technology adoption. Fewer technological trends now filter down to the masses from business, and more trends take the opposite route.

For a while this meant that innovations such as cloud, mobile and social media were more likely to be exploited (and understood) by consumers and employees than by business. Now the pendulum is swinging back towards the centre. As innovative businesses prove the commercial benefits of emerging

digital technologies, and these are built into more business-oriented software and services, it becomes progressively easier for others to follow suit.

Top priorities for the next decade are knowledge of extraction tools for mining business intelligence, data modelling and analysis, and knowledge management: all are vital for exploiting big data. Also needed are new skills for change and project management, new approaches to funding and product development and leveraging technology to attract, develop and manage talent (Table I2).

The findings highlight what global experts see as key technologies over the next decade and beyond that will affect consumer behaviour and decision making and in turn have a critical impact on business, the accountancy profession and the global environment in which accountants will operate.

Table I2: Skills needed for next decade

Rank	Skill	Standard score
1	Knowledge of data extraction tools in the mining of business intelligence	75
2	Use of tools that support data modelling and analysis	72
3	Knowledge management skills	59
4	Project management skills	57
5	Change management skills	57
6	Knowledge of new approaches to funding and product development	57
7	Ability to use technology to attract, develop and manage talent	57
8	Knowledge of emerging payment platforms	56
9	Better working knowledge of connectivity and IT security	53
10	Knowledge of how applications integrate	44
11	Understanding of and ability to utilise client portals	16
12	Ability to convey core skills and competencies through media channels	16

METHODOLOGY

In this report, the ACCA Accountancy Futures Academy (AFA) assesses current adoption as well as the potential reach and scope of rapidly advancing technologies that are relevant to the accountancy profession. Through an extensive meta-analysis of technologies that are available, established and emerging, a total of 10 have been identified that could affect the profession over the next 5 to 10 years and beyond.

Three waves of research were undertaken.

A series of one-to-one interviews and email consultations were held with experts in accountancy and technology and academics. Experts in their respective fields identified what they perceive the future will hold for each of the 10 technology trends.

A series of events were held across Australia where these trends were discussed in depth.

A survey of over 2,100 ACCA and IMA members around the world.

In the following chapters, this collective research is referred to as the '2012–13 ACCA–IMA research'.[2]

'Accountants must be capable of understanding technology trends in the very early stage and how they may impact business.'

2012–13 ACCA–IMA MEMBER SURVEY RESPONDENT

2. The Australian events took place as follows: Brisbane, 24 May 2013; Melbourne, 22 May 2013; Sydney, 21 May 2013; Perth, 20 June 2013; Adelaide, 30 May 2013; Auckland, 28 May 2013. Two ACCA and IMA members' surveys were conducted: 13 September to 2 October 2012, and 15 August to 4 September 2013.

REPORT STRUCTURE

Each of the next 10 chapters is dedicated to one of the 10 technologies and includes:

- a definition
- current adoption, and
- future possibilities.

Finally, Chapter 11 examines the priorities that are emerging for the profession and it considers the role of accountants and finance professionals as agents of change over the next decade.

NEW ISSUES, NEW DEBATES

This report is intended as a platform for engagement between members of ACCA's global forums, members of IMA, their broader memberships and the wider community of stakeholders on the future of accountants and the accountancy profession. It is also intended to help stimulate discussion about a broad range of emerging and converging technologies and their potential to influence the accountancy profession.

Neither technology sceptics nor optimists can predict the future with any degree of certainty. Furthermore, technologies and innovations are diffused and adopted at unpredictable rates. Nonetheless, by keeping informed about technologies as they evolve, considering new technologies as they emerge, and then assessing their implications for finance professionals and those they serve and support, accountants can be prepared to minimise the burdens and maximise the benefits. In this way the profession can exploit technology and potentially change the scope of what it means to be an accountant.

THE ACCA GLOBAL FORUMS AND ACCOUNTANCY FUTURES ACADEMY

As the global body for professional accountants, part of ACCA's mission is to provide opportunity and access to people of ability around the world and support its members throughout their careers in accounting, business and finance.

To ensure future success and provide members with the best possible service, ACCA developed an innovative programme of global forums which bring together respected thinkers from the wider profession and academia around the world.

As part of this programme, the Accountancy Futures Academy provides an opportunity for ACCA to look towards the emerging trends, discussions and reforms in the global business and policy spheres.

Looking at a 5 to 10-year horizon or more, the Academy identifies and explores issues of major significance for the global accountancy profession to ensure that it complements the other ACCA global forums.

1. Mobile

The number of mobile phones overtook fixed lines in 2002, and 2013 will be the year when the number of desktop and laptop computers is overtaken by internet-connected mobile devices such as smartphones and tablets (Tilevich 2012). Mobile devices are now constant companions and crucial components in the personal and professional lives of billions across the globe.

Today, a smartphone has more computing power than a room-sized 1970s mainframe. Adding broadband connectivity to a mobile device creates a pipeline to unlimited IT resources; exploiting built-in hardware features such as accelerometers and global positioning system (GPS) receivers give access to innumerable new products, services and applications (apps).

Mobile technology changes where people can work and how effectively and productively they can do this, providing access to tools on the office network and in the cloud at any time and from anywhere. Mobile commerce is intensifying: more and more products and services are bought and sold using m-commerce applications, mobile devices and wireless payment terminals.

By exploiting mobile devices and targeted apps, accountants and the businesses they work with and for can benefit by:

- creating faster and more connected workforces
- using 'anywhere, anytime' access to information to increase productivity
- empowering managers and employees to make informed decisions faster
- supporting collaboration across the business
- making products and services more accessible
- creating new products and services
- being agile enough to grasp new opportunities as they arise, and
- having the tools to predict financial performance with greater accuracy.

CONCEPTS AND DEFINITIONS

The mobile technology market comprises various devices, operating systems, wireless networks and standards. So, like many of the 'umbrella' terms of reference used by the technology industry 'mobile' can be applied very broadly – even when it has a modifier (such as 'device') to make it more meaningful.

Devices

Mobile devices range from mobile phones and smartphones, through tablets and laptops, to many other objects, such as GPS-enabled cars, smart television sets and wireless payment terminals. As mobile technology rapidly evolves, mobile device groupings and terms of reference are also evolving to encompass new developments and devices, and dividing lines are becoming indistinct.

A tablet is a mobile computing device that is smaller than a laptop and larger than a smartphone. The latter provide voice calls, native functionality such as cameras and GPS, built-in software applications, internet access, text messaging, and the ability to download and use a host of apps. Recent hybrids such as phablets and fonepads are blurring distinctions between smartphones and tablets, by adding the ability to make calls to devices with tablet functionality and size.

Operating systems

There are many mobile operating systems (OS): the software that allows devices such as smartphones and tablets to run the software known as apps. The most widely used are Apple's iOS and Google's Android: the former has around 17% of the world marketplace and Android is used on around 75% of the mobile devices shipped (International Data Corporation 2013a).

Android's sizeable market share conceals significant OS fragmentation. It encompasses various releases of Android Ice Cream Sandwich, Android Gingerbread and other variations on the Android theme. This is because wireless carriers are responsible for issuing OS updates and other companies in the mobile space and use Android code as the basis for their own OSs (in a practice known as 'forking'). Baidu Yi and Tizen are Android forks, and once upon a time Android itself was a Linux fork.

Networks and standards

Mobile network providers are too prolific to list. The state provider China Mobile has the greatest number of users (despite serving only China and Hong Kong), followed by the international providers Vodafone, Barti Airtel (the largest provider of fixed and mobile telephony in India), and SingTel (the partly state-owned Singapore Telecommunications) (GSMA Intelligence 2013). There are also many international and national providers.

COMMUNICATIONS TECHNOLOGIES

The range of communications technologies used to transmit mobile voice, voice and data, or just data is also diverse. It includes (but is not restricted to):

- Bluetooth, which connects mobile devices wirelessly
- dial-up services, which connect using telephone lines and modems
- digital cellular technologies, which connect via networks using high-speed, third-generation (3G) standards such as the global system for mobile communications (GSM), general packet radio service (GPRS) and universal mobile telecommunications systems (UTMS), and emerging ultra-broadband 4G services
- near field communication (NFC), which allows enabled devices and tags to connect with each other when in proximity or touching
- virtual private networks, which connect to private networks via shared and public networks, and
- wireless fidelity, or wifi, which connect via short-range network access points and hot spots.

Apps

The impact and influence of apps has been huge: these bite-sized programs are what attract people to smartphones and tablets. During the first three months of 2013 downloads from the leading app stores – Apple's App Store, Google Play, Windows Phone Store, and BlackBerry World – exceeded 13.4 billion (Canalys 2013).

There are millions of apps available, with tens of thousands more being added every month. They range from personal entertainment, such as games, to personal productivity tools such as Dropbox and Evernote. Growing numbers of apps connect the user with business solutions and functionality such as billing and invoices, travel and expense management, and the ability to review purchase orders, and endorse or decline sales quotes.

ADOPTION

Accountants are exploiting mobile technologies for productivity and efficiency gains, bringing businesses closer to their clients and suppliers, and staying connected to them, whether they are in the office or travelling. Numerous mobile devices are being combined with cloud services to provide 'anywhere, anytime' access to specialist software and the associated business and finance data. The 2012–13 ACCA–IMA research found that 80% of accountants expect the profession's adoption of mobile technologies to become widespread within the next two years (Figure 1.2).

Some accountants have already developed their own mobile 'utility apps' to attract publicity and new clients and to service existing customers better. By developing a profitability analysis app that shows the effect of changes in pricing, one regional UK accountancy firm was able to attract purchasers in Switzerland, Norway, France, UAE, India, New Zealand, Australia, the US and Canada. Other firms have developed apps such as a tax tool and a business mileage logger.

Super-charging finance

Finance professionals already enjoy the convenience of mobile access to enterprise information: performing everyday tasks such as approving payments while away from the office. Accountants are also taking the opportunity to accelerate the cycle times for key processes, eliminating bottlenecks, reducing operational costs and improving productivity, and exploiting all of this to become more strategic.

LOOKING FORWARD

The world of enterprise mobility is changing fast. Even before many organisations have met the challenges of 'bring your own device' (BYOD), there is a much more significant trend of BYOx – or bring your own anything. Workforce use of personal devices has moved beyond simply 'connecting' to the corporate network. Individual employees are increasingly likely not just to select and buy their own mobile devices, but to choose which apps they use for business – and corporate data will follow.

An estimated 1.3 billion people will work remotely using mobile technology by 2015 (International Data Corporation, 2011) and by 2016, 38% of employers expect to stop providing workers with devices. Most have yet to validate the business case for this, and it is worth

Figure 1.1: Impact of mobile technologies on business in the years ahead

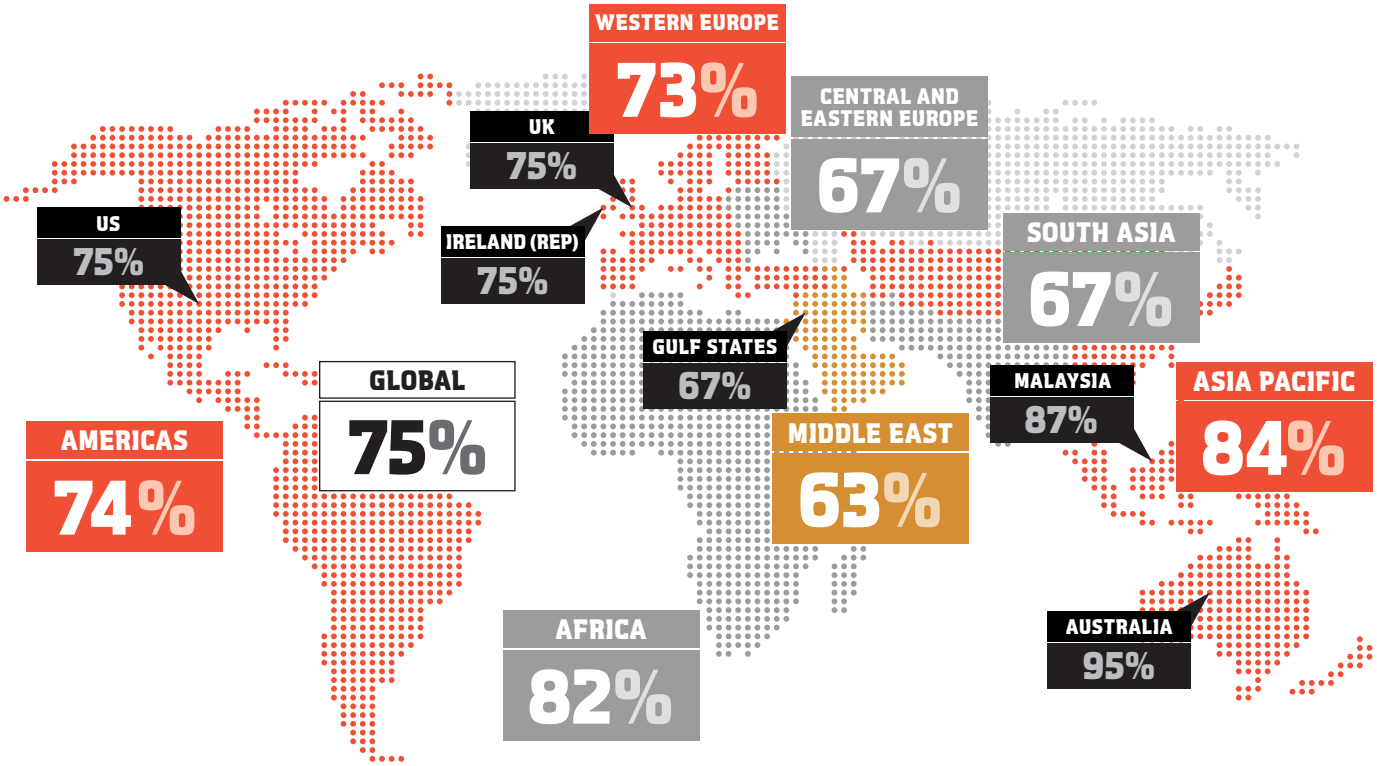
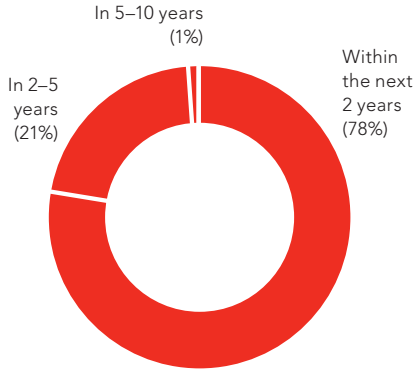


Table 1.1: Impact of mobile technologies by respondent type

ROLE	**Accountants and sole practitioners**	**Managers and senior managers**	**Directors, executives and partners**	**CFOs**
	71%	76%	79%	78%
SECTOR	**Accountancy practice**		**Corporate sector**	
	75%		74%	
ENTERPRISE SIZE	**SME (<250 employees)**		**Large (250+ employees)**	
	74%		75%	

Figure 1.2: Expectation of widespread adoption of mobile technologies



noting that device support issues persist no matter who owns a device. The majority of enterprise mobility support issues and costs are associated with email, application and network support.

Bandwidth demands

Bandwidth demand also affects cost. Global mobile traffic expanded at 69% in 2012 and by 2018, it is expected to exceed 131,000 petabytes (ABI Research 2013a) as developing nations come online. By 2017 the mobile internet is expected to reach 64% of the population in China, 37% in Brazil, and 29% of that of India (Forrester Research 2012a). India is already the third-largest smartphone market and it is growing at a rate of 163% a year. It remains to be seen if existing telecommunications providers can sustain this growth using existing business models and infrastructure.

Radio access antenna technologies, carrier aggregation, network optimisation, and cognitive radio technologies such as white space TV are all being investigated as ways of beating the 'capacity crunch' by boosting spectrum capacity. Reliable broadband networks are essential to the expanding mobile ecosystem. For countries, investment can be crucial to economic recovery, as it contributes to gross domestic product, stimulates employment and raises productivity, but many are relying on commercial entities to build the required infrastructure.

A South Korean *cheabol* (business conglomerate) owns SK Telecom, the company that launched the world's first true 4G network. It is capable of download speeds of 150Mb per second, which is around 10 times the maximum speed that users can hope for from the 3G networks that currently dominate the market. To put this further into context, SK Telecom expects users of the 4G network to be able to download an 800Mb movie in just 40 seconds – which bodes well for less bandwidth-hungry data.

The profession is planning

Accountants are well aware of the significance of mobile. When CFOs were asked for their perspectives on the future of technology, 78% said mobile technology will have a large impact on their business in the years ahead.

Accountants also appreciate the extent to which mobile and some of the other technologies in this report are mutually reinforcing. When ACCA and the IMA asked their members about which technologies they expected to become particularly significant in accountancy and the finance function, one responded: 'All of the technologies are very significant as most lead into the next. In particular mobile and cloud computing', and many respondents linked these two technologies.

Over the horizon

In the longer term, mobile technologies are likely to take a very different direction, under the influence of innovations such as microscopically small computers known as 'smart dust' (see pages 30–31) and the 'Internet of Everything' (IoE).

Although 2013 may feel like the year of IoE, it will be many years before the internet of everything reaches its full potential. Today, there are around 10 billion wirelessly connected devices, and analysts expect it to take until 2020 for this to rise to 30 billion (ABI Research 2013b).

Smartphones and tablets will remain essential, but future growth will be driven by wireless node or sensor-type devices, and by 2020 these will account for 60% of the installed base. By 2022, new industries and business trends could create an estimated $14.4 trillion in value, through increased revenues and lower costs (Cisco 2013).

'Mobile computing has shown the true power of the internet. Most people now have two or three devices and they interact with business applications across all of them.'

CHRIS DAVEY, GROUP PRODUCT MANAGER, GLOBAL ACCOUNTANT OFFERINGS, INTUIT

2. Big data

The amount of information published was growing exponentially before the world embraced computers and information dissemination became digital. Converging technology trends, the shift from analogue to digital, widespread mobile device adoption, internet-connected systems and 'exhaust data' from physical objects (also known as the internet of things, or the internet of everything: IoE) have combined to create the vast amounts of structured and unstructured data we now call 'big data'.

Most information now originates in digital format: 90% of the world's data has been created in the past two years and the quantity is unlikely to diminish soon. Each day an estimated 2.5 quintillion bytes of data are added by the output from bar codes, telephone signals, digital images, transactional databases, personal location records, statutory reporting systems, online searches, radio-frequency identification tags, social data, video clips, website visits, and more.

As the technology for collating, managing and analysing big data becomes increasingly accessible and affordable, individuals and organisations are exploring its potential to:

- enhance predictive analytics
- unlock value from vast data sets
- make unstructured data more meaningful
- turn patterns into actionable insights
- innovate in business models, products and services
- transform audit and forensic accounting
- make competition fairer for small businesses
- support, automate and improve decision-making
- lower process costs and boost operating margins, and
- identify and reduce risks.

CONCEPTS AND DEFINITIONS

It can be difficult to comprehend just how much data is available. Currently the largest 'official' (SI) unit prefix is a yotta: a digit followed by 24 zeros. Eventually there will be so much data that a new unit will be needed to quantify it. A name for this is still undecided: the bronto, the googol, the hella and the xenna each have their advocates. Meanwhile, it is a struggle to give the world's daily output a meaningful context.

Knowing that it is an estimated 2.5 quintillion bytes of data is not very useful. Smaller units can provide more meaningful context: one quintillion bytes is 1,000 petabytes and one petabyte is enough to store the text from 20 million four-drawer filing cabinets filled with text – apparently. Perhaps it is more meaningful to consider that 2.5 quintillion is 2,500,000,000,000,000,000 bytes and one byte of data stores the code representing one letter of the alphabet.

Big data is heralding a new generation of technologies and architectures

These technologies and architectures have been designed to extract value economically from massive volumes of many types of data, by enabling their rapid identification, capture and analysis. There are three main big data characteristics: the data itself, the analytics of the data, and the presentation of the results of the analytics – plus the very many products and services that can be wrapped around these elements.

The term 'big data' started life in the world of computer science. There it was used to describe sets of data so large that they cannot easily be processed using the sort of 'traditional' tools for database management that people (including the average software engineer) have traditionally had at their disposal. Think Oracle Database, Microsoft SQL Server, IBM DB2, plus various other relational database management systems (RDBMS) that have historically been the weapons of choice in data centres.

A moving target

A single data set can range from many petabytes down to a few dozen terabytes (1,024 terabytes = 1 petabyte) in size and these are typically located across multiple data nodes. As data proliferates it becomes more difficult to manage. Traditional database structures and tools were not built to process the vast amounts of fast-changing data now being distributed across so many locations and devices, let alone the 80% of daily output that is unstructured.

Since the early 2000s, data processing has evolved. Developments such as Hadoop[3] and MapReduce[4] have supported the creation of massively scaleable big data analytics infrastructures. As accessible and affordable products and services emerge, more and more businesses can gain insights that would otherwise have been beyond their reach.

ADOPTION

Patterns and information that were previously hidden in large quantities of data (because extracting them required too much work, would take too long, or was too expensive) can now be exploited in many ways. Accountants and finance professionals have already spotted the potential. In the 2012–13 ACCA–IMA survey 78% of respondents said that they expect widespread adoption of the data analysis tools that can be used to collate, manage and analyse large amounts of structured and unstructured data Figure 2.2).

So far, the technology sector has led adoption. Big data is behind Amazon's targeted product recommendations and Google Mail's spam reduction programme. Tech start-ups are exploiting big data too: companies such as BitSight leverage big data analytics to help businesses identify and quantify IT security risks while Solum uses big data analysis of soil to help farmers increase their crop yields.

Tangible business benefits

Mining vast amounts of data helped Scandinavian airline Wilderoe see a disconnection between its systems and its call centre staff. After reconfiguring its systems, Wilderoe significantly improved its call centre conversion rates and got a return on its technology investment within six months (Boxever 2013; QlikView 2013). The Amsterdam-Amstelland fire service in the Netherlands uses big data to calculate the risk profile for all buildings, roads, waterways and train rails in its region (over 600,000 objects) and decide where the risk of fire and other incidents is highest, and how and where its resources should be deployed to greatest effect.

Analytics for big data are being built into software that businesses (and accountants) are used to having available. As well as business intelligence (BI) tools, big data capabilities are being added to applications such as finance and human resources (HR). Workday, for example, is developing a big data analytics app that will integrate with its cloud financial and HR software, so that users can combine the data from these with third-party data sources of any type.

LOOKING FORWARD

These are early days in the evolution of big data and only time will tell where the insights and inspiration it can provide may eventually lead. Accountants are already preparing. In the 2012–13 ACCA–IMA survey, members identified the technology skills that they expected to find useful during the next decade. These included: knowledge of data extraction tools for mining business intelligence (72%) and use of tools that support data modelling and analysis (70%), and the significance of these skills was rated consistently highly across every world region from Asia and Africa to Europe and the Middle East.

Other research (Visiongain 2013) indicates that 80% of enterprises in the developed world are already investing at least some part of their budget in big data, and the role of big data is expected to increase over the next five years as new and existing systems further exploit its potential. Global revenues are predicted to reach $12.4bn in 2013, with a compound annual growth rate of 21.1% for big data services and 53.4% for big data storage each year until 2018, as organisations of all kinds and across all sectors compile and manage increasing amounts of data (Visiongain 2013).

Mutually reinforcing trends

Some growth will be driven by the convergence of trends in cloud and mobile; specialist software developers are already investigating the possibilities. More than one leading developer of accounting software is exploring ways to exploit the data produced by customers. In its aggregated form, it can be used to provide data and intelligence that could help accountants to make better decisions and add value to their client services, as software and services becoming progressively smarter.

The massive amounts of data created by the IoE will themselves generate increasingly more. Estimates suggest that 99.4% of the physical objects that may one day join the 'internet of everything' are as yet unconnected (Cisco 2013). Both the quantity and sources of data are expanding and sensors are making their way into some unconventional items. The desktop and laptop will become the platforms of the past, as they are superseded by a myriad of mobile devices with sensors embedded.

3. Hadoop is a distributed file system that allows data storage across multiple nodes.

4. MapReduce allows various data processing tasks to run in parallel across multiple nodes.

Figure 2.1: Impact of big data on business in the years ahead

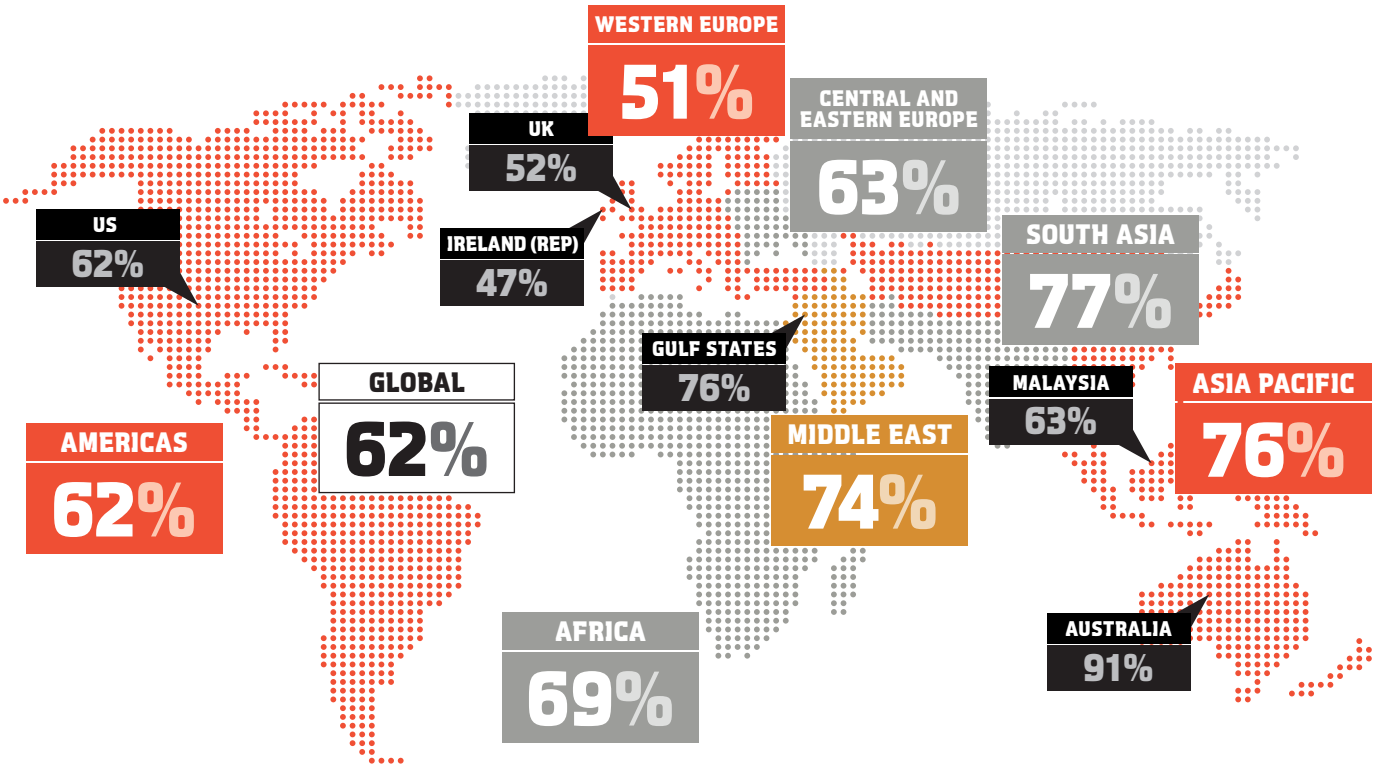
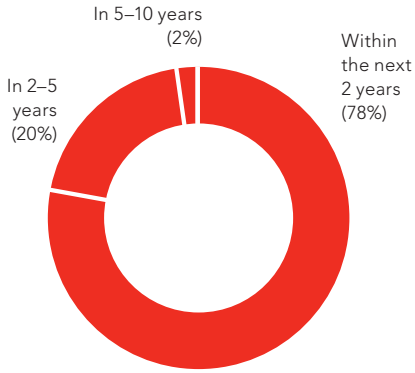


Table 2.1: Impact of big data by respondent type

ROLE	**Accountants and sole practitioners**	**Managers and senior managers**	**Directors, executives and partners**	**CFOs**
	58%	63%	61%	62%
SECTOR	**Accountancy practice**		**Corporate sector**	
	50%		67%	
ENTERPRISE SIZE	**SME (<250 employees)**		**Large (250+ employees)**	
	55%		68%	

Figure 2.2: Expectation of widespread adoption of big data



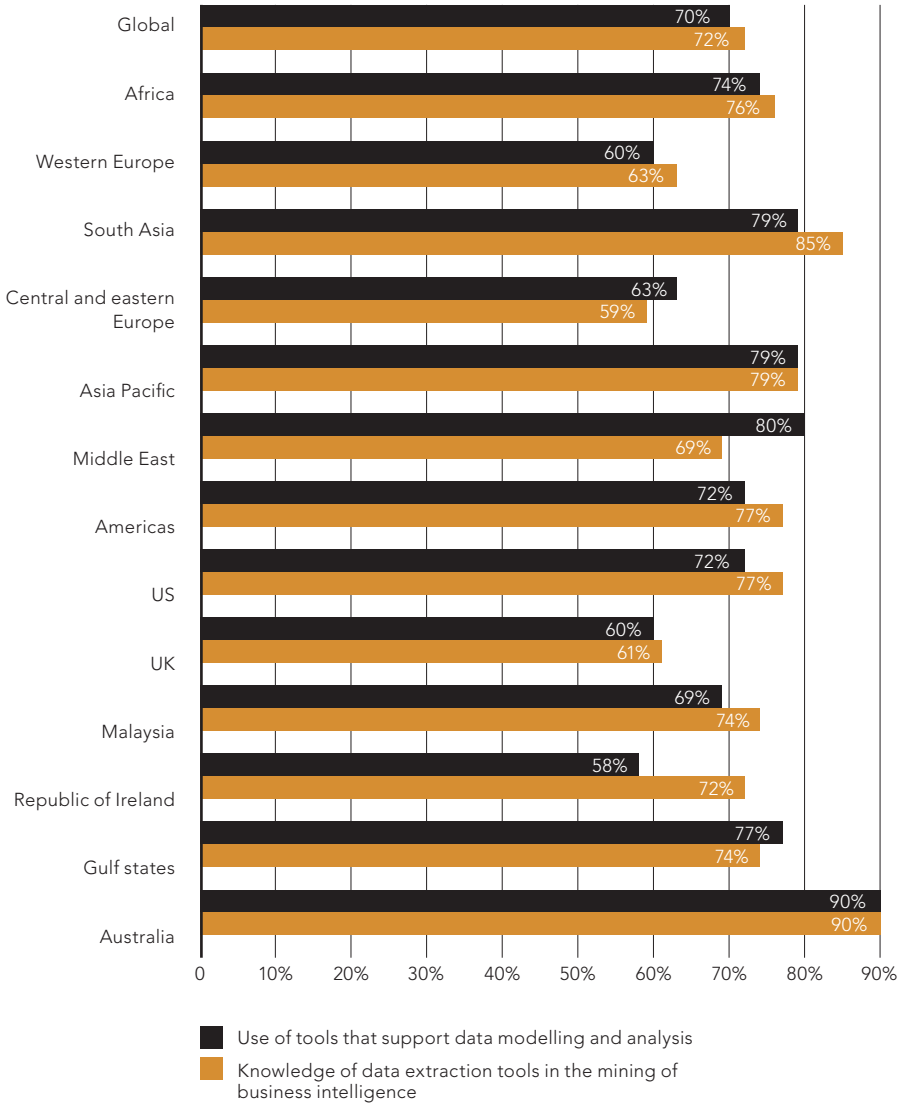
BIG ROLE FOR ACCOUNTANTS

This connected world will be a welcoming place for many accountants. Big data comprises the greatest amount of contextual relationships, information and data that humanity has ever experienced; exploiting this will create a demand for people with the necessary analytical and interpretation skills, who know which questions to ask to gain insights, and who appreciate that quality of data can be just as important as quantity – and that data must be tagged in the manner required for rapid and automated analysis.

As more data is gathered, correlated, stored and analysed, ethical issues will also increase – for individuals, businesses and governments. When data from online activities, mobile devices, payment systems, social networks, surveillance cameras and other devices is combined, it can reveal much about our personal and professional lives, online and offline. Accountants and finance professionals will need to ensure that data protection legislation is followed and that data is used ethically. New business procedures and new laws may be required to maintain privacy and prevent the misuse of data and of data gathering technologies.

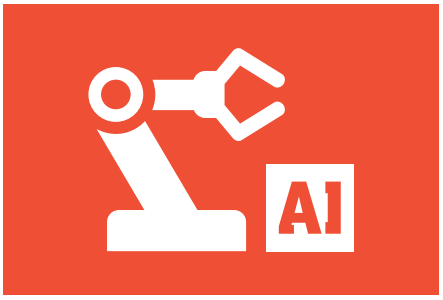
There will be many challenges for the profession, but also many opportunities. Exploiting big data demands the sort of structural and analytical skills that are commonplace in accounting. Research has already shown (Brynjolfsson 2012), that companies that adopt 'data-driven' decision-making methods can outperform their less enterprising peers; there are many easily accessed opportunities waiting for companies that use big data to their advantage, and accountants could be the ones to identify this.

Figure 2.3: Big data skills needed for the next decade



'Accountants already know how to use traditional analytics and BI tools to explore known unknowns. Now they need to get involved in analysing big data so that they can navigate the unknown unknowns.'

ROBIN GILTHORPE, CEO, TERRACOTTA



3. Artificial intelligence and robotics

Forget the androids and other forms of artificial intelligence (AI) that appear in films such as *2001: A Space Odyssey*, *Star Wars*, and *Terminator*. The reality is very far from the extremes of science fiction. Yet the direction of travel is clear: computers, software applications, machinery and robotics are already automating boring, complex, demanding and repetitive tasks and processes – and often doing them more cheaply or with greater accuracy and reliability than human beings.

As robotics has become more cost-effective, its use has become commonplace in industries ranging from manufacturing, through medicine to structural engineering. On the other hand, AI pushes the boundaries even further by transforming software and business processes across many different industries. It is enhancing developments in areas such as facial recognition and changing approaches to the security of systems and processes. Interactive Web robots, known as 'bots', have become the public face of AI and robotics, giving advice, customer service, information and support in areas including financial services, retail, and utilities.

As software and hardware become smarter and more 'intelligence' is built into them, they are complementing and replacing human activities and decision-making processes. By exploiting existing AI and robotics technologies and exploring the emerging possibilities, businesses can benefit by:

- automating routine, repetitive and labour-intensive tasks and processes
- reducing operating costs and increasing efficiency
- providing 24/7 service via myriad fixed and mobile devices
- developing innovative new products and services
- ensuring that products and services meet customer needs
- scaling up operations with fewer and cheaper resources, and
- extracting more value from existing investments in technology.

CONCEPTS AND DEFINITIONS

AI applies to a broad range of machines and software that demonstrate characteristics of intelligence, and that are often described collectively as 'intelligent agents'. AI systems are the data, people, procedures, hardware, software and knowledge needed to develop these computer systems and machines.

Although an agent intelligent enough to replicate the human brain is not yet a reality, there are many examples that can demonstrate limited 'intelligence', depending on how this is defined. Intelligent behaviour can include: learning from experience, determining what is important, handling complex situations, understanding visual images, being creative or imaginative, and other characteristics.

AI is a vast area of computer science. It includes a number of branches, such as genetic programming, pattern recognition, neural networks (which can act like, or simulate the functioning of, the human brain), and many concepts and topics, such as expert systems (which store knowledge and make inferences), natural language processing (software that can understand and react to commands and statements made in a 'natural' language such as English or Mandarin Chinese), and robotics (see below).

Rules and robots

Most experiences of AI involve rule-based 'expert systems'. These use stored knowledge to provide advice or to guide users through complex processes by emulating the decision-making abilities of a human expert. All sorts of software now have built-in expert knowledge and the capacity to 'learn' how to improve their own processes and performance, and examples range from accounts production software to search engines. Natural language processing (NLP) is also entering the mainstream (see Adoption on page 26) as NLP systems get faster, smarter and cheaper.

There is some debate about whether robotics is a branch of AI. Some see it as a separate discipline, of which AI is a branch, along with other areas such as robot surgery, nanorobotics (the creation of tiny machines) and telepresence.[5] For present purposes, it is enough to know that robotics involves the design, construction and operation of robots (including computer systems for their control, sensory feedback, and data processing), and the application of these robots.

5. Telepresence gives the illusion of being elsewhere, which can involve the remote control of robotic devices, called 'telerobotics'.

Changing expectations and experience

A robot is a system containing sensors, control systems, manipulators, a power supply and software, which work together to perform a task or tasks. Characteristics include the ability of the robot to power itself using sources such as batteries, light, electricity and bio fuel; to move around its environment; sense its surroundings; to digest information and make decisions; and to have a physical form. As the internet has evolved so has use of virtual robots (bots) and this is changing expectations and experiences of robots.

Bots have been running automated tasks online for years, making independent decisions as they learn and interact with each other and with other sources of data. They have been joined by 'virtual agents' that look like people and mimic human behaviour: using NLP to interpret questions and answer using online and computer-generated chat. Integration with systems such as customer relationship management (CRM) and inventory makes them effective sales people and support agents. It almost seems incidental whether a hard line exists between the virtual and the physical, for robots or people.

ADOPTION

The achievements of AI supercomputers such as IBM Watson attract understandable publicity. IBM Watson uses NLP to understand human speech, make sense of huge amounts of complex information, rank answers based on probability, and learn from its mistakes. This has helped it to beat human contestants on quiz shows and help doctors tailor medical treatments to meet the complex needs of individual cancer patients. Now it is being used as the basis of a new generation of business applications, such as the IBM Watson Engagement Advisor. This will use AI to enable businesses to give fast, data-driven answers to customer questions, offering feedback and advice via cloud-based services and online chat sessions.

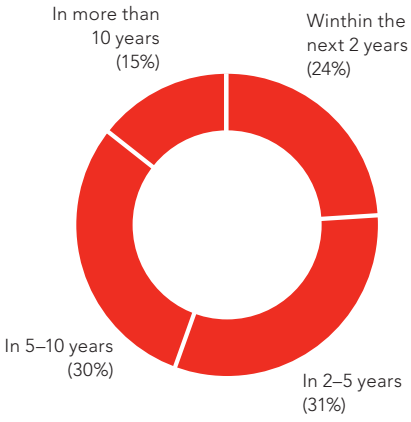
The application of AI and robotics is also spreading in industry. The Chilean state copper giant Corporacion Nacional del Cobre de Chile (Codelco) uses AI and advanced knowledge-extraction techniques to generate potential targets for exploration and to automate many mining processes. At four of its sites in Chile, trucks drive themselves, operations are controlled remotely, and it is working towards an intelligent 'digital' mining model. This will combine these automated processes with integrated information networks and expert systems, such as the one Codelco already relies on to manage quality for some of its operations and maintenance.

Accountants and finance professionals increasingly rely on the expert knowledge built into software to work efficiently and effectively in a range of scenarios – particularly in rule-based areas such as compliance. Smart software is being used to ensure the consistency of audit-related processes and their compliance with International Auditing Standards; software for applying eXtensible Business Reporting Language (XBRL) tags to financial information, and learns from the decisions made by its users. In the US an intelligent system based on AI, negotiation techniques and argumentation theory is being used to check whether supplier selection processes comply with the Sarbanes–Oxley Act.

LOOKING FORWARD

Of the 2012–13 ACCA–IMA survey respondents, 24% predict the widespread adoption in accountancy of AI, expert systems and robotics within the next two years (see Figure 3.1). Some organisations are already replacing human operatives with 'robot servers'. Infosys, the Indian multinational IT services and consulting giant, is using self-learning software robots for software tasks: a robot costs around $15,000 a year, which is 50% less than it currently costs to hire a software engineer in India (*The Economist* 2013). The UK's Co-operative Bank has improved efficiency by 80% using robot software to automate account closures, direct debit cancellation, audit reports and other processes (Blue Prism 2008).

Figure 3.1: Expectation of widespread adoption of AI and robotics



Such adoption has the potential to transform the profession. Within 5 to 10 years, many other finance processes and services will change. Specialist software applications already automate some business and accounting processes and then present the results to expert users who use their professional judgement to review them and make any necessary adjustments, in areas from audit to tax.

The blessings of automation

AI, robotics and other types of automation will continue to transform many front and back-office functions in the same way that they are already transforming manufacturing. This can be a mixed blessing for businesses, sectors, and the economies of countries. Recent research highlights that rising automation and use of robotics has contributed to increased labour productivity and competitiveness in countries such as China, Japan and Germany (Euromonitor International 2013). Nonetheless, rising automation can also contribute to long-term structural unemployment as part of a fundamental shift in the skills needed by an economy, which can weaken consumer spending and confidence.

Taiwanese technology giant Foxconn plans to introduce one million robots over the next three years, to cut rising labour costs and improve efficiency. It currently employs 1.2 million people, with about one million of them based on the Chinese mainland. It remains to be seen how many workers are replaced and how this affects the economy of China. There are many countries and professions where automation has led to the loss of jobs in clerical work and professional services; as more processes are automated and become autonomous, more highly skilled jobs could become obsolete.

'Over the next two years, automation will mean the disappearance of many cumbersome bookkeeping processes such as transaction coding, which will enable accountants to focus on high value work such as advisory services instead. The future will be with smart applications that drive value for accountants and their clients.'

CHRIS DAVEY, GROUP PRODUCT MANAGER, GLOBAL ACCOUNTANT OFFERINGS, INTUIT

'In 5 to 10 years, AI will be considered the normal way to carry out tasks and decision-making, and the trend can only accelerate.'

ANDREW ANDERSON, CEO, CELATON

4. Cybersecurity

Information is now collected, stored and shared using numerous software and devices: from email and social media platforms, through surveillance cameras and search engines, to accounting systems and online data vaults – via numerous corporate and personal smartphones, tablets, memory sticks, digital cameras and other items. Unfortunately, reliance on these digital technologies exposes individuals, organisations and entire countries to a host of both deliberate and non-malicious threats.

Sensitive data can be compromised by the theft or loss of a smartphone, and criminals can sneak into corporate files and search them for confidential data without leaving a trace. Theft of digital information has overtaken physical theft as the most commonly reported fraud, and the relative insecurity of the small and medium-sized enterprises (SMEs) is making them a growing focus for cyber-attacks. As ever more products and services are provided, sourced and accessed online, and personal and professional mobile devices proliferate, the security of data and systems becomes increasingly complex and their governance becomes increasingly important.

All organisations need to:

- understand the nature and likelihood of cyberthreats
- identify, assess and mitigate existing and emerging risks
- implement and maintain strong controls and policies to govern data privacy and security
- educate users on emerging risks, such as those associated with mobile devices and social media
- plan for increasing complexity, and
- make technological risk a board-level concern.

Cybersecurity is an area where an organisation can achieve limited outcomes by working alone. To combat emerging cybercrimes effectively and catch and punish attackers, companies, industries and governments will need to collaborate to:

- share information on cybercrime, and
- create consistent, uniform and better global regulations.

These steps will enable them to provide citizens and businesses with appropriate protection from cyber-attacks.

Cybersecurity is an area where a single organisation can achieve only so much by working alone. In order to effectively combat the growing range of emerging cybercrimes and catch and punish attackers, companies, industries and governments will need to collaborate to:

- cooperate and share information on cybercrime
- create consistent, uniform and better global regulations, and
- provide citizens and businesses with appropriate protection from cyber-attacks.

CONCEPTS AND DEFINITIONS

The end is nigh! Or is it? Reacting proportionately to threats and risks is challenging for a number of reasons – not least the hype. Information security breaches are rarely out of the headlines and fear can be a powerful motivator.

Tales of crippling cyber-attacks and feckless losses of personal data attract more readers than reports on businesses that have never had their computer systems threatened or their data compromised – either accidentally or deliberately.

It is worth noting that cyberspace is not the internet or the World Wide Web or the cloud – though the latter does seem to have replaced it as the most popular catch-all for the online world. Over the past decade the term 'cyberspace' has become progressively less widely used, and 'cybersecurity' has become more widely adopted. The term has also evolved. It is often used to describe the protection of systems, networks and data in cyberspace or the cloud, or the internet, or online – and it does relate to these. Its meaning has gradually expanded, however, and cybersecurity is now widely used to describe pretty much anything relating to the security of information technology and computers.

Crime wave

Cybersecurity includes headline-grabbing developments such as cyberwarfare, cyberterrorism and cybercrime. Cyberwarfare involves nation states using hacking, malware (malicious software) and various other types of computer-generated nastiness to attack or infiltrate a strategic target or tactical resource for the purpose of espionage or sabotage – and it can be directed against military, infrastructure and economic targets. There is potential for these to overlap with cybercrime, as this term encompasses any economic crime that is committed using computers and the internet, such as distributing viruses, illegally downloading files, phishing (using deception to acquire users' credentials), and stealing personal information.

Cybersecurity is about more than cybercrime. It also includes more traditional threats to the security of information technology and computers, such as accidental damage and loss, natural disasters and naive or disgruntled employees. As this makes cybersecurity a vast and growing area, it can help to divide it into three main categories.

1. Procedural security includes business continuity management, compliance, education and training of personnel, incident management, information security policies and documentation, operational procedures and responsibilities, third-party management.

2. Physical and environmental security includes information classification and handling, secure areas on site and at third-party premises (including those of service providers and personnel), the control and management of assets such as mobile devices.

3. Technical security includes access controls, backup, e-commerce services, malware protection, and the security of corporate, mobile and Web applications (during acquisition, development, maintenance, and use).

ADOPTION

Cybersecurity has become so complex and multifaceted that expertise is needed just to understand many of the risks, before the viability of the products and services that promise to address them can be considered. As each new technology joins the hardware and software that comprise the digital infrastructures on which business depends, new security products emerge to address the new risks. These can be grouped into categories such as access security, application security, content security, data security, data centre security, endpoint security, identity management, and network security.

Each of these specialist areas includes even more specialised products and services.

Take 'endpoint security'. The security tools and services include familiar anti-virus, anti-spyware, and anti-intrusion (firewall) products, as well as less familiar offerings such as biometric authentication systems[6] and vulnerability scanning services.[7] As new security solutions emerge they demand fresh judgements about prioritising risks and the costs of protection and mitigation and investment.

Accountants are acutely aware of the need to take adequate steps to protect computer systems and data against a growing range of deliberate and accidental cyberrisks. In the 2012–13 ACCA–IMA research cybersecurity was the leading technology priority, and 79% of respondents expect the need to assess, protect and mitigate cyberrisks to increase in significance over 2014–15 (Figure 4.1). On the face of it, there seems to be an association between security concerns and action to address risk, but what appears to prompt such initiatives is not the awareness of specific risks but the feeling that risks in general are multiplying, becoming more threatening and leading to higher losses.

Table 4.1: Percentage of respondents who are concerned with risks related to cybersecurity in their organisations

ROLE	**Accountants and sole practitioners**	**Managers and senior managers**	**Directors, executives and partners**	**CFOs**
	49%	69%	58%	56%
SECTOR	**Accountancy practice**		**Corporate sector**	
	40%		56%	
ENTERPRISE SIZE	**SME (<250 employees)**		**Large (250+ employees)**	
	50%		58%	

6. A biometric authentication system identifies individuals by traits and characteristics that are distinctive and measurable.

7. Vulnerability scanning services is a computer-based program that is designed to assess weaknesses of computer systems, computers, networks or applications.

LOOKING FORWARD

This perception appears to be accurate. Failing to protect computers, data and networks adequately is becoming more costly – and not just because overall adoption levels are increasing. Failure to comply with statutory regulations or with industry rules can lead to fines and sanctions for any organisation.

The Finance Ministry in Greece was fined €150,000 by the country's privacy watchdog for allegedly failing to protect data about millions of taxpayers (Reuters 2013). Almost all merchants that take card payments are expected to comply with the Payment Card Industry Data Security Standards (PCI DSS). If non-compliance is followed by a security breach, the fines can be substantial.

New threats

At the moment, the biggest threat to the privacy and security of data remains the physical loss of a mobile device such as a smartphone, through theft or carelessness. One in ten companies has lost critical data when a device was left in the back of a taxicab (McCarthy 2013); while weak passwords are responsible for more than 80% of security breaches (Verizon 2013). Yet the nature of risks is changing fast. Cybercrime and cybercriminals are becoming more sophisticated; the world is becoming more dependent on digital technologies; communications and computing infrastructures are becoming more interconnected and interdependent. All this is exposing individuals, organisations, industries and entire countries to new risks and increased levels of risk.

The growing presence of personal devices in the workplace demands better protection against accidental data loss and deliberate exfiltration. Monitoring of social media and other online outlets is becoming important. Wikileaks may dominate the press, but it is not unusual for disgruntled employees to use less high-profile services such as Pastebin to post sensitive corporate material. The nature of external risks is also becoming more complex, because most attacks are now the work of sophisticated criminal groups.

Moving targets

Targets and victim profiles are changing. According to a threat analysis (Symantec 2013), the largest growth area for targeted attacks in 2012 was businesses with fewer than 250 employees: 31% of all attacks targeted them – a figure expected to rise.

The 2012–13 ACCA–IMA research shows that accountants are preparing for the worst, identifying 'better working knowledge of connectivity and IT security' as necessary for the future. Maintaining security is a never-ending process that will demand more and more resources. Research found that even businesses with sound security policies are not reviewing these often enough to ensure that they are effective against new threats (Loveland and Lobel 2012). So which new threats should business and the accountancy profession be most wary of over the next 5 to 10 years? Experts expect the criminal threat to grow, along with state-sponsored attacks and use of nanotechnology.

Tiny computer chips will eventually be embedded in objects from buildings to jewellery as 'smart dust' that can scavenge power from its surroundings as it collects and transmits data. One

Figure 4.1: Expectation of widespread adoption of cybersecurity by accountants and the finance function

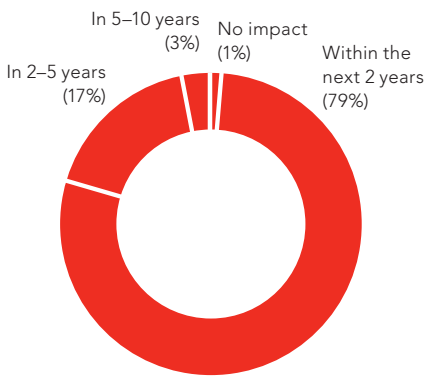
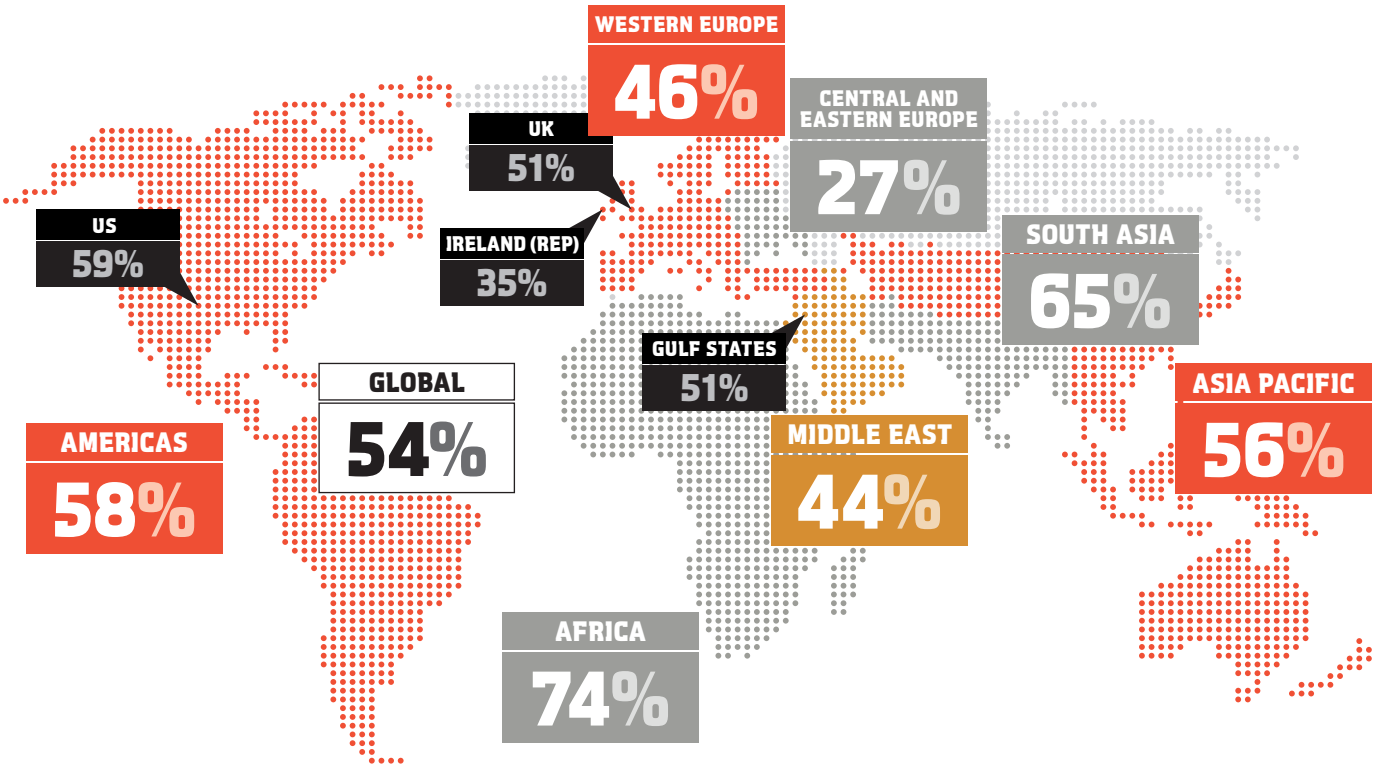


Table 4.2: World regions most at risk for cybercrime attacks

Region	% identified by all survey respondents
Africa	15%
Asia Pacific	16%
Central and eastern Europe	9%
Middle East	7%
Americas	36%
South Asia	5%
Western Europe	11%

Figure 4.2: Percentage of respondents concerned with risk associated with cybercrime

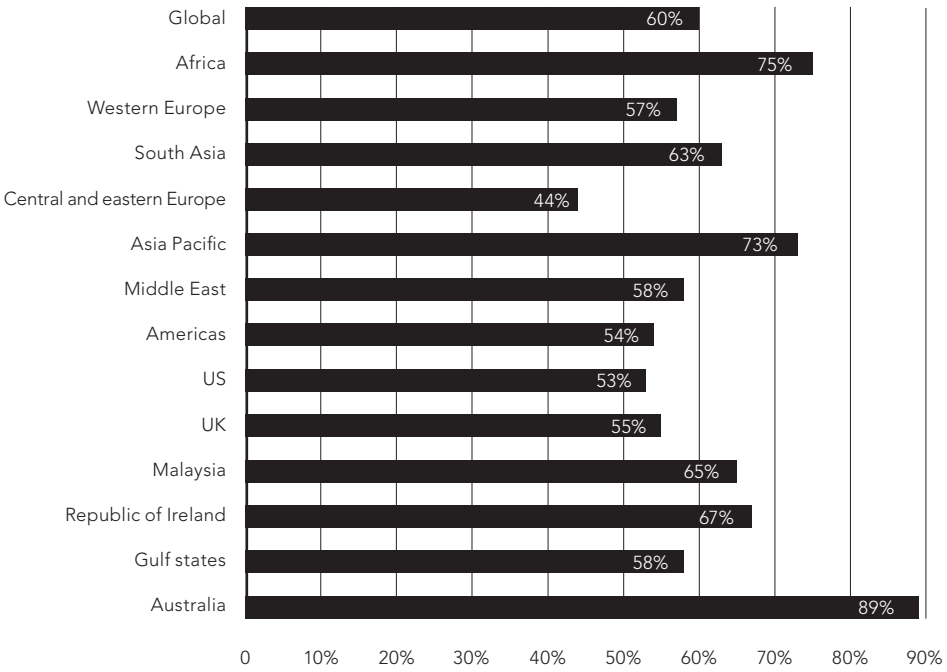


cubic millimetre-sized prototypes with sensors can transmit data via radio waves (Anderson 2013). Beyond 2025, biotech-engineered bacteria may also be able to contain electronic circuits. If these are made capable of reproduction they could become impossible to avoid. One hopes that the security industry will continue to meet each new threat with a solution: without detectors to test for and detect these new types of biological pathogen, concepts such as privacy and security could become a distant memory.

'Attacks are inevitable so organisations must plan for forensic investigations to ascertain what information was compromised and how to learn from security vulnerabilities.'

DR DARREN HAYES, CIS PROGRAM CHAIR, SEIDENBERG SCHOOL OF CSIS AT PACE UNIVERSITY

Figure 4.2: Percentage of respondents who identified better working knowledge of connectivity and IT security as a necessary skill for the next decade



‘Attackers are no longer predominantly individuals motivated by curiosity; they are well-funded criminal organisations that are motivated by profit.’

KAPIL RAINA, DIRECTOR PRODUCT MARKETING, ZSCALER, INC.

5. Educational

Digital technologies are reshaping education. The internet began this and as more digital technologies emerge and converge, the scale, scope and pace of change are all accelerating. Increasing capability brings access to innovations such as live and interactive online classrooms and their latest incarnation, massive open online learning courses, or MOOCs.

Knowledge is being democratised and professional educators are no longer its only originators and keepers. Information is now available to anyone with a device and internet connectivity. Access to and participation in education is expanding in various economies, from Europe and the US to Latin America and north Africa. Global mobility is growing for employees, employers, students and academics.

Educational techniques are changing, reflecting the new demands of computer-based learning and exploiting the new possibilities created by emerging technologies. Games and social tools are making learning more fun; simulations and augmented reality are making it more immersive; intelligent algorithms are being used to personalise education and to track the achievements of students and teachers efficiently.

Learners, employees, professionals, employers, teachers, education providers and entire countries are just starting to explore the possibilities, but as the role of digital technologies grows so does the potential for:

- increasing flexibility, access and choice in education
- customised, personalised and optimised learning
- attracting and retaining younger generations in the workforce
- increasing the global mobility of professional talent
- higher levels of student engagement
- new approaches to lifelong learning
- new educational business models
- a rich, diverse and inclusive virtual education ecosystem, and
- a global knowledge-based economy where creativity and innovation are the benchmarks of success.

CONCEPTS AND DEFINITIONS

It took centuries for the traditional education system to evolve from a single-room schoolhouse into today's networks of public and private schools, colleges, and universities, with their complex national and international infrastructures. Initially, the book was the primary learning tool and the classroom was the main site for learning. Now, with the spread of broadband access and the growing ubiquity of computing (particularly use of the internet and mobile devices), education is being reshaped.

Since the 1990s e-learning has become integral to distance learning and to education in schools, universities and business. Audio, animation, text and streaming video provide support inside and outside classrooms, using fixed and mobile devices 'connected' to local networks and the internet. Emerging digital technologies are bringing more enhancements. These range from smart self-learning software, to classroom systems that combine 3D virtual reality tools with existing tools.

Hybrid learning

Educational programmes are increasingly 'hybrid' and provide a blended learning experience by using various types of media and instruction. This mixed-mode approach combines traditional (and innovative) face-to-face classroom methods with computer-based and computer-mediated activities. At least some part of the content and instruction is usually provided online at a place, time, and pace, and using devices that are all – to some extent – within the control of the students, who can now use an array of technology-based tools and services to improve the way they study.

Interactive online courses, Web-based classes, podcasts and video tutorials (vodcasts) can be accessed via a growing range of fixed and mobile devices (from desktop machines to smartphones and tablets) and used to acquire, develop and apply varied knowledge and skills (from learning material for exams, to soft skills for the workplace). As well as providing benefits such as greater convenience and flexibility, some of these technologies are leading to more innovative approaches to teaching, such as the 'flipped classroom' model.

This model involves using teacher-created videos; educators can deliver instruction to students at home (or other non-classroom locations) and move homework into the classroom. This can enable teachers and tutors to spend more one-to-one time with their students, face to face in the classroom, and give students the opportunity to ask questions, solve problems and do practical work with guidance from both educators and their peers, which makes learning less memory-based to more applied and collaborative.

Scaling up

Digital technology is underpinning an even more radical development: MOOCs, which offer access to interactive online courses on a vast scale. Enrolment is often open to anybody, regardless of their level of education and many (though not all) MOOCs and learning materials are free. If a textbook is required, a free read-only version of the text is provided and when courses require the use of special software this is either freely available online or accessed online through MOOC providers' portals.

The high-profile MOOC providers such as EdX (not-for-profit) and Coursera and Udacity (for-profit) all operate in partnership with leading universities – though not all MOOCs derive from traditional courses. MOOCs are evolving fast. Many of the earliest were in English, but students are increasingly global and so are course languages and the educational establishments involved. The range of MOOC providers and courses is also growing – inside and outside the formal education sector, as is the number of MOOCs that lead to certification.

ADOPTION

Accountancy training has not been slow to exploit emerging technologies and their potential to enrich and improve learning. There are several global Web-based classes where students can interact in a virtual classroom, in real time and with a live tutor.

The software provider SAP (known among accountants for its enterprise resource planning systems) is cooperating with the Hasso Plattner Institute to provide MOOCs on topics that support people who work in the SAP ecosystem. Rumours suggest the Chinese government is planning to develop its own MOOC platform.

Engaging employees

Employers such the insurer Jardine Lloyd Thompson (JLT) are using MOOCs as an alternative to classroom-based solutions and off-the-shelf e-learning tools. At its office in Mumbai, India, JLT is using structured MOOCs from Coursera, EdX and Udacity for courses such as Finance for Non-finance Managers and Introduction to Financial Accounting.

Educators are also exploring the potential of other digital technologies. Social networks are supporting discussion inside and outside the classroom. Epistemic games enable players to develop new ways of thinking about problems and justifying solutions by encouraging them to think more like urban planners, engineers and accountants, applying high standards and professional values.

Learning from technology

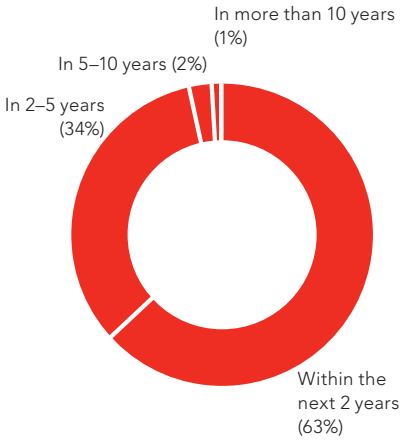
Augmented reality apps for phones and tablets are being used to teach a broad range of skills: from anthropological research processes to welding. In some Singapore schools, self-learning Web-based chat bots are helping teenage science and English literature students to develop critical inquiry skills, while an intelligent algorithm is helping teachers to assess the individual needs of learners and to tailor education to meet these needs.

LOOKING FORWARD

The availability of information and knowledge, development of open educational resources, the globalisation and internationalisation of education, and the blurring of boundaries between teaching, learning and research, and between real and virtual learning environments will all have an impact. Values that characterise the Web, freedom, openness, transparency, participation, collaboration, meritocracy, and flexibility, are already challenging tradition-bound principles and practices in higher education; more change will follow.

Where MOOCs meet big data, for example, new insights will emerge into how people actually learn, which will turn education into a more data-driven science. The capacity to exploit new technology and its potential positive impact on education is, however, determined by many factors.

Figure 5.1: Expectation of widespread adoption in accountancy of educational technologies



Developing and developed markets are very different. This is partly because of national and regional variations in technology infrastructure and literacy levels, and partly because a lack of trained professionals limits trainers and students to the same teaching techniques that were in use 50 years ago.

Eastern promise

Although a unified global system is years away, it is becoming easier for learners and educators to use emerging technologies to improve education – though some economies are better prepared than others for emerging changes. Research indicates that standards of education in maths, reading and science are highest at schools in China and Shanghai, followed by Hong Kong, Finland, Singapore, South Korea and Japan (OECD 2013). As the role of technology grows and more technologies emerge and converge, these may be the countries that are best positioned to exploit them.

So where will technology have taken professional education 5 to 10 years from now? Of the ACCA–IMA survey respondents, 63% expect a significant impact by 2015. Many in the profession and the professional education sector expect emerging technologies to be assimilated in the future in the same way as they were in the past. The pocket calculator was once the cutting edge of technology. Today it rarely features in discussions about technology; tomorrow many more technologies will have moved from novel to mainstream in a similar manner.

New radicals

Today MOOCs are radical. In the longer term, they will seem mundane by comparison with cutting edge technologies that promise new possibilities in learning and education. Clinical psychology research has demonstrated that applying a tiny current across regions of the brain can stimulate mental capacities and improve learning outcomes in a process called trans-cranial direct current stimulation (University of Oxford 2012). Experiments have shown for the first time that memories are stored in specific brain cells. Triggering a small cluster of neurons forces a subject to recall a specific memory; removing these neurons means the loss of it (MIT 2012).

In 20 years, accountants may not need to spend three or four years training. Who knows where this will go. Is it too radical to suggest becoming an accountant (or any other type of professional) could mean uploading data to a brain chip that contains all the required technical expertise and using this in combination with artificial intelligence to make professional judgements. So the accountant of the future might be an 'augmented' person, or exist only virtually as a cloud-based software agent, or be the sort of walking, talking android that once existed only in the realms of science fiction.

'New educational technologies will be adopted at different rates in different sectors and parts of the world, because of the variations in infrastructure and literacy levels'

MARIE MCCREA, PARTNER, CIL

'Professional education will need to evolve fast to stay ahead of technological advances and provide students with the right knowledge.'

PROFESSOR DÉSIRÉE VAN GORP, ASSOCIATE DEAN OF DEGREE PROGRAMS, NYENRODE BUSINESS UNIVERSITEIT

6. Cloud

The cloud began as a metaphor for the internet. As this evolved from a network that connects millions of computers into a network of interactive computing platforms, the metaphor evolved too. Now clouds are transforming the way individuals and organisations communicate, collaborate, share and store information and the ways that they procure and provide information technology resources and services in their personal and professional lives.

Organisations of all kinds now supply and use a growing range of cloud-based IT resources 'as a service' rather than 'as a product'. Physically remote software applications, computing power and data storage can be accessed online from fixed and mobile devices, providing benefits that can (but do not automatically) include:

- 24/7 access
- ability to scale up and down to meet demand
- reduced up-front costs
- pay-as-you-go charges based on consumption
- lower management overheads
- reduced maintenance costs
- rapid implementation times
- easier data-sharing and collaboration.

IT resources have moved from the hands of the few, to the fingertips of the many. Over the next decade and beyond cloud computing will combine with other technological trends to reshape the increasingly online world of business.

CONCEPTS AND DEFINITIONS

The cloud means different things to different people because it is constantly changing and expanding. At the simplest level, 'cloud computing' is about using internet-based technologies to provide or gain access to IT resources that are held on physically remote computers.

Public clouds

The 'public cloud' is where IT resources such as software, computing power, data storage and related services live on the computers of third parties. Resources are managed and maintained to be made available 'on demand' to any individual or organisation. Some are made available free to the end user; some must be paid for.

This way of accessing IT resources can be simpler than acquiring and then managing and maintaining one's hardware and software (and licences), but it is not without complexity. Costs based on consumption can be difficult to predict, analyse and control. Data duplication, sovereignty and security can create major challenges.

Private clouds

Aspects of the public cloud deployment model appealed so much to some organisations that they decided to create their own 'private clouds'. These also use the internet to provide online access to remote IT resources, but their structure, ownership of software licences and hardware, and their service contracts are different and can vary widely.

A private cloud can be operated by a third-party provider (such as a managed services company) or by a business (in a data centre or shared services centre). Software is licensed to or owned by the business, but it can run this on its own computers or those of the service provider and the latter may be used by a single tenant or shared with other customers of the service provider (a 'multi-tenant' system).

Hybrid clouds

Public clouds give flexibility and scaleability, but private clouds also allow more control over technology and service agreements. Many organisations take a 'hybrid' approach, supplementing private clouds with public cloud services to optimise resource use and to meet spikes in demand efficiently and economically.

Types of cloud computing

At present, on-demand pay-as-you-go public cloud services fall into three broad categories:

- Software as a Service (SaaS)
- Infrastructure as a Service (IaaS), and
- Platform as a Service (PaaS).

SaaS

Any user of a free email service (such as Yahoo!) and social networking tools (such as Facebook) has used SaaS, and stored some of their data in a 'public cloud'.

IaaS

Users access remote computers and use them for storing data and performing computer-based processes. Amazon Web Services started this in 2004 and has since been joined by other providers.

PaaS

Online access to the software and hardware needed to design, develop, test and deploy applications, plus applications-hosting and various associated services. Force.com (from salesforce.com) and Google App Engine are examples.

Service providers are increasingly blurring the line between public clouds and private clouds. As cloud-based services evolve the barriers between different types of cloud and cloud computing categories will probably become progressively less significant.

ADOPTION

Levels of adoption vary across different geographies, industries, sizes and types of organisation – and profession. Accountants are already exploiting different types of cloud and cloud-based services. Systems for bookkeeping and accounting were among the first software applications available as online services. There is now a growing range of business software and productivity enhancing tools – from budgeting to payroll. Yet many favour private cloud deployments.

A survey of IT professionals (IDG Enterprise 2013) found that private cloud deployments outnumbered public ones. The average percentage of companies' IT environments in private clouds is also higher. Concerns that are limiting the growth of public cloud resources include data security, privacy and sovereignty, and the transmission and storage of data outside national boundaries. This reflects natural concerns driven by regulations (such as the UK Data Protection Act and the US Patriot Act).

There are other areas where public cloud services and their consumption-based, pay-as-you-go approach can create challenges for accountants and their organisations. For example, lack of integration between systems and their associated data can be a barrier to efficiency. Other concerns range from the expectation that IT systems will all be available online (often at all times) to the widespread misconception that pay-as-you-go is always the most cost effective way to resource IT.

It can be difficult to make like-for-like cost comparisons between public and private cloud services, between these and more traditional IT service mechanisms, and between alternative or competing cloud services. Charges in the infrastructure market are based on things that are not usually included in traditional IT costs. These range from how long a central processing unit (CPU) is used, through different hardware combinations,[8] to whether the user has 'reserved' capacity. A vast matrix of options and pricing schedules and lack of detail in billing data make it difficult to estimate future use and costs or to analyse past use.

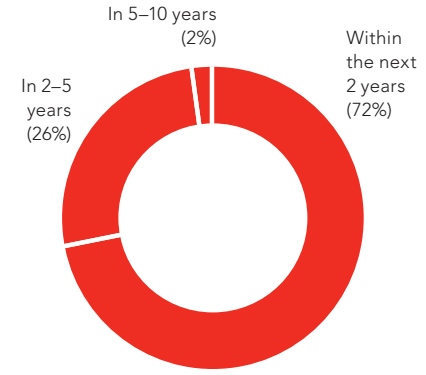
LOOKING FORWARD

Despite these and other challenges the profession is well aware that cloud could be the way forward. Although most organisations will continue to access IT resources using a mixture of traditional and cloud-based systems well into the foreseeable future, the 2012–13 ACCA–IMA research found unanimous agreement on the significance that cloud computing will have as it becomes increasingly adopted by accountants and the finance function; some 72% expect this to happen during 2014–15. Accountants are not alone in this. Analysts have described the period between now and 2016 as 'a new stage of growth and maturity' in the public cloud.

Table 6.1: Impact of cloud-based systems by respondent type

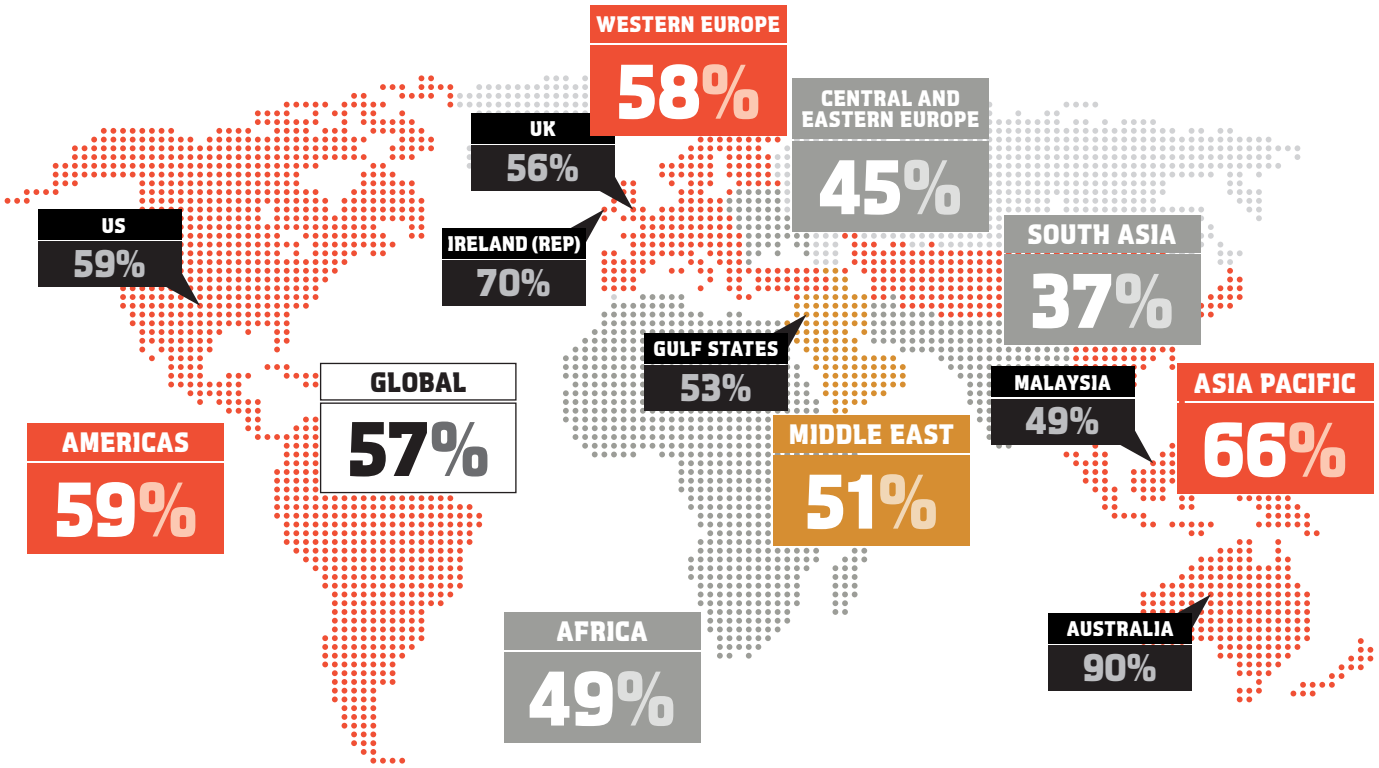
ROLE	**Accountants and sole practitioners**	**Managers and senior managers**	**Directors, executives and partners**	**CFOs**
	60%	57%	61%	52%
SECTOR	**Accountancy practice**		**Corporate sector**	
	62%		56%	
ENTERPRISE SIZE	**SME (<250 employees)**		**Large (250+ employees)**	
	60%		55%	

Figure 6.1: Expectation of widespread adoption of cloud-based systems



8. Called 'instance types'.

Figure 6.2: Impact of cloud-based systems on business in the years ahead



As spending on public cloud services approaches $100bn in 2016 (International Data Corporation 2012), emerging markets are expected to become centres of cloud innovation and growth. Expectations of cloud services will change as cloud investment priorities move from simply improving IT operations to driving business innovation: a shift that will not be restricted to large organisations. As more IT resources and services become available in public clouds, increased demand for public cloud services from small and medium-sized businesses will create new possibilities and challenges for users and providers of these services, and for traditional IT vendors.

Farewell to desktop software

The amount of desktop software is going to reduce until there is very little left. If technological problems and security issues are resolved and communication lines are reliable, then most applications will be available in the cloud by 2020.

Analysts expect that before 2020 IaaS will emerge as the largest segment in the public cloud, as uptake of Business Process as a Service (BPaaS) and cloud Business Process Management (cloud BPM) grows. Spending for BPaaS and cloud BPM will grow from $1.09bn in 2013 to $7.12bn by 2018 (Research and Markets 2013), as third-party providers in the cloud ecosystem take over more business processes, including advertising and marketing, human resources, operations and sales, and finance and accounting.

Accounting for change

The impact this could have on the profession is potentially vast, particularly when considered in the same context as the evolution of expert systems and robotics (see pages 25–26), and the increased likelihood that even complex multi-faceted processes will be automated – particularly where the work done is driven by rules. When ACCA and IMA members were asked how they expect technology to affect their profession over the next decade, one responded: 'I feel accountants will no longer be required in the next 10 years. I feel accountants will be replaced by techaccountants'.

Although a decade from now the cloud will be as ubiquitous as its name implies, it will take longer for the 'as a service' delivery model to displace traditional on-premises systems or traditional accountants. As the cloud converges with technologies such as mobile and big data and they become more mutually reinforcing, it will bring unanticipated changes. Businesses will need to work with these technologies as they emerge: those that fail to do so risk falling behind and becoming irrelevant.

'Progressive accountants are helping to drive cloud adoption.'

DANIEL WALLS, DIRECTOR AND CO-FOUNDER, FATHOM APPLICATIONS

'It seems inevitable that virtually all software and data will eventually be 'in the cloud', mirroring the move from paper to electronic data and working over the past few years.'

ANDREW FLANAGAN, MANAGING DIRECTOR, DIGITA, THOMSON REUTERS

7. Payment systems

Money has existed as a unit of measurement, a medium of account and exchange, a store for value, and a standard for deferred payment, since the Mesopotamians replaced bartering with clay tokens more than 5,000 years ago. Since then, as cash has evolved, it has gradually increased the speed of trade, and money can now move between accounts electronically in the blink of an eye. As the internet increases its role as the centre and the platform for commerce and financial credit facilities and the infrastructure for a resurgence in bartering, payment systems across the world are being reshaped.

Traditional notions and concepts of money and currency are fading. The use of cash is diminishing, cheques are being phased out and use of debit cards, pre-paid cards and the myriad of alternative electronic payment platforms is increasing. Banks increasingly provide their services online; statutory payments are increasingly made electronically; payment options using mobile phones are proliferating; there are many ways to make and accept payments for goods and services and to access start-up and working capital finance and trade finance instruments.

Developments in electronic payment technologies, e-commerce and e-finance are reshaping financial activity by:

- creating safer, smarter ways to receive and make payments
- automating complex transactions
- improving cash flow management
- broadening access to financial resources
- expanding the market for banking and other financial services
- increasing consumption in emerging markets
- underpinning the development of new financial products and services
- supporting the development and use of alternative currencies, payment platforms, and ways of defining and exchanging value, and
- disrupting traditional business models.

CONCEPTS AND DEFINITIONS

At the simplest level a 'payment' is the transfer of value from one entity to another. Most such exchanges take place using money, in the form of sovereign currencies. Although many transactions still involve the exchange of cash, payment increasingly takes place electronically.

The term 'electronic payment' is very broad, as it describes any type of non-cash payment that is made using electronic devices. An electronic payment is no longer an exchange that results in just the transfer of monies. It is an electronic exchange that results in the transfer of 'value'. With a resurgence in bartering, these transfers increasingly take the form of goods, services, and various types of alternative currency.

Virtual currency

There are virtual 'digital currencies' such as Bitcoin, Linden Dollars and Ripple in today's marketplace. A virtual currency has a value in real-world currency and/or can be used to buy goods and services. The Linden Dollar is the unit of trade in the virtual world Second Life, where players can use it to buy and sell goods. In addition, Linden Dollars are a centralised virtual currency with a central repository, and it can be converted to and from real-world currencies.

Bitcoin is a 'maths-based' crypto currency that is created (very slowly) using a cryptographic protocol. It is a decentralised currency, described by its mysterious inventor (Satoshi Nakamoto) as a 'peer-to-peer electronic cash system'. The creation of Bitcoins is carefully controlled and even its most ardent advocates acknowledge some of its limitations, many of which might be addressed by one of its derivatives, Ripple, which is both a crypto currency and a payment system.

Unlike Bitcoin, Ripple transfers easily into and out of other currencies, from the Icelandic krona to the Japenese yen. Ripple does not have to be mined.[9] OpenCoin, the company managing Ripple, maintains a single global ledger and checking the legitimacy of a transaction takes seconds.

9. Mining virtual currencies: a computationally intensive process that involves sifting through large amounts of data to find numerical patterns that confirm a transaction is legitimate.

Payment mechanisms

Although most electronic payments are still made using traditional currencies, and traditional payment systems, the array of electronic payment mechanisms and service providers is expanding. It includes PayPal, the e-commerce specialist (and currently the largest online payment provider), but there are many other competing, overlapping and incompatible internet, mobile and internet/mobile payment platforms. New ways of making and taking electronic payments are emerging almost daily.

Digital wallet platforms such as Google Wallet and Square are proliferating, as are mobile wallet platforms such as Osaifu-Keitai, which is popular in Japan, and Square Wallet (which is a different app than Square), and Apple Passbook, the 'not quite mobile wallet'. There are also wallets such as the Russian Qiwi кошелек, which can be used via interfaces on a number of devices, and 'in-stream' social media commerce platforms such as Chirpify, which enable commerce and payments via the news feed on Facebook.

Confusion costs

Some wallets use near field communication (NFC) technology for proximity payments. NFC allows the transfer of small amounts of data between two devices when they are a few centimetres from each other, and some systems require dedicated card readers. NFC systems use a variety of devices and procedures at the point of sale. This can be confusing for customers and costly for retailers, phone makers, carriers, and others trying to develop products and services.

It is worth noting that most of these new and emerging payment mechanisms and transactions are still underpinned by the payment networks and clearing systems traditionally used by banks. Digital wallet transactions must be financed with something, and most of the time this is a traditional bank account, credit card or prepayment card. A cashless society with only digital currencies is still some years away.

ADOPTION

E-commerce features are increasingly being built into software and e-banking is following: even entry-level accounting systems now automate links with bank accounts. Consumers and businesses are exploiting prepaid smart cards and mobile phones as 'electronic wallets' using services such as Barclays (Pingit) and the start-up Square. Some organisations are hedging their bets. Mobile payment options available to Starbucks customers vary between branches and include the retailer's own app, Apple's Passbook and the mobile app Square payment services.

There are many developing economies where penetration is high for very basic mobile phones. So financial institutions and mobile phone service provides are working with networks of agents to deliver mobile banking services to rural populations that lack a bank network.

New money

Peer-to-peer (P2P) lending sites such as Crowdfunder, Kickstarter and Zopa are also broadening both access to finance and investment opportunities. These can lead to financial rewards and more esoteric or intangible non-financial rewards, such as tickets to a film premiere, having a supporting character in a novel named after you, or the satisfaction of helping someone realise their dream. The 'value' exchanged in electronic payments is taking a similar route. Easy access to internet-based trading mechanisms has increased transactions among bartering communities, using 'complementary' regional and community currencies and virtual currencies.

In France, Toulouse has the alternative currency SOL Violette, and Pézenas has introduced L'Occitan, while the Greek city of Volos has the TEM (topiki enallakiti monada), which is used by local individuals and businesses to buy and sell goods and services: members' accounts are opened and administered online and value is exchanged using paper vouchers and SMS text. The international barter website *Ormita.com* trades using traditional currencies and the WOCU world currency unit (a composite currency based on the top 20 world economies). The Irish barter website *Tradefirst.ie* has the Trade Euro (TR€), which is tied in value to the real euro.

LOOKING FORWARD

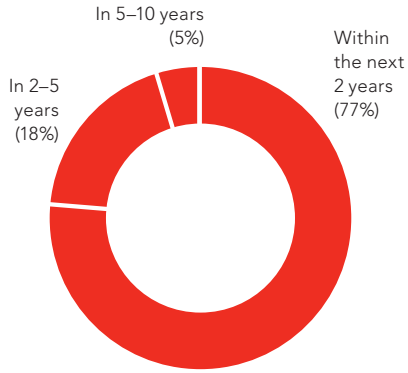
Over the next decade, these and other developments in payment systems will bring even more change, as the impact of technological advances dramatically transforms the traditional landscape of financial transactions. These changes will be driven not purely by advances in technology but also by globalisation as the world is increasingly connected through migration and trade. Even traditional payment mechanisms will not be immune.

A Single Euro Payments Area (SEPA) is being introduced that aims to simplify and harmonise euro bank transfers across the 27 European Union member states, plus Iceland, Liechtenstein, Monaco, Norway and Switzerland. Numerous national payment schemes are being replaced by a single unified scheme that uses the pan-European payment instruments:

- SEPA credit transfer – SCT – used by debtors to initiate payments
- SEPA direct debits – SDD – initiated by creditors to collect outstanding receivables.

It is not a minor development. It will affect lots of back and front office systems, from accounting and finance, to point-of-sale, and it will have an impact on all companies doing business with partners in the eurozone and sending or collecting payments in euros. But harmonised payments could also enable businesses to handle all European-based transactions from a single bank account. With business becoming more global, a decade from now the world could be planning for harmonised global payment instruments.

Figure 7.1: Expectation of widespread adoption of alternative payment systems



Digital disruption

Meanwhile, other developments in online and mobile payment mechanisms are doing more to disrupt than to harmonise. The world is on the brink of a fundamental shift in how goods and services are bought and sold online and offline, driven by the consumer transition to mobile devices and digital wallets and there is no shortage of companies eager to provide mobile offerings to retailers, many of them are taking a measured view of the short-term benefits (Forrester Research 2012b).

Many challenges must be considered when a company decides to invest in mobile technology. These range from the multiplicity of mobile payment services and readers that a business can potentially use for transactions, to the software tools that it may need to get transaction data into systems such as accounting or inventory management. The finance profession has an invaluable role to play as both advisers and adopters. In the 2012–13 ACCA–IMA survey, 77% of respondents indicated that they expect to adopt new payment platforms during the next two years.

Challenges and convenience

Lack of network interoperability among merchants, card companies, mobile networks, manufacturers and financial institutions is challenging all those involved. Policymakers and legislators are now becoming aware of the risks. Canada, for example, has expanded its code of conduct for the credit and debit card industry to ensure that transparency and fairness are upheld for payments that access debit or credit accounts through a mobile device. The Canadian minister of state for finance made the point that while the country supports new and convenient payment options, it does not want small businesses and consumers to be punished with hidden fees or undisclosed conditions (Government of Canada 2012).

Governments have been slow to regulate in many areas, such as virtual digital currency, but this is changing. The Reserve Bank of India has announced that it is watching the spread of virtual currency but does not plan to regulate, yet – a position shared by the central banks of many other jurisdictions. In the US, the Financial Crimes Enforcement Network (FinCEN) has issued guidance to clarify the applicability of the US Bank Secrecy Act to persons creating, obtaining, distributing, exchanging, accepting, or transmitting virtual currencies (US Department of the Treasury 2013). Perceptions of money and expectations of its uses will continue to change.

Farewell to cash

In light of the expanding array of mobile payment options, analysts predict increased dependence on a new type of mobile device app (Gartner 2013b), the digital payment adviser (DPA), which recommends the most appropriate payment product for a purchase. As DPAs will encourage the purchase of day-to-day products and services using alternative currencies, such as loyalty points and social currencies, there may be a shift in people's attitudes towards cash and payment cards. If so, DPAs could support a wider shift in power from banks and payment card issuers to their customers.

This seems likely to become more apparent over the next 5 to 10 years as future purchasing decisions become cluttered by more payment mechanisms and platforms, and wider access to alternative currencies. In the longer term there may be fewer currencies, though not necessarily because of the spread of alternative and virtual currencies. Some futurists predict a return to a few strong currencies or even one single global currency, used as gold and silver were in the past.

'The capabilities and ubiquity of modern mobile devices, coupled with a renewed impetus behind digital wallets is likely to drive a revolution in how we buy things both on and offline.'

DAVID SMART, CROSS SELL MANAGER, SAGE PAY

'We might return to a global standard of just two or three real currencies and maybe even a single global currency in the coming decades.'

JOSÉ CODEIRO, DIRECTOR, THE MILLENNIUM PROJECT

8. Virtual and augmented reality

The 1935 short story *Pygmalion's Spectacles* (Weinbaum 1949) does not feature the phrase 'virtual reality' (VR) but its author, Stanley G. Weinbaum, laid the foundations of VR with his fictional 'movie that gives one sight and sound', adds 'taste, smell, even touch', and puts the viewer in the story where 'you speak to the shadows, and the shadows reply, and instead of being on a screen, the story is all about you, and you are in it'. Since then, many ideas, expectations and manifestations of VR have been shaped by its origins in the world of science fiction: from William Gibson's *Neuromancer* (which defined the concept of cyberspace), to popular films such as the Wachowski brothers' *Matrix*.

Fictional virtual worlds set the bar high by providing complete sensory and emotional immersion that is indistinguishable from real life (RL). In some ways RL manifestations are more mundane than this; in other ways they are more exciting. Computer modelling and simulation are already being used to create artificial 'virtual environments' (VE), and to simulate a physical presence that can interact in these and in the real world. Mixed 'augmented reality' systems are enhancing human perceptions of reality by overlaying it with sensory input such as sound, graphics, photos, video and other types of data.

By exploring and exploiting the latest developments in this area of technology organisations and individuals are:

- creating alternative approaches to business activities
- using virtual environments to visualise complex business processes
- improving interaction between people and computers
- developing new services in existing industries
- spawning new products and services
- improving sensory input such as eyesight
- making human interaction with VEs and augmented reality (AR) more immersive
- enhancing education and training, and
- using VEs and AR to become more efficient and cut costs.

CONCEPTS AND DEFINITIONS

At a fundamental level any definition of virtual reality is itself based, to some extent, on the definitions of 'virtual' and 'reality' – though these are not as fixed as they once were. The dictionary definition of virtual as 'almost or nearly as described' has been expanded to include 'not physically existing but made by software', and reality is not what it used to be either. Philosophical questions on the nature of 'reality' can just as easily confuse as enlighten. Even dictionary definitions of 'reality' such as 'the state of things as they actually exist, and not as they appear or as we could imagine them to be' allow plenty of room for interpretation.

Debating terms of reference

Some opt for 'virtual reality'; some prefer 'virtual environments'. Some opt for 'augmented reality'; some prefer 'mixed reality'. Definitions also vary for close companions such as simulated reality, computer-mediated reality and 'telepresence'. As a growing range of VR and AR systems, tools and applications head into the mainstream, the 'virtuality continuum' that extends from the completely real to the completely virtual is becoming more crowded, and it is becoming progressively more difficult to be definitive about overarching and overlapping terms of reference such as VR and AR (though some now refer to the latter as '4D').

The term 'VR' can be used to describe an artificial three-dimensional or other sensory environment, created using computer modelling and simulation, that a person is able to explore and interact with, using various fixed and mobile input and output devices. VR can also encompass telepresence, where technology enables people to interact with artificial graphical environments and real environments, and to control devices and machines such as robots (see Chapter 3).

Some consider AR to be a type of VR; others do not; but most agree that AR uses devices such as smartphones (and their infrastructure and built-in sensors), and wearable technologies (such as Google Glass) to overlay the 'real' with the 'virtual' – with the help of specialist software from AR 'platform' developers such as Daqri and Vuforia.

Suspending disbelief

In some places on the virtuality continuum, human experiences are primarily visual and aural (and sometimes emotional) and use commonplace input devices such as keyboards, mice, headphones, touch screens and games controllers. At some points on the continuum people can observe virtual and mixed reality environments by looking in on them from the outside 'exocentrically'; in

others the visitor is more 'egocentrically' immersed – though the definition of 'immersion' is wide and varied. A totally immersive experience would (as in science fiction) require all five senses to perceive the virtual as real. Immersion can be cerebral and cognitive, it can be emotional, physical, spatial and tactile; even a convincing VR narrative can lead to a partial suspension of disbelief.

Wired gloves, head-mounted displays, exoskeletons and other devices that enable interaction in artificial and mixed environments make the experience more immersive, by allowing people to interact with virtual and remote objects. This interaction gets closer to the sensation of touch with the help of 'haptics', these are devices that can enable a bidirectional human–machine interface.[10]

ADOPTION

For around a decade the inflated expectations created by science fiction and the fumbling impracticalities (and disorienting latency) of virtual reality headsets have combined to make many experiences of virtual environments and tools disappointing. Nonetheless, over the past few years, there have been some significant developments. As the VR experience provided by some headsets has become more convincing and computer-augmented virtual environments (CAVEs) have become easier to create and more immersive, VR has gone from experimental to essential across a range of industries, including oil and gas exploration, utilities, medicine and vehicle manufacture.

Car manufacturer Ford is using motion-capture from the Nintendo Wii plus various other technologies to create a CAVE, where projections onto multiple screens form an immersive 3-D environment. At Ford's research and development centre in Germany this is being used to design and test vehicles digitally (Ford 2012). The CAVE makes it much easier and quicker to analyse designs, so creating and assessing prototypes and testing and refining details in new car designs takes a fraction of the time. This makes manufacturing more efficient and saves physical resources and cost.

It is not unusual for technologies originating in the gaming industry to find their way into the industrial applications now residing somewhere on the virtuality continuum. Culture and entertainment have been enthusiastic adopters of virtual technologies and this seems set to continue. Innovations include a Vatican Museum 3D tour of a replica of a 2,600 year old Etruscan tomb (it lets visitors explore artefacts that would otherwise be too fragile) and a touring augmented and virtual reality kit that Marvel used to promote the film *Iron Man 3*, by letting fans don the character's armour and then become the Iron Man version of the character Tony Stark.

Augmenting reality

By comparison with the totally virtual, mixed AR environments require significantly fewer resources. The ascendancy of the smartphone and tablets has coincided with an increase in the popularity of AR, and spawned a host of '4D' apps that can exploit the camera, compass and global positioning system (GPS) built into many mobile devices. Layar, for example, provides tools that can be used to create geo-location AR apps that overlay buildings and other locations with data and vision-based AR. It makes print interactive by displaying digital content in context with objects such as magazines and product packaging. Similarly Daqri has put together more than 1,000 AR experiences for businesses as diverse as Cadillac and Sony Computer Entertainment.

LOOKING FORWARD

If Moore's Law holds true, for example that the density of the transistors on integrated circuits doubles every 18 months, the resources will eventually be available to create totally immersive virtual environments that do not just pass for reality but surpass it. How long this will take remains to be seen.

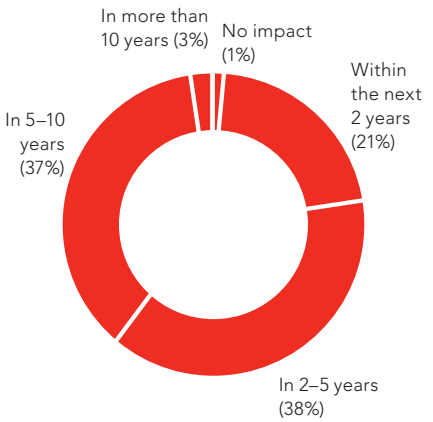
Research predicts that by 2020 it will be possible to use simulated virtual environments to actively engage with data (Gartner 2010). So rather than drilling into the cells in a spreadsheet (which will apparently still be in use), smart software agents will assemble simulated environments based on observations of how people work with content, and users will then be able to use these to interact with and manipulate virtual representations of the underlying data.

10. Haptic devices include sensors that can read the motion and force being input by the person using them. They then react with a corresponding motion and force output, which reflects the resistance exerted by a remote object, or simulates this for a virtual one.

Early adopters

A future in which accountants become the profession's version of Robert Downey Jr in *Iron Man* may be hard to imagine. Accepting the notion of overlays on smaller screens providing desktop and mobile access to mixed 'augmented reality' environments is not: 75% of ACCA and IMA members said that they expect to adopt these technologies within the next 2–10 years. Many, however, are already using smartphones and tablets to access consumer AR apps without realising it, such as: iON Road Augmented Driving (to improve road safety), Lookator (to find out the location and strength of nearby wifi hot spots), and one of the oldest AR apps, Google Sky Map (which explains what is twinkling in the night sky).

Figure 8.1: Expectations of widespread adoptions of virtual and augmented reality technologies



AR is already the medium through which most people access the 'virtuality continuum', and this will continue. Experts expect augmented reality to become commonplace over the next three to five years. The cameras in smartphones and other mobile devices will need to become more sensitive and their compasses will need recalibrating, but improvements to hand-held devices, faster wireless networks, and wearable technology such as Google Glass will increase adoption. According to research, Google Glass, and Google's efforts to promote applications development for it, could push 'smart glass' shipments up from 50,000 in 2012 to 6.6 million units during 2016 (IHS Research 2013).

Through the looking glass

Most smart glass shipments are to application developers, but if an ecosystem grows up around it, this should lead to apps with mass-market appeal. Perhaps accountants can look forward to an app that enables them to see if comments have been posted against a number or text in a spreadsheet or report and then 'select' this just by moving their eyes. This may not materialise in the next five years because of the challenges of providing lens display technology with constant wireless connectivity for long periods of time (ABI Research 2013c).

Both reality and perceptions of it are changing fast. Disney has demonstrated an interface that sends a tiny electrical signal across the body to alter people's perceptions of anything touched and simulate the sensation of texture. The Ikei Laboratory at Tokyo Metropolitan University is developing a 'virtual body' that will make VR more immersive by engaging all five senses (Heidelberg 2011). Microsoft and the University of Washington are testing AR contact lenses that receive radio signals and transmit them via optical nerves directly to the brain (Quantglass 2013). Scientists are only just starting to explore the enormous potential of nanotechnology. As many small changes aggregate, progress along the virtuality continuum will be limited only by imagination.

'Within five years we will use augmented reality as a normal part of our day-to-day lives, in business as well as pleasure.'

MATS JOHANSSON, CO-FOUNDER, PRESIDENT AND CEO, EON REALITY

'Augmented reality glasses, smart mobile devices and miniature power sources will have a much bigger role to play in the coming years.'

VANDANA SAXENA PORIA OBE, CEO, GET THROUGH GUIDES

9. Digital service delivery

Organisations in all sectors, from governments to supermarkets, and banks to utilities, are becoming increasingly aware of the capacity of digital technologies to increase efficiency, customer satisfaction and market success. As digital technologies such as big data analytics, cloud, embedded devices, mobile and social technologies become all-pervasive, they are reshaping services. The ways in which organisations exchange information, buy, sell and support products and services, and their interactions with customers, suppliers, investors and numerous other stakeholders are changing.

New companies may be fully digital from the start, but most organisations are at an intermediate stage, adopting tools such as self-service bots on retail websites, finding value in the analysis of large data sets, or using the eXtensible Business Reporting Language (XBRL) to file statutory returns electronically. By adopting digital technologies, those in business are engaging in diverse Web-based business processes, e-commerce, mobile commerce (m-commerce), and cloud-based software and services – often, more efficiently and cost-effectively than would otherwise be possible.

By exploiting emerging technologies organisations can:

- automate repetitive and time-consuming tasks
- automate and streamline complex business processes
- replace human interaction with machine-to-machine and person-to-machine interaction
- reshape business models to make the most of available resources
- exploit the benefits of global standardisation
- access and provide public services more easily and cheaply, and
- monetise underused assets.

CONCEPTS AND DEFINITIONS

There is room for debate about when the transition to digital services began. In fact the idea of computing as a utility and the first computer bureaux date back to the 1960s. They both helped to lay the foundations for the software application service providers (ASPs) that started to emerge before the turn of the century 'dot-com' boom and then evolved into today's rapidly increasing 'as a service' market for IT resources.

These are the technologies and trends that now underpin the development of so many digital services. The transition from a handful of pioneering ASPs to the present information and communications technologies was a complex process. It required:

- global agreements on communications protocols and the development of technical standards to support and simplify the automatic exchange of data between machines, networks and application programs
- the development of standardised systems for tagging text files and specifications for data formats and structures, and
- the support of affordable and widespread access to broadband.

All this enables the digital delivery of information and transactional services, from simple online forms to entire services. This can now be done across a variety of platforms and devices (from websites, through mobile apps to social media), to internal customers, external customers, or both. This digital service infrastructure has three layers.

1. Information – this includes structured, semi-structured and unstructured data (see Chapter 2) from databases, books, multimedia and online transactions.
2. Platforms – these range from application programming interfaces (APIs) and connectors through content management systems and social business platforms (see Chapter 10) to specialist (and sometimes sector-specific) service delivery platforms.
3. Delivery mechanisms – including websites, applications that can be viewed via browsers on fixed and mobile devices, social media and other 'presentation' systems.

Features and functionality

Key features such as interactive self-help and self-assessment tools are being built into a growing range of software and services. The latest generation of customer relation management tools, for example, provides online self-help solutions across multiple channels, including websites, social media, and Web chat, as well as integrating with virtual assistants, chat bots and virtual agents. Users of business intelligence (BI) systems no longer need the IT department to help them extract and manipulate data from multiple systems, to turn this into reports; they can do it themselves using visualisation tools such as dashboards.

Engagements between citizens and governments are also being transformed, as more interaction

becomes digital by default. Although the necessary infrastructures are largely being built by governments, access often requires investment by individuals and businesses (as software developers and users). For example, where XBRL has been adopted by regulators around the world, businesses have needed specialist software to create and file mandatory data and documents in the correct formats.

ADOPTION

Some businesses would not exist if they were not able to provide most or all of their services using digital technologies: they are essential to business-to-consumer (B2C) internet 'pure-plays' (companies that do business purely through the internet) such as Amazon and Netflix, business-to-business (B2B) operations such as Alibaba and NetLine, and supporting services such as the e-commerce business PayPal. Meanwhile, traditional businesses, public sector organisations, and those in the third sector must go through a period of adjustment.

Many organisations are moving to digital services via individual business processes and services. By moving customer enquiries, for example, these can be processed, recorded digitally 'end-to-end'; the needs of service users can be more precisely defined and fine-tuned; services can be accessed continuously from fixed and mobile access points; unnecessary cost and oversupply can be eliminated.

Banking, travel and retail are among the industries providing automated, improved and more personalised services to customers digitally and often more cost-effectively than conventional services.

Apps are being used to link multiple communication and service channels to mobile devices and to provide a more unified customer experience; 'geofencing' technology, which creates a virtual perimeter around a real geographical area, is being used to support existing location-based services and facilitate the development of new applications and services. Accountancy practices are offering self-service features such as secure online data vaults that clients can use to access statutory and management reports and other material the firm has worked on. Accountants are also consuming digital services, as individuals and as businesses, as all sorts of commercial organisations, governments and regulators streamline and automate their systems.

LOOKING FORWARD

Most established organisations are necessarily taking a piecemeal approach to digital services, but a few are taking a more holistic approach.

Among retailers, fashion brands Burberry and Nordstrom are becoming digital, by using technologies such as big data, cloud, social and mobile to reach out and change the way they engage with customers (across all their channels), as well as reshaping internal processes, operations and supply chains. The customer experience is evolving, as context grows in significance.

More sectors will need to exploit digital technologies to add value to their services and meet consumers' changing expectations. In India, for example, as technology gets cheaper and investment in 3G and 4G infrastructure increases, digital financial services are expected to grow from $8bn in 2012, to between $60bn–70bn by 2020 (McKinsey & Company 2012), if banks can catch up with their high-value consumers. Winners in this race will be those that develop more compelling and easy-to-use online and mobile applications, adjust their sales and service practices and incentives, and make digital a core priority, rather than just a marketing exercise.

Connected and consistent

All this requires interconnected services that are underpinned by an interconnected IT infrastructure. As decisions on system selection and purchase authorisations become more dispersed and disconnected (as is the way with cloud) their management becomes more challenging – and important. Some speculate that rather than one big service contract, there are likely to be lots of smaller ones with niche agencies and specialists. The ease with which cloud services can be up and running makes loss of control over data, brand, customers and costs a real risk, as parts of a company and even individuals go off and do their own thing.

Connected systems can provide a single view of the customer and a connected and consistent experience at every point of contact, as effectively and economically as possible. Nonetheless, it is equally vital to discover new and innovative uses of digital technologies. While organisations such as Amazon and eBay are exploiting digital technologies to mechanise same-day delivery using traditional fulfilment, US retailer Walmart is considering offering some of its millions of store customers a discount on their shopping bill for delivering packages, on their route home, to online buyers.

Figure 9.1: Impact of digital service delivery on business in the years ahead

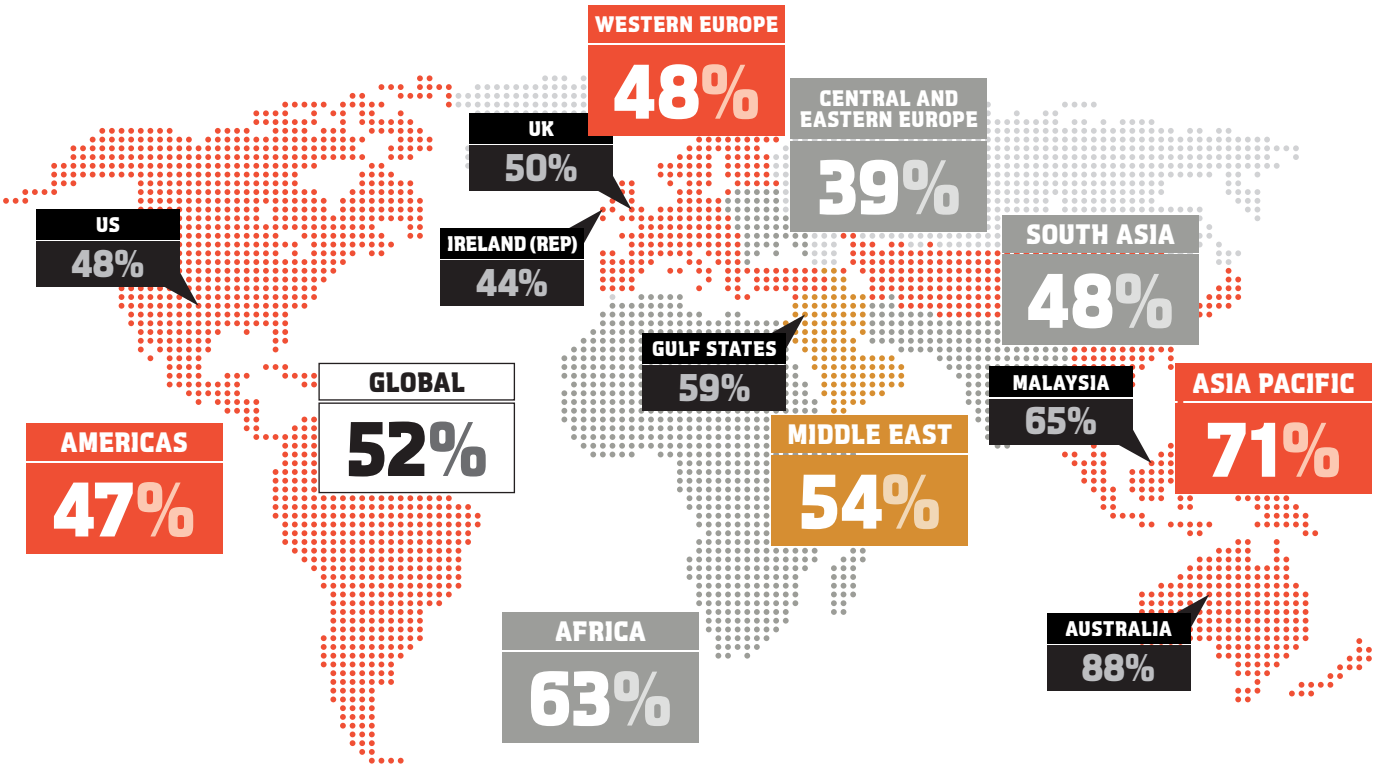
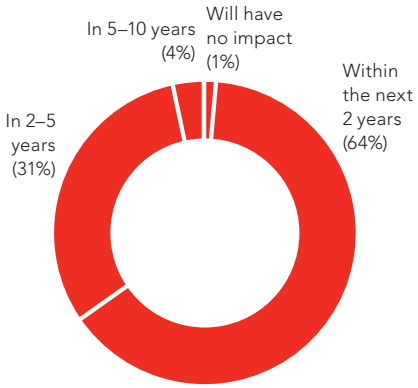


Table 9.1: Impact of digital service delivery by respondent type

ROLE	**Accountants and sole practitioners**	**Managers and senior managers**	**Directors, executives and partners**	**CFOs**
	53%	52%	52%	50%
SECTOR	**Accountancy practice**		**Corporate sector**	
	52%		53%	
ENTERPRISE SIZE	**SME (<250 employees)**		**Large (250+ employees)**	
	50%		54%	

Figure 9.2: Expectation of widespread adoption of digital service delivery



Doing more with XBRL

So far, most XBRL adoption has been driven by regulatory compliance. This has improved data access for investors and other stakeholders in countries from Australia to India. But it could do more to improve the automated exchange of data internally and along supply chains: if businesses, sectors and professional bodies across the globe can co-operate to produce the required taxonomies, if software developers enhance their existing products and create new ones, and if businesses push for change. It is also possible that another technology could come along and make XBRL obsolete.

Digital service delivery is already reshaping business processes, it is starting to reshape business models, and it will eventually reshape entire professions. As more services are provided digitally by all sorts of entities from government departments to small accountancy firms, and further implementation of developments such as XBRL facilitates progressively more automatic and electronic data exchange, there may be a disintermediation of the accountant's role in regulatory compliance. The systems of businesses and those of regulators could eventually become so interconnected that they can exchange information automatically after it has been verified and validated automatically by smart software.

Timing is crucial

If firms do not embrace automation and enhance their services they risk obsolescence. The 2012–13 ACCA–IMA research shows that accountants intend to avoid this: 64% expect to embrace digital service delivery within the next two years, 31% within two to five years. So although some firms and organisations in other sectors are using digital technologies to provide real-time collaborative advice and services, many need to do more. Those that miss the window of opportunity risk becoming casualties of digital Darwinism, like Borders and Polaroid. Fortunately, the evolutionary process brings good news and bad news: no entity is too big to fail, or too small to succeed.

'Firms need to embrace compliance automation and enhance the services they provide to ensure they are seen by clients as trusted advisers, not form-fillers.'

ANDREW FLANAGAN, MANAGING DIRECTOR, DIGITA, THOMSON REUTERS

'It is possible that another similar technology with a better ontology and clearer semantic benefit will emerge rendering XBRL obsolete. Such is the way of reporting technologies and technologies in general.'

DR ROBERT PINSKER, ASSISTANT PROFESSOR OF ACCOUNTING, FLORIDA ATLANTIC UNIVERSITY

10. Social technologies

People have been using computer-based networks for decades to create, share and exchange information and ideas. As personal computers and broadband internet access became as common in the home as the workplace, and cloud and mobile technologies spawned mass-market consumer products and services, internet use evolved. Static Web pages became dynamic interactive websites, and there was a shift from content based on significant up-front investment to user-generated content. The balance of power moved from the few to the many.

The rise of social media was driven by people, not organisations. Historically, IT innovation was driven by big business and the military, but blogging, instant messaging, internet telephony, and sites for sharing pictures and music have become established as popular personal communication and collaboration tools. These have then attracted the attention of businesses, government bodies, charities and other organisations that also wanted to exploit them to improve communication and collaboration with and between their many internal and external stakeholders.

As more organisations explore the possibilities offered by public social media and 'enterprise' social tools they are finding that they can help to:

- improve communication and collaboration (inside and outside the enterprise)
- enhance decision-making and productivity
- open up new routes to investment
- support the development of new products and services
- improve understanding of customers and clients
- personalise customer experiences
- analyse and respond faster to feedback
- tap into and exploit intelligence outside the enterprise
- source, attract and engage talent, and
- develop a brand and build brand loyalty.

CONCEPTS AND DEFINITIONS

The term 'social technology' started its life back in the 19th-century world of political science, where it was used in the context of social engineering. As social media platforms evolved and entered the mainstream of business, a new term of reference was required, and 'social technology' was adopted. Early experiences of social media were negative for many businesses: for instance, they worried that staff would post information that could damage the company image. Technology marketing was used to reposition 'social media' as just one branch of the 'social technology' tree.

A giant sequoia

Social technologies can range from social software such as wikis, blogs and social networks, to tools such as internet telephony and Web conferencing, via a host of existing and emerging software and services that enable social interactions. Many people still equate social technologies with social media and social networks, which have a high profile, but Facebook and Qzone, professional variants such as LinkedIn and Tianji, and microblogging sites such as Twitter and Sina Weibo, have been joined by a growing range of enterprise social tools.

The emergence of 'social business' and 'enterprise social' tools has given new meaning to the phrase 'social enterprise'. Most definitions of social technology are so all-encompassing that they can easily be stretched to include the 'information-sharing' World Wide Web that sits on top of the internet, and the entire network of networks and computing platforms constituting this. For example: a social technology is 'any technology that facilitates social interactions and is enabled by a communications capability, such as the internet or a mobile device' (Gartner 2013a).

Enterprise perspectives

'Enterprise social' is also an overarching term of reference with branches that can include any social technologies that are used in an enterprise context. 'Enterprise social software' refers more specifically to the tools that businesses and other types of organisation are using to implement and exploit social networks – within the enterprise and across key members of its supply and distribution chains – to enhance communication, coordination and collaboration for business purposes.

Enterprise social platforms such as Jive Software offer functionality that supports social collaboration within the enterprise and engagement with

customers and communities. General purpose social tools such as Chatter and Yammer can be used alone or integrated with other enterprise software applications (including specialist platforms such as Jive).[11] Social tools increasingly integrate with business applications such as finance and human resources, though basic social functionality is also being embedded in these.

ADOPTION

When businesses began exploiting social technologies they tended to focus on many of the same types of social media (and often the same social networks and communications tools) as had gained popularity with personal users. Although much overlap remains, businesses are adopting different social technologies. At one end of the spectrum businesses are using LinkedIn for recruitment and Facebook for brand management. At the other end, sites such as Crowdfunder and Kickstarter are being used to raise investment for start-ups and established businesses, where traditional funding would either be unavailable or difficult to access.

Crowdsourcing (obtaining information, input, services, funds, and so on from large groups, especially online) is influencing advertising, marketing and product development. Users range from a small Arizona business, Local Motors, which uses crowdsourcing to design vehicles and then contracts with micro-factories to build them, up to giants such as Nike, Proctor & Gamble, and Sony. European brand Orangina (part of the Japanese giant Suntory) is using the social illustration platform Pixiv to crowdsource a design for a virtual human character to help it to crack the Japanese soft drinks market – and social technologies are entering the mainstream.

The Securities and Exchange Commission in the US has announced that social media outlets such as Facebook and Twitter can be used to make disclosures to investors (SEC 2013). Whereas the first wave of business social technology adoption used social media alone to establish a voice in the 'new world' and create personal connections with followers and other stakeholders, the second wave is also using enterprise social tools to enhance communication, coordination and collaboration inside the enterprise and across supply and distribution chains.

LOOKING FORWARD

Organisations are increasingly exploiting social technology that has been built to address enterprise-specific needs and wants, but there are regional variations. A survey (International Data Corporation 2013b) found that in North America, 79% of the companies surveyed had already deployed an enterprise social network, and almost 30% reported having more than one. Uptake is lower elsewhere. Recent use patterns indicate adoption increasing in Western Europe and Australasia, with Asian countries at earlier experimental stages.

Finance potentially has much to gain. The appeal of a Facebook-style interface tends to be generational, but research shows that social technology ranks second behind analytics as a technology innovation priority. Adoption is expected to increase as accountants in practice and the finance function understand what social collaboration can do to improve their performance. Though respondents in the 2012–13 ACCA–IMA survey are divided about how soon the profession's adoption will become widespread.

The impact on finance

A significant 59% of respondents expect widespread adoption by the profession within the next two years and 29% within the next two to five years. Over 9% expect to feel the impact on the finance function between five and ten years from now and just 2% expect no impact on accountants and the finance function.

As enterprise social functionality improves, social tools will become more useful to the finance function. In an ideal world, collaboration software will develop situational awareness that enables it to contextualise processes and the roles and relationships of participants. In the context of finance, for example, software needs automatic understanding of the difference between general exchanges and any that must be tightly controlled – such as exchanges between tax and finance departments.

Situational awareness

Rather than default to 'public' mode (as social media tend to) some enterprise social tools reflect the accessibility of the record to which comments are attached: a user who cannot see an invoice record in the finance system cannot see social media comments on it either. With more situational awareness, social tools could improve many business and finance processes, from tightening up the financial close to making billing issues easier to resolve.

11. These platforms provide real-time information on the status of people, processes and projects.

Figure 10.1: Impact of social technologies on business in the years ahead

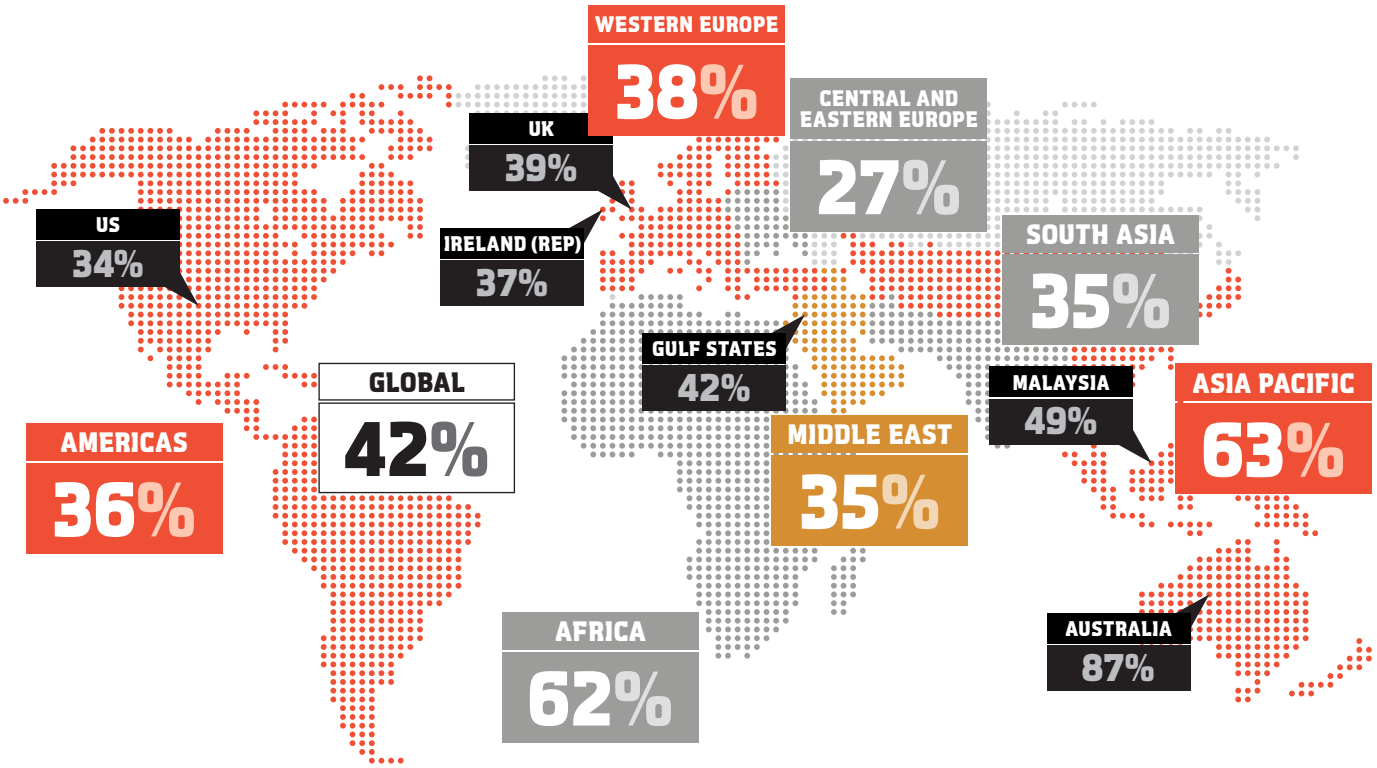
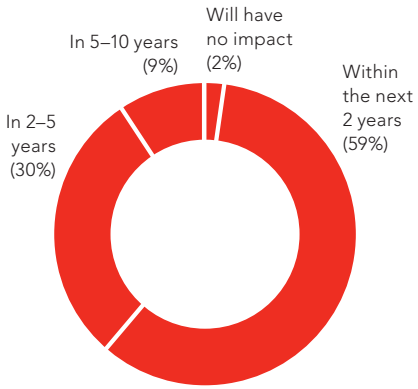


Table 10.1: Impact of social technologies by respondent type

ROLE	**Accountants and sole practitioners**	**Managers and senior managers**	**Directors, executives and partners**	**CFOs**
	44%	45%	45%	38%
SECTOR	**Accountancy practice**		**Corporate sector**	
	41%		40%	
ENTERPRISE SIZE	**SME (<250 employees)**		**Large (250+ employees)**	
	42%		42%	

Figure 10.2: Expectation of widespread adoption of social technologies



For businesses to maximise the potential benefits of social technologies over the next 5 to 10 years, finance involvement is key: the reasons for using social tools must be clear and the benefits must be measured. Businesses, clients and entrants to the profession will increasingly expect it to embrace new and more efficient ways of working. By 2020 social tools will have changed the way people communicate and collaborate inside and outside the workplace – and spawned new industries, products and services.

‘Finance professionals and the organisations they work with and for will need to embrace social technologies. The brightest recruits will expect new and more efficient ways of working.’

HELEN SAMWORTH, PRODUCT MANAGER, M-HANCE

‘Those who adopt social [technologies] in a coherent way will gain the competitive advantage to create a faster, smarter and more connected workforce.’

SIMON SHORT, VICE PRESIDENT AND CTO, CAPGEMINI (UK), AND HEAD OF THE DIGITAL SERVICES BUSINESS UNIT.

11. Embracing the new normal

Over the past decade digital technologies have changed the world in more ways than anyone could possibly have predicted. A 'new normal' is emerging: individual people, business, society and government are all becoming more dependent on digital technologies and these technologies are all becoming more dependent on the internet and on each other.

Over the next decade these trends will continue. Existing technologies will evolve and new technologies and trends will emerge, and many of these will converge and become mutually reinforcing. It is impossible to predict the future with any degree of accuracy, but all this change is certain to create challenges and opportunities – some more predictable than others.

All in this together

Each of the 10 technologies in this report create common challenges, such as the need to maintain constant awareness, and to consider factors such as affordability, interoperability, regulation and risk. Many of them also create common opportunities, such as the potential to reduce costs or to develop new and improved business processes or products.

All these considerations are important to the profession, just as they are for other professions, but accountants and finance professionals have a unique role as advisers to business. Whether they are working in the finance function or in practice, they must be aware of the challenges and opportunities that require the profession to harness its particular strengths and develop both new and existing skills.

Table 11.1: Analysis framework for the 2012–13 ACCA–IMA study of technology trends

Technologies	**Key impacts and implications**	**Action imperatives**
Important technologies shaping the next decade – and beyond	Critical issues for business and the profession	Key response strategies
■ Mobile ■ Big data ■ Artificial intelligence and robotics ■ Cybersecurity ■ Educational technologies ■ Cloud ■ Payment systems ■ Virtual and augmented reality ■ Digital service delivery ■ Social technologies	■ Faster and easier access to technology resources ■ A more connected world and workforce ■ Opportunity to automate more business processes and services ■ De-skilling of the accountancy profession ■ Vast amounts of data ■ Enhanced compliance and decision-making ■ New ethical challenges relating to data gathering and analysis ■ More transparency ■ New routes to investment ■ Innovation in services, delivery and business models ■ Level playing field for big and small entities ■ Greater productivity and efficiency ■ Faster and smarter period-end processes ■ New areas of risk ■ Challenges to data security and sovereignty ■ Challenges to traditional role of the profession ■ Expectation of access to IT resources 24/7, on any device, anywhere ■ Separation of skill and expertise from professionals	■ Explore new ways of establishing costs ■ Prepare for changing working patterns ■ Keep watching brief on many emerging technologies ■ Assess risks and address security ■ Plan timing for adoption and implementation ■ Develop change management skills ■ Enhance data analysis and interpretation skills ■ Recruit digital natives ■ Establish a broader and more strategic remit for finance ■ Understand technology market conditions/ planning/risks ■ Explore potential of process automation ■ Introduce better controls and education to enforce governance ■ Use technology to add value ■ Anticipate new regulation ■ Learn enough to know which questions to ask to gain insights ■ Adapt to meet changing business needs ■ Apply human brakes and overrides ■ Manage expectations of internal and external customers

CHALLENGES FOR THE PROFESSION

Accountants and finance professionals need to understand digital technologies well enough to gauge their potential impact on business, on the profession, and the relationships between them. The profession has always been a force for good, serving the public interest by influencing the evolution of business ethics and values, the development and setting of standards, and prioritising financial stewardship and integrity.

As IT has become increasingly integral to business and accountancy, the role of the profession has expanded. It has become not just an enthusiastic adopter of emerging technologies but the first resource for many businesses that are looking for advice on their use and adoption. In future, as digital technologies accelerate the rate of change, the profession's role as IT adviser will become difficult to sustain.

Specialists and first responders

Experts on technology are becoming more specialised and many accountants may also need to be more selective about the areas of technology they focus on. Not everybody can be at the forefront of technological developments – not everybody is required to be. Nonetheless, responses to emerging technologies will shape the future for individual accountants and those with and for whom they work.

All accountants will need to consider their approaches to and influences on technology use, adoption and decision-making processes now and in the future. By thinking ahead, the profession can take a more proactive than reactive approach to digital technologies. By embracing the 'new normal', the profession can actively reshape it, rather than simply being reshaped by it.

IMPERATIVES FOR THE PROFESSION

Over the next 10 years business and the accountancy profession will be changed dramatically by developments in existing and emerging technologies. This will present many accountants with the chance (and in some cases the need) to redefine their role and the extent to which they are involved in short-term and long-term technology-related decision-making processes.

Each of the 10 technologies in this report will present accountants and finance professionals with different challenges and opportunities and demand different responses.

1. Mobile

A faster more connected workforce with the tools to be more efficient and productive will enable finance to improve the services it provides to clients inside and outside the finance function and throughout accountancy practices. It will not, however, be easy to manage data and device security or adapt to changing working patterns. It is important to:

- identify and educate business on the costs and risks associated with mobile-driven trends such as 'Bring your own device'
- create and enforce appropriate cost, data and process controls
- identify the finance services and processes that work best 'on the move', and
- exploit the knowledge of workers who have grown up using digital technologies.

2. Big data

Analysing very large data sets can yield new and valuable insights to finance and the rest of the business – and many in the profession will be able to exploit this. There will be challenges, such as the need for high-quality data, security and privacy, and legal issues, but big data could become a very big opportunity for many accountants if they are able to:

- explore new ways to manage, analyse, and extract value from big data
- ensure that data protection legislation is followed and data is used ethically
- apply the profession's analytical and critical skills to establish a broader, more strategic remit
- use this broader business perspective to inform and identify the questions big data can most usefully answer, and
- monitor the specialist software and systems that are emerging and learn how to exploit them.

3. Artificial intelligence and robotics

Although potential benefits range from automating repetitive tasks and processes to improving compliance and decision-making, the profession faces some significant challenges. The regulatory focus on rules makes some areas of accountancy ideal for automated, self-learning systems that could become more effective than individual professionals. The profession must:

- carefully assess and prioritise tasks and processes for automation

- identify the areas of accountancy most likely to be de-skilled or commoditised
- up-skill to take advantage of the potential to focus on higher value tasks and services, and
- develop new ways to communicate and measure value and success.

4. Cybersecurity

It is inevitable that the cost and complexity of cybersecurity will continue to increase. This will create an increasing role for internal audit and for the growing number of accountants who have chosen to develop expertise in this area. As gatekeepers of financial data security, all accountants and finance professionals will need to ensure that:

- the growing threat to individual users and small and medium-sized entities is recognised
- the workforce is educated/aware of existing and emerging risks and the need for vigilance
- constant monitoring identifies and assesses technology-related business risks
- defences are updated as necessary to mitigate and reduce risks, and
- the value of specialist tools and expertise is recognised from board level down.

5. Educational

This is one of the areas where emerging technologies could turn out to be as much of a burden as a boon to the profession – particularly as some of the other technologies in this report merge and become more mutually supportive. Individual members of the profession – and those involved in their professional education – will need to carefully monitor advantages and disadvantages for the foreseeable future, and:

- constantly reassess approaches to professional education
- take advantage of the more data-driven approach to education that is emerging
- identify the areas of accountancy most likely to be de-skilled by technology
- respond to the growing focus on access to information and its applications rather than its assimilation
- use new technologies to support knowledge transfer within the profession
- identify and respond to the challenges and opportunities created by broader access to education and the profession, and
- prepare for a globally mobile professional workforce.

6. Cloud

There are many potential benefits of cloud technology range from reduced up-front costs to ease of access, scalability and data sharing. Many of these benefits also create challenges, such as difficulties in monitoring, controlling and analysing IT costs and the need to manage the expectations of those outside finance. It is important to:

- become familiar with the range of IT resource options possible in public and private clouds
- demand more granular use and cost data from service providers
- explore ways of establishing financial costs, and
- clarify national and international tax regulations and complications.

7. Payment systems

As the ways in which people buy and pay for goods and services multiply and non-bank routes to funding and other financial services emerge, accountants and finance professionals will need to keep up to date if they are to maintain their pivotal role as advisers. Accountants and finance professionals will need to:

- position themselves to use and advise on new payment platforms and mechanisms, including peer-to-peer systems
- develop the skills to exploit new money paradigms and methods of exchanging value
- drive the required changes to back-office systems such as accounting and treasury management
- ensure that emerging platforms and services are adequately and appropriately regulated, and
- use professional insight and experience to innovate and adapt.

8. Virtual and augmented reality

Existing and emerging technologies in this area are already helping some professions to visualise complex data, enhance products and services, and work more efficiently, and accountancy will follow. To get the most from this as a profession, and to help business do likewise, accountants and finance professionals will need to:

- identify the niche technologies with the most potential

- assess the scale of business opportunities
- consider areas of application, such as data visualisation, where augmented reality overlays can benefit finance
- explore the potential for simplifying and enhancing the communication of complex finance-related information to non-finance stakeholders, and
- compare the operating and ownership costs of virtual and physical assets.

9. Digital service delivery

A transformation is already under way and the profession will not be able to escape the impact, as digital connectivity reshapes culture, business models and working practices. The profession could gain from exploiting XBRL and other developments to enhance the efficiency of the finance function and to develop new products, services and processes. To do so, the profession will need to:

- work with taxonomy developers and standard setters to speed up taxonomy development and improve the interoperability of standards
- recruit or develop the required digital literacy skills
- identify business and financial benefits and how to unlock them
- consider the implications of business, advisers and regulators becoming more connected and exchanging data automatically, and
- develop new propositions and services that enable the profession to add value.

10. Social

The professional benefits of social technologies are just starting to emerge as business-oriented social technology features are built into more products and services. While accountants look forward to developments such as faster period-end processes and improved collaboration, the profession can influence short-term decisions about adoption and investment, and highlight areas of risk. It is important to:

- assess and explain the risks and financial implications of new developments
- develop the hands-on skills required to exploit them in finance
- adapt to meet the changing expectations of new entrants to the finance profession and customers inside and outside the finance function, businesses and practices.

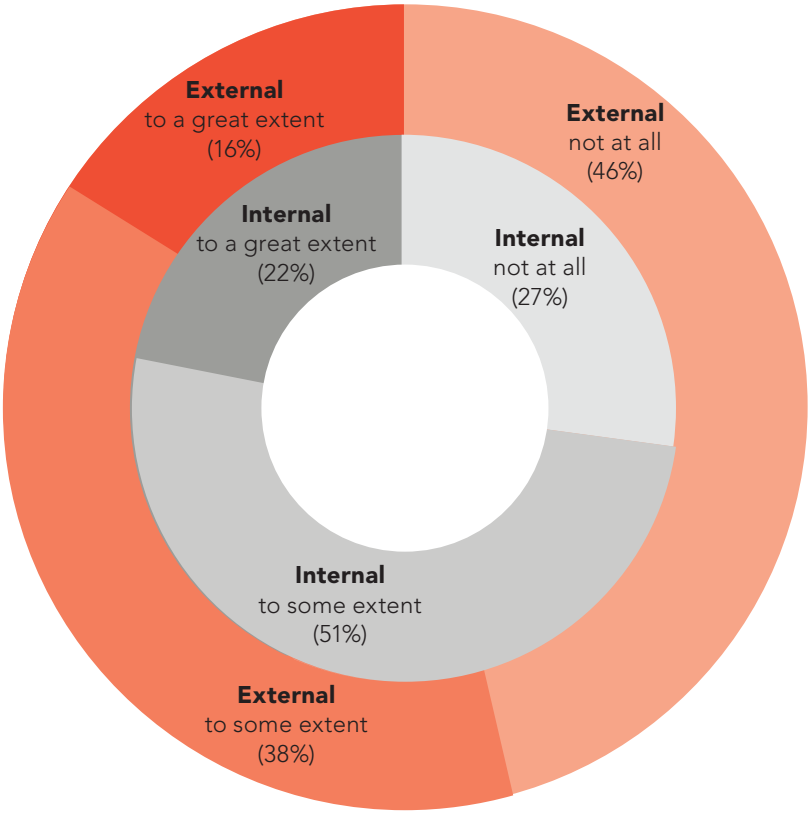
AGENTS OF CHANGE

The accountancy profession is uniquely well positioned to influence decisions on the adoption of technology. But there are many different types of organisation, many different types of accountant, and many different factors that can potentially impact on their capacity to be a driver for change.

All accountants prioritise financial stewardship and integrity, and this has an impact on their perspectives on the technology decision-making process. The profession is necessarily and understandably more risk-averse than those in other areas of business. But accountants' perspectives on technology and technology-related financial decisions are also coloured by their current organisational role and involvement in technology decisions.

The 2012–13 ACCA–IMA research asked members about their influence on technology decisions. Within their own businesses and practices 73% of accountants indicated that they influence technology decisions to some extent or to a great extent. Influence appears to be greatest among CFOs, where this figure rises to 97.5%. More than 50% of respondents provide advice to their external clients on the use of technologies in their business, with those at director and partner level reporting the greatest influence.

Figure 11.1: The extent to which accountants and finance professionals influence the use of technologies externally (advising clients) vs internally (to their own business)



DOES LOCATION MATTER?

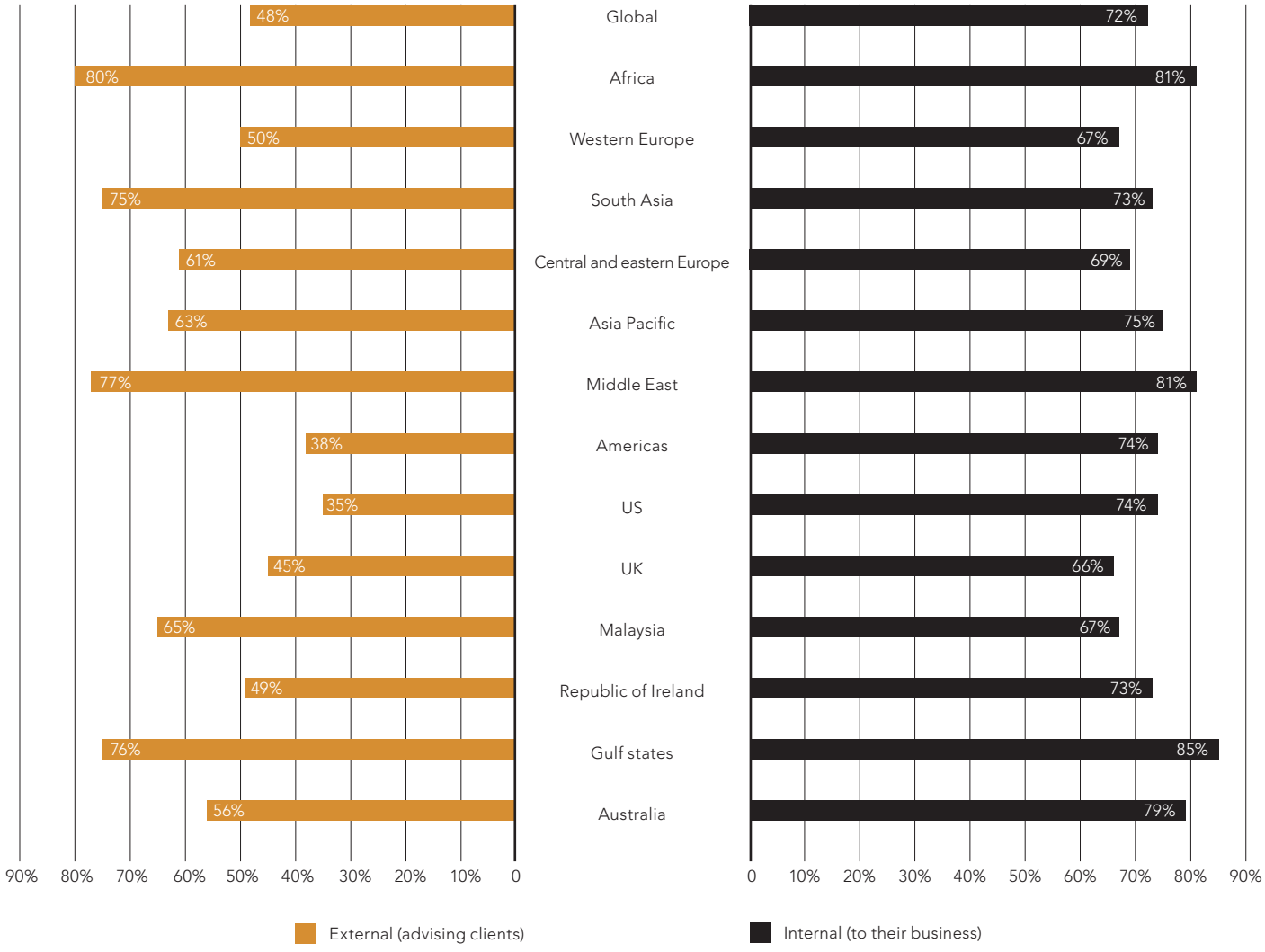
The location and the influence of finance professionals on which technologies business adopt does matter, based on the 2012–13 ACCA–IMA research.

Africa and the Middle East are the regions where accountants and finance professionals report having the greatest influence on technology decision-making, both inside and outside their businesses. A closer look reveals the Gulf states as the area where finance professionals have the highest levels of influence on technology-related decisions. This could reflect the regional attitudes towards technology and/or the accountancy profession; it could reflect high business growth rates in the region.

Accountants and finance professionals in the Americas report much lower levels of influence over technology decision-making outside their business, than members in other regions. A closer view (see Figure 11.2) reveals that this low-level of involvement is concentrated in the US. This may reflect the relative maturity of the information technology industry in the US and how specialised IT professionals are in this region.

Looking ahead, it seems as if the future potential of the accountancy profession to influence technology decision-making will be determined by a complex mixture of factors. Clearly this includes regional variations and the organisational roles and responsibilities of each accountant. It also includes the extent to which each accountant is currently involved in technology-related decisions, and how involved they aspire to be.

Figure 11.2: Percentage of finance professionals who influence the use of technologies externally (advising clients) vs internally (to their own business)



Accountants and finance professionals have a significant role to play in the increasingly connected and interconnected ecosystem that will emerge as the 10 technologies in this report come together to create the 'new normal'. The internet and cloud-based technology resources are reshaping myriad aspects of business: from the way we finance, resource and develop new and existing enterprises, to the way we create, buy and sell products and services. Nothing in the future is certain, and the unforeseen interactions between these technologies promise to be both interesting and challenging.

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