

Report

Public sector global technology trends 2020

March 2020



Foreword

There is a view, widely held, that the public sector lags behind commercial entities when it comes to innovation. However, this is not the case.

Smart cities, smart transportation, citizens' engagement, smart water, smart waste, sustainability. These are all terms familiar to local government and the wider public sector. Initiatives including AI, IOT, edge computing, big data analytics, cybersecurity, cloud computing are fundamental to planning and managing local communities. 5G will soon be standard and the public sector is in the vanguard of preparedness.

Indeed, local governments face a unique challenge in transforming successful pilot projects into widespread adoption. They need to overcome a host of challenges including funding, skills, bureaucratic organisation, lack of political vision and often a dearth of strategies.

This means that new technology adoption is progressing fast in a proportion of the local government market, but not as fast as it could be. To disseminate the use of new technologies in municipalities, the leading solutions and technology providers focus primarily on the large and prosperous cities and are almost absent in the rest of the local government market. This creates a very unbalanced situation. Small municipalities simply do not have the economies of scale to justify the investment in innovative technologies across a broad range of services. New innovative business models are needed.

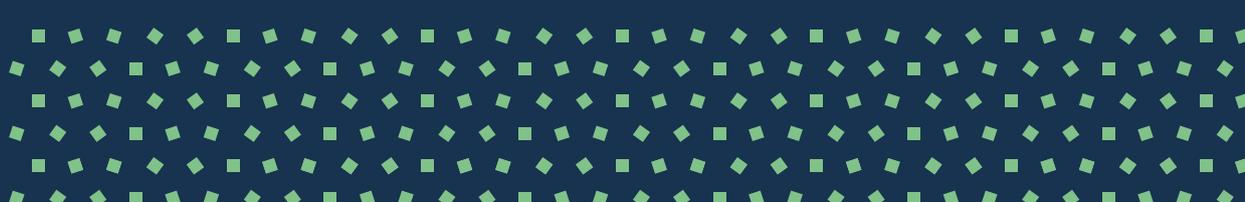
Smaller local governments need to merge, or at least establish shared service arrangements, in order to create the critical mass that can justify investments based on sound business cases. This will be challenging. It is not enough, for example, to simply merge technology functions. There is a need to impact the fundamentals of business operations. Without this, smaller local governments will never be able to embrace, fully, the opportunities presented by digital technologies. And that will increasingly result in citizens questioning their relevance.



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Executive summary

A spectrum of developments and trends in technology and digital adoption across public sector organisations is revealed in this international research. While many technology themes and priorities are common, there are nuances and variations stemming from geography, appetite for risk and local need.

In general, public service organisations in our participating countries are heavily focussed on citizen need and the digital context of emerging technology. Across the board, digital inclusion matters. ICT investment is business-driven and increasingly outcome-focused.

The top three technology priorities that emerge for 2020 will be artificial intelligence (AI), Internet of Things (IoT) and cloud computing. These are evaluated alongside cyber protection, citizen-centred design and affordable and flexible implementations.

With the expected growth in AI, machine learning and robotic process automation (RPA), there is a need to focus on data safety, ethics and the potential for unintentional bias. Corporate data and information policies will help ensure data is well-managed and data risks are exposed and contained. These are new priorities for the coming year and beyond.

Public trust in digital government will also be a topic of consideration. If the public sector fails to retain the trust of citizens - in how digital services work and how personal data is used - then the take-up of digital transformation will be slow, and its benefits reduced.

Other future challenges voiced by public sector ICT and digital leaders include the risk and complexity of new technology. This needs to be balanced against its benefits and opportunities. ICT and digital leaders are mindful of the problems that can emerge if things go wrong in moving from legacy ICT. They are also aware of a growing need to be persuasive in bringing forward business cases and explaining the risks and benefits to CFOs and CEOs.

Sustainability and ethical sourcing are also now key. ICT departments need to prioritise environmental concerns when developing strategies and implementing plans. It is key that ICT departments understand their organisation's procurement policies and use this knowledge to inform their actions.

The importance of executive support and understanding of digitally enabled change, and the associated ICT requirements is also necessary. For public bodies with political leaders, their support and understanding is also seen by many as key to their success.

Overall, this research paints an exciting picture for digital public services enabled by new technology in the decade ahead. 2020 represents the start of a new era in technological opportunity and, judging by the examples and innovations seen already, local public services will be at the forefront.



Background to the research

This research provides a guide for local public service leaders about which technologies are most likely to become mainstream in the coming year, and why.

It draws upon the perspectives of many ICT and digital professionals and leaders across the globe. It provides insight, predictions and comparisons that will be of interest to all those involved in transforming, designing and sustaining public services for better outcomes in local places.

There is never a shortage of annual ICT predictions from technologists, vendors and consultancies. However, these tend to be generic, not sector-specific, and over-optimistic about both the pace of technology development and adoption. Some also make unqualified assumptions about the public sector and its digital journey.

The focus of this report is less about the technology itself and more about its practical application in affecting public service improvement. Specifically, it considers the growing opportunities for digital development in local public services and how they can combine to achieve better outcomes in diverse local community settings.

This report is a first. It is unique in its reach and range, based on conversations with leading ICT professionals in the public sector across the world and a survey of the members of international ICT membership organisations. The contributions from ICT and digital leaders in Major Cities of Europe (MCE),¹ and the presidents and leaders from the eight LOLA² professional associations was particularly helpful. The methodology is set out in [Appendix 1](#).

Whilst there are differences found between the various countries and organisations engaged in this research (See Figure 1 and [Appendix 3](#)), in general there is also a common set of themes that emerge for public service organisations, at a time when ICT is expected to create significant value to people and places as a consequence of digitally transformed public services.

Figure 1. The countries and organisations engaged in this research



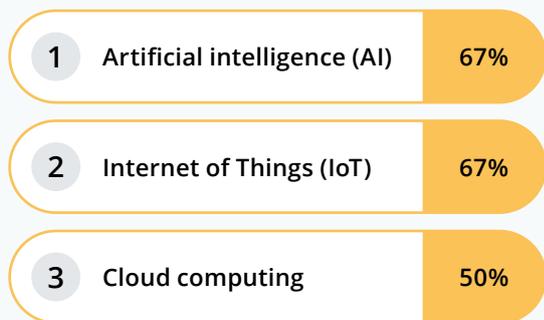
International comparisons

Most of the key technologies and digital trends listed in this research are common themes for all countries in 2020, but there are some subtle differences.

For example, the UK public sector places a higher priority on artificial intelligence (AI) than is reported elsewhere and also in their expected investment in sophisticated data developments.

All countries report growing use of technologies that enable greater mobile and flexible working, offering improved wellbeing for staff and new ways of delivering digital services to citizens.

Respondents were asked to select the areas they believe will be most relevant this year. Across all countries, there was commonality with three areas - in particular - highlighted:



Despite common themes, there was a variation between participating countries:

Survey responses by country	
Australia	<ol style="list-style-type: none"> 1. Internet of Things (IoT) 2. Robotic process automation (RPA) 3. Augmented reality (AR)
Belgium	<ol style="list-style-type: none"> 1. Cloud computing 2. Self service application development 3. Artificial intelligence (AI)
Canada	<ol style="list-style-type: none"> 1. Artificial intelligence (AI) 2. Internet of Things (IoT) 3. 5G exploitation
Netherlands	<ol style="list-style-type: none"> 1. Digital transformation programmes 2. Cyber security 3. Business intelligence and data analytics
New Zealand	<ol style="list-style-type: none"> 1. Artificial intelligence (AI) 2. Internet of Things (IoT) 3. Cloud computing
United Kingdom	<ol style="list-style-type: none"> 1. Artificial intelligence (AI) 2. Internet of Things (IoT) 3. Cloud computing

These priorities hide a range of other digital challenges that public service leaders believe they will face if they are to exploit technology potential. The main areas highlighted as impacting local governments include:

- > Legacy ICT constraints and a lack of skills (ICT and wider)
- > Public perceptions and support
- > Capacity and prioritisation constraints
- > Privacy and security concerns

- › Lack of government standards
- › Staff resistance to change and new methods
- › Insufficient political support for risk and investment
- › Lack of executive and CEO buy-in to digital change
- › Business change capability
- › Problems with partners or shared services
- › Supplier and industry issues
- › Poor broadband and internet access
- › Financial constraints

From the feedback and wider consultation for the study, it is evident that many common and previously known barriers to digital transformation and change will persist into 2020 and beyond. Detailed comments and feedback are shown in [Appendix 2](#).

However, the fact that these barriers are not new, and many public service digital leaders have shown how they may be overcome, means that in 2020 a concerted effort will be needed to address them.

Case studies and the work of LOLA and MCE in sharing international public sector best practice will help to embed progress. This is especially true in terms of making a sound business case for technology investment that is necessary to underpin change programmes and to remove the drag factor of legacy ICT and cultural resistance.

Digital business of public services

There are a number of digital themes that have emerged from this study that set a context (and sometimes a constraint) for the development of digital public services in 2020.

Some are country specific (such as Brexit in the UK), others are more general (such as the importance of public trust in digital government). The themes covered in this report include:

- › Customers and digital citizens
- › The UK and Brexit
- › ICT and digital leaders as business managers
- › ICT suppliers and the public sector
- › Changing workstyles
- › Digital transformation and ICT development
- › ICT projects and the CIO in 2020
- › Digital skills for all

Customers and digital citizens

The public sector, as much as the private sector, is focused on customer needs and preferences, especially as new digital services are rolled out. However, for the public sector there is the issue of growing public mistrust of digital services and how data is used, which could act as a brake on digital developments in 2020. It is clear that the public trust the private sector with their data more than they trust their governments.

"The positive impacts of digital include economic development, creating new jobs and skills locally to support the new technology that the community is wanting. It would also help to improve council service delivery."

South Grampians Shire Council, Australia

If the public are not willing to trust digital services because of data risks, or if they simply fear the march of technology or government surveillance, then digital progress in the decade ahead will be slowed. For some countries, such as the UK, this is more of an issue, where national digital identity schemes have been resisted fiercely. Current, design-led work on attribute-based identification in Scotland³ may prove to be more successful.

There is also a subtlety in that public services do not have 'customers' in the strict sense, (they may be voters, tax payers, service users, residents or tourists for example) and the public sector also has to consider the implications of disinformation campaigns, social isolation, wealth inequality, climate change and political unrest in how digital developments are presented.

Designing services must be driven by user need and preferences. This is the same for the public and private sectors. For the public sector, this impacts on how we work in partnership with third parties to create services.

In 2020 there are still issues to tackle regarding digital exclusion,⁴ especially for the public sector. Whilst most people own a smartphone, true digital inclusion requires access to affordable broadband, a bank account (for online shopping) and the skills, awareness and confidence to use technology.

The barriers to digital inclusion are especially important to public sector users where digital take-up requires those less technologically able to participate. For example, as countries move to become cashless societies, those without bank accounts will have increasing difficulties in making and receiving

payments, which then becomes an issue and a pressure for public services. Recent work by Socitm in a series of three policy briefings on 'Digital by Choice'⁵ is relevant to the UK analysis of this topic.

Smart cities and smart places

Development of 'smart cities' and wider potential of the concept for whole regions, is much more than the simple implementation of new technologies, such as IoT. In particular, the true potential lies in repositioning communities for the future, in terms of jobs, skills, infrastructure, public protection and sustainability, not just investing in ICT itself.

To date, most of the developments have been seen in smart cities, introducing technology into urban areas for specific applications (such as transport management, street lighting, parking, utilities, safety, waste monitoring), and more latterly, pollution tracking and reduction. These types of developments have often been supported by a public/private partnership with larger suppliers, helping to design a 'smart city infrastructure'.

For some time Socitm has been advocating a far broader 'location-based'⁶ focus for local 'smart places', including but beyond cities, led by a partnership of local public services, the private sector and others. This is about connecting new ICT opportunities with civic outcomes – public protection, regeneration, job creation, infrastructure investment, digital inclusion and carbon neutrality.

Socitm research has identified that encouraging a local SME sector can increase GDP in an area more than other industries. It also has a light environmental footprint, supports the wider development of digital skills and helps with the progress of digital government.

Realising this vision needs local authorities and municipalities to work in partnership with business, academia and communities to develop a clear 'smart places' strategic plan,⁷ which not only 'joins the dots' of technology possibilities, but also addresses the growing concerns of citizens about how personal location data is used.

"New technologies create the possibilities for customers to get better access, service and experience of public services."

Geelong Council, Australia

This is more than using leading edge IoT. It requires a whole reconfiguration of how public services work for and with their communities, with partners and suppliers and in investment priorities. Smart places enable sustainable environments, reduced carbon emissions, improved air quality, better housing conditions, access to services and overall better outcomes that elude national governments. Fundamentally, they enable a shift to considering social value rather than narrowly-defined (and often short-term) economic value.

From an emergency services perspective, the opportunity of a zero emergency city is fascinating and while it may be some time away, more medium term capabilities that could deliver real benefits include the ability to: reduce the number of unwanted false alarms by more accurately monitoring and identifying fires; sense fires in upland/moorland areas, which contribute significantly to national carbon emissions; detect slips and trips in the homes of vulnerable groups; proactively manage the fire hydrants; and use drone technology to detect and respond to incidents.

In 2020 all public services should consider their part in development of smart places, whether they are working nationally or locally, connecting the potential of technology with the needs and demands of public services and their users.

Healthy and well communities

Arguably, the health and wellbeing of communities, spanning the full spectrum of care and conditions that contribute to personal and collective wellbeing, should be leading the charge for digital government and digital transformation in public services in all countries. This focus offers some of the most compelling and citizen-centred technology possibilities, especially with some of the new tools described in this research.

In practice, however, most current applications, although exciting, are either in the area of highly specialist tele-medicine applications, such as 'markers' in medicines and specialist technology equipment, or simple AI-driven front ends to services, or they are in providing technology to support those in need of social care in their homes. Rarely do they form part of a co-ordinated

approach to prevention and improvement - addressing the conditions that give rise to vulnerability and poor health, and that generate high costs to society.

Applications, such as wearable devices, are undoubtedly giving people more independence and offering life changes that would not have been possible in the past. Nonetheless, the more challenging and elusive digital opportunity for health and social care from 2020 lies in other areas, and these are becoming barriers to progress.

Examples include: the integration of health and social care records and services in whole regions, the federated ownership of health data and services by the people that use them, and stronger linkages between medical and non-medical support services for example, for end-of-life care and social prescribing.

These are proving challenging since they fundamentally impact budget allocation, risk models, ethical standards and the demarcation of professional responsibilities. They also presuppose integrated service and citizen identity which are elusive and problematic in some countries such as the UK.

These are the areas where leading public services in all countries will be focussed in 2020, if they are not already doing so, with a focus on data and their use at the heart of service design. Socitm research in this area⁸ is relevant to these predictions.

International issues

Whilst in the UK there is a specific matter to address in 2020, namely the impact of leaving the European Union, many of the issues that have given rise to this major shift are international in their origins and commonly felt in other countries.

Mobility of labour, the status of immigrants, smart places (operating in an international, not a nationally framed context), sustainable access to resources and resourcefulness, harnessing and abusing data, and the breakdown of trust in big governmental and corporate institutions are just some of the challenges faced.

Scotland's National Performance Framework⁹ addresses many of these issues 'head-on'. It explicitly recognises and sets out a vision for Scotland's role in the world and how such issues, generated internationally, can be addressed locally, treating people with kindness, dignity and compassion, respecting the rule of law and acting in an open and transparent way. It also explicitly addresses the United Nations' Sustainability Development Goals.¹⁰

Meanwhile, Estonia is the first country to embrace the opportunities afforded by new technologies to break down international barriers through its e-Residency programme.¹¹ Government-issued digital identity and status provides access to Estonia's transparent digital business environment and allows digital entrepreneurs to manage business from anywhere in the world, entirely online.

The political nature of these opportunities and the challenges they present is captured in a recent lecture by Mark Thompson.¹² He makes the case that, together with the politics surrounding climate change, digital politics is one of the most important conversations facing humanity in 2019. He argues that the emerging relationship between technology and society is inescapably political, since there are stark choices to be made, and that there are emerging battles to be fought over how we shape our digital future and, in turn, how our digital future comes to shape us.

Digital technologies will offer opportunities to mitigate potential disruption and to proactively drive new opportunities and social value. Parts of the public sector dependent on overseas workers will need to consider what services can be provided electronically from abroad, and acceleration of self-service systems will reduce the dependence on professional intervention to provide services quickly and efficiently.

Developing smart places and smart cities which stimulate and promote the technology industry can specifically help to mitigate economic impacts in an area, regardless of the national context.

Whatever political views are held, these new challenges are being felt in the realm of local public services. In the UK and elsewhere, national governments will devolve more to localities, with or without matched

funding, and this will require new resourcefulness to address problems and opportunities; national governments are not going to come to their rescue.

ICT and digital leaders as business leaders

ICT and digital leaders in the public sector are increasingly becoming 'business leaders' as they seek to align ICT activity with innovating better public service outcomes. In 2020, we will see this trend accelerating, with a shift in ICT budget profiles and potentially a tipping point in how new digital technologies are procured and used:

- Hardware continues to fall in price and software investment increases
- Cloud technologies continue to replace traditional outsourcing
- There is a strong move away from capital ICT projects to revenue budgets for ICT
- ICT infrastructure and tools investment (not ICT) will be prioritised
- GovTech¹³ will become a significant part of the ICT portfolio
- Procurement frameworks for innovation and dynamic purchasing will become commonplace

The trend for ICT and digital leaders to become business managers is clear in the survey, with every country describing the business problems they are seeking to address, not their ICT challenges in isolation.

2020 will see the continuing integration of technology into the business of public services, not just through digital transformation but also through an inevitable trend to increase automation. This means ICT is not just a tool to improve services, but is actually becoming the service. This will require realignment of ICT infrastructure, technology innovation and investment priorities.

One of the business challenges associated with digital transformation is a distribution of ICT budget spend beyond ICT, into individual departments and digital transformation teams. The risk of a 'shadow ICT' model emerging is less of a concern than the creation of a fragmented approach to digital infrastructure, standards and tools, diluting corporate synergy and data value. ICT and digital leaders will need to find the right political balance to strike in 2020.

ICT and digital leaders will also have to coordinate (or make sense of) increasingly complex ICT supplier relationships in multi-cloud environments. Some of these have evolving contract pricing models, which can make it hard to present business cases for increased ICT spend, especially in public services where the pressure is to reduce overall revenue budgets is considerable alongside dealing with ICT legacy constraints.

Anecdotal evidence in the UK suggests that on average ICT budgets in local authorities are approximately 3% (or less) of total organisation spend. Given the demands on digital development and the pressing needs to improve cyber security and deal with legacy ICT, ICT and digital leaders may need to push for more investment in ICT in 2020. They should focus on the priority areas to support digital change and the mitigation of the most significant barriers.

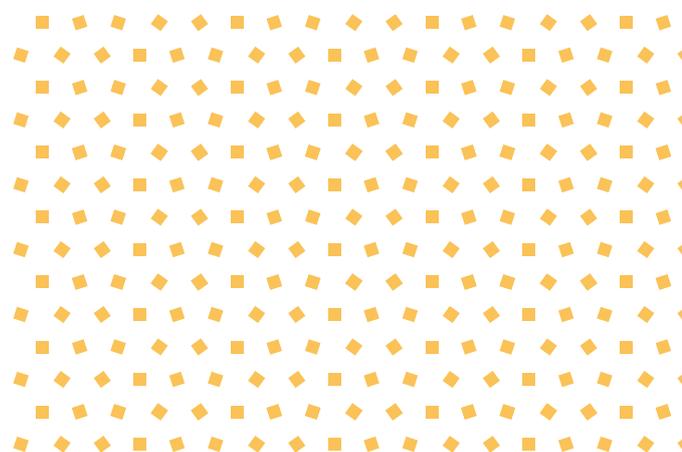
It will help to work closely with their CFO and with suppliers to improve the organisations understanding of the importance of ICT investments and the adequacy of ICT budgets, as well as the value demonstrated from ICT investment. In 2020, the public service ICT and digital leaders who set a lead will be those directly helping their public service organisations to retire legacy applications, and to map the way for digital transformation with the associated cultural change.

With the development of digital solutions across public service organisations, there is a need to review how ICT operates and works. A number of ICT and digital leaders in this study describe how they are reviewing ICT policies, practices and ICT guiding principles in 2020. For example:

- › Are ICT decisions fully aligned with corporate public service strategic plans?

- › How should ICT resources increase for infrastructure provision, cyber security and other essential building blocks of successful digital operation?
- › Are ICT decisions, and in particular the development of new ICT solutions, developed with users interests at the centre, including their direct involvement?
- › Is ICT collaborating sufficiently across a wide range of service providers, users and other partners, not developing solutions in isolation?
- › Are ICT costs, services, opportunities, risks and constraints sufficiently transparent in organisations to help business colleagues at board level understand the potential and challenges presented by new technologies for service design and digital transformation?
- › Is ICT a centre of innovation and digital development, not just an operational technology department?
- › How mature is ICT in terms of placing 'data stewardship' at the heart its purpose and role?
- › Is ICT as a service doing enough to support digital leadership outside its immediate sphere for user and service leaders to understand the possibilities?

In 2020, if public sector ICT and digital leaders are simply responding to the needs that arise from individual service departments then there is unlikely to be a harmonious and integrated digital service.



ICT suppliers and the public sector

ICT suppliers have a growing part to play in the future of digital government and in the modernisation of ICT delivery methods. A number of areas have been highlighted by ICT and digital leaders in this research where ICT suppliers need to respond better, over and above the provision of powerful ICT solutions to digital problems.

Example areas of concern or priority for 2020:

- Making supplier pricing models and licensing fees simpler, more transparent and more predictable. Public sector leaders report that some contracts are difficult to understand or subject to unexpected price increases or 'true-ups'. Limiting total contract costs within service level agreements can help with insulating public services from unexpected ICT budget pressures, especially in flexible cloud contracts
- Demonstrating the value of new technology solutions to public service business outcomes, rather than just the benefits of the technology itself. This means ICT suppliers need to understand the unique circumstances of public service providers and how ICT solutions could generate direct business value
- Being more open about risks associated with technology change and systems incrementation. Often it is said that ICT supplier enthusiasm about the technical benefits of their offering runs ahead of reality, and either deliberately or intentionally underplays the complexity and risks of implementation
- Taking more responsibility for cyber security and data protection in how systems are designed, implemented and maintained. This includes working with public sector organisations in determining appropriate business continuity and disaster recovery arrangements and being clear about their own practices and known risks
- Building more flexibility into contracts, especially to allow greater levels of innovation and affordable change. This is, in particular, where the majority

of ICT outsourcing contracts in the public sector fail, where every contract variation has an associated and often unexpected cost

- Sharing the risk for ICT cost prediction; for example, whilst 'pay-as-you-go' public cloud options have much merit, they can still result in unexpected budget pressures if significant growth in demand occurs. A number of major suppliers are now beginning to move to 'pay by the second' cloud models, which may require greater sophistication in ICT contract monitoring and planning
- There is also some concern beginning to be voiced by ICT and digital leaders in cases where previously low-cost or even free cloud services are gradually seeing price increases, with some public sector ICT and digital leaders questioning whether on-premise cloud may be a more viable option in 2020 as a result

ICT suppliers are seeking to differentiate themselves by offering models of ICT delivery which are more flexible, innovative, and transparent than have been seen in the past. This is likely to grow in 2020 as public sector ICT and digital leaders scrutinise ICT supplier offerings more closely in the drive to reduce costs and accelerate digital change.

ICT suppliers will respond not just by offering improved customer service and product quality/price, but also in the social value they offer and in their 'corporate social responsibility' values. This chimes with a trend for public service organisations to pull back from strategies to drive short-term gains in ICT procurements at lowest cost, instead of recognising a wider contribution that ICT suppliers can make to solving broader, societal problems.



For example, in the UK, ICT procurement in the public sector is already considering the impact that ICT partners can make beyond the direct product benefits, perhaps on a local economy and jobs, social well-being, partnerships with schools, or simply in their commitment to reducing the impact of and on climate change.

Where suppliers fail to develop suitable digital solutions there is a likelihood from 2020 that the public sector will do it for itself. This is not the same as the 'ICT development shops' in the public sector in the 1980s, since it will be based on common public cloud hosted platforms, agile methods, low-code/no-code tools, open APIs and open-source tools.

In the UK a group of councils are being funded by the Ministry of Housing, Communities and Local Government to develop a shared, open-source revenues and benefits system.



Led by Teignbridge District Council with five other local councils, they are procuring support to establish the feasibility of this approach in 2020.

The drive to do this stems from the resistance of existing traditional ICT suppliers to develop modern, open and affordable revenues and benefits systems over many years, with councils feeling locked into inflexible, dated and expensive ICT platforms.

Where the relationship between ICT suppliers and public service organisations works well, there will be a clear understanding of ICT business value and joint working to develop digital platforms and the digital ecosystem that support citizens' needs and preferences.

Changing workstyles

Mobile and flexible working supported by technology is already commonplace across the public sector in all the countries surveyed. But the potential flexibility of new ICT in shaping how workspaces function and how work is actually defined and designed is nowhere near achieved.

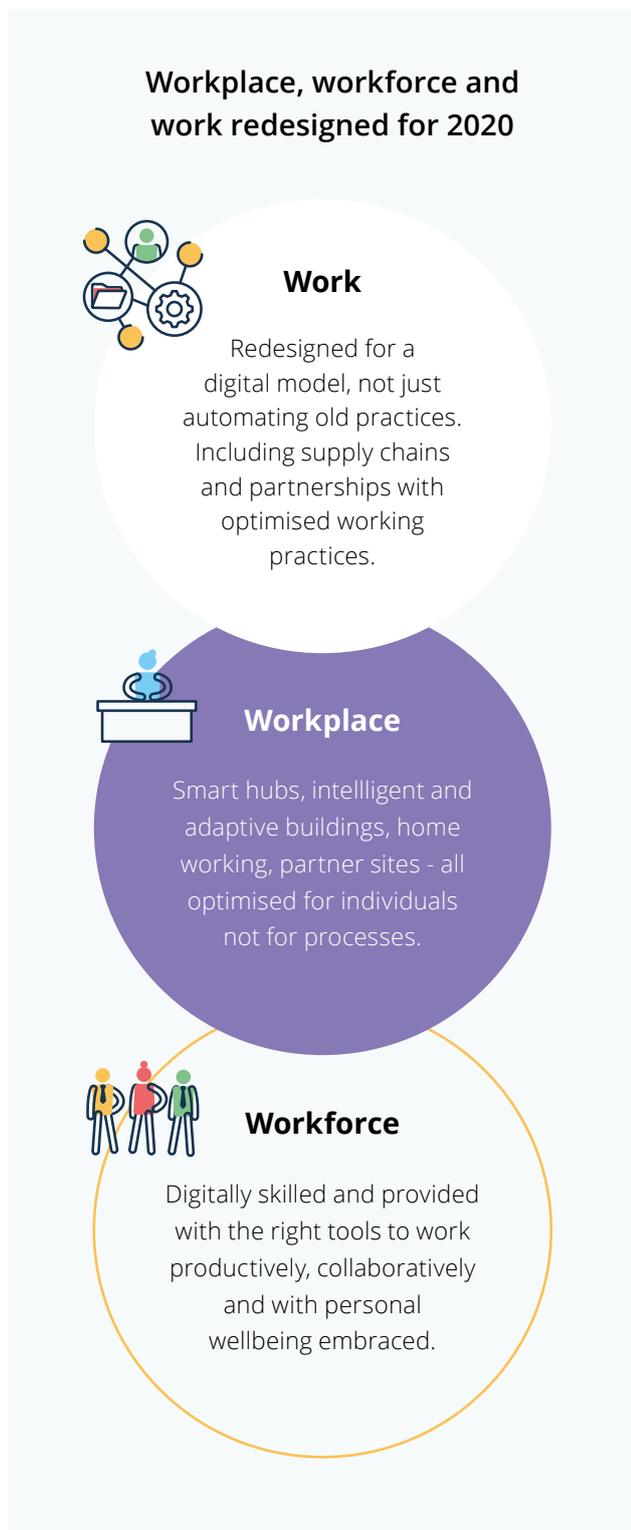
This is particularly true in how public service organisations meet the needs of citizens; business innovation does not come from technology alone. For example, whilst office space has often been rationalised, most people still travel to 'work', for at least part of the week, and 'the paperless office' remains elusive.

Also, whilst public sector jobs are more efficient today than they were a decade ago, because of ICT tools such as smart printing, 'bring your own device' and cloud computing, much of the adoption of new technology has automated traditional working practices. The benefits of this approach are reaching their limits in 2020:

- › 'Home working' is mostly in place, often with less footfall in offices (especially on Fridays!)
- › 'Hot desking' is common (although not ubiquitous) and has allowed public services to rationalise their property estates
- › Partnership working has grown, supported by ICT that allows disparate teams to collaborate virtually to solve problems
- › Remote working using cloud systems to support the public while on the move is common. But these benefits will plateau without a fundamental redesign of 'work'

In 2020, the opportunity (and arguably a growing necessity) for all public services is to move beyond this by harnessing data and new technologies to fundamentally rethink and redesign services – what is done, by whom and for what outcomes?

This means, for example, that HR, ICT and digital leaders in public services will need to combine their expertise to redesign work. This could potentially unlock a whole new era of public sector productivity, efficiency, customer service and work/life balance benefits:



Many offices were designed in a pre-digital age. They may offer 'hot desking' and automated low-energy heating and lighting systems, alongside room booking and space allocation software, with intelligence built into communications (mobile, video and collaboration spaces). But they are rarely truly intelligent buildings that can adapt dynamically to both the business and the personal needs of the individuals who work there, rather than the other way around.

In 2020 workplaces should become smarter, introducing presence detection technology, coupled with personalised IoT devices, so buildings modify organically to changing demands for different types of space and personal comfort.

These adaptive building systems will use artificial intelligence to learn from employees habits and preferences, and even anticipate needs – reducing some of the health and wellbeing issues that arise from poor working practices. Wearable devices in the workplace will go further in creating a symbiotic relationship between people and the buildings in which they work.

HR professionals, as specialists in organisational design and development, need to become digital leaders in promoting new technologies that can optimise space use, job design, matrix management and employee workplace comfort.

They also need to work with ICT and estate professionals, to address the obvious risks and downsides – people could be exploited as much as supported by these new methods, and technology can run away with its own possibilities, losing sight of its real purpose, which is to add business and social value.

Another related challenge for ICT and digital leaders in 2020 is to ensure effective mobile device management. Most public service organisations now allow personal devices as well as work-provided devices to be used, and this, coupled with the growth in IoT sensors and intelligent non-ICT equipment requires a new approach to infrastructure planning, network design and security maintenance.

Automation and robotics will also begin to change the composition of the job market for the public sector in 2020, bringing new organisational disruption and potential fears amongst workers of role changes and job losses. The public service organisations that anticipate this in the decade ahead will minimise the anxiety, disruption and displacement that this will inevitably bring.

Digital transformation and ICT development

The 'digital transformation' journey for most public service organisations will continue into the 2020s, with technology being the main catalyst for change.

With new technologies offering the possibility of new service models, there will be accompanying pressures on technology infrastructure, and ICT will need to become increasingly 'virtualised' in response: hardware, software and people.

The trend away from traditional ICT outsourcing and on-premise data centres will continue in 2020, but there will be growth in on-premise development capacity increasing. Typically, this will utilise agile methods. There will be a growth in low code and low cost tools. Apps, not big ICT applications, will be built.

ICT service organisations need to be careful how they support this, both to ensure they do not create legacy problems for the future, but also to avoid some of the cyber risks that can be associated with bespoke ICT development.

A number of public service organisations are also creating 'digital innovation hubs' to stimulate change and test risks. A careful approach is needed in the way systems are developed and designed, above and beyond using agile methods and co-design with end users. Many public service organisations are not yet ready for this.

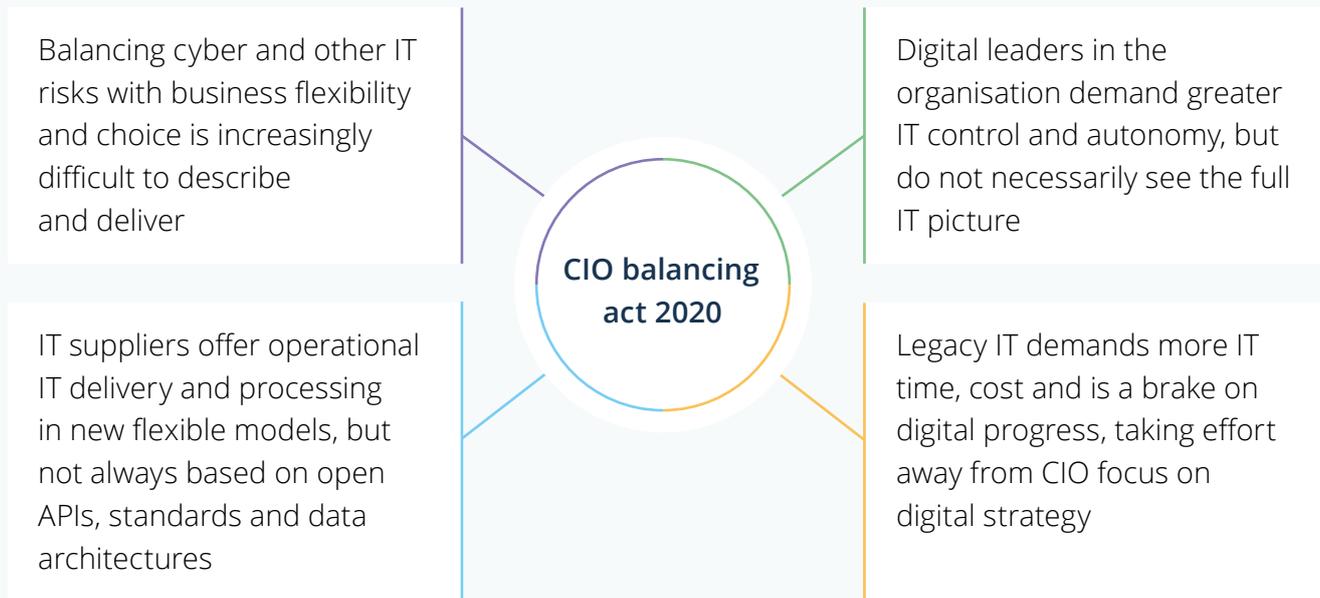
Fewer public service organisations will design ICT budgets around big application projects in the way they have previously. Today, developments in the public sector tend to be agile, modular and driven by the contribution technology can make to solving business

challenges facing the sector. For example, South Waikato District Council (New Zealand) is undertaking a project using business process mapping and automation to rethink the inputs for ICT developments.

For ICT and digital leaders this means several changes in 2020, if not already in place:

- **How data and systems architectures are designed**, since coherence is now required in ways not previously envisaged to allow data to be shared and linked, and systems to be dynamically adapted as changing circumstances dictate. Smaller, modular and non-proprietary (or flexible) systems are needed, with a strong core of standards and principles, and greater flexibility at the edge (where more processing will take place).
- **The role of ICT will need to continually change.** The ICT and digital leaders control is in some respects lessened, with devolved choices about digital solutions. This requires a rethink of the purpose of ICT itself in terms of its relationship with the wider organisation and its contribution to strategic outcomes. Does 'ICT' just get split between 'digital leadership' and 'operational ICT oversight'?
- **Corporate governance has to ensure a tighter coupling** between technology choices and service outcomes, without compromising corporate architecture. Topics such as cyber risk, digital strategy, ICT investment, information management and data strategies may demand changes in the organisation to avoid a fragmented approach to digital transformation.

The CIO and their ICT teams need the skills to steer a course through these challenges in 2020, since they offer an opportunity to expand the influence of the CIO and build a stronger basis for successful future digital change. But the reverse is also true. ICT and digital leaders failing to grasp this political and cultural change will find their roles diminishing in 2020 as technology, data and related decision-making activities are absorbed into digital teams or integrated into externalisation of ICT supply.



Digital skills for all

There has been a growing challenge for many public service organisations in equipping all employees, partners and ultimately citizens to become digitally-ready.

The challenge for the public sector lies in several areas for 2020:

- They are not as digitally mature as many private sector organisations where competitive pressures and commercial interests have forced a faster move to a digital operating model (and they care less about digital exclusion since it does not usually adversely affect profit)
- Senior leaders and politicians do not always understand digital opportunities and risks and are understandably focussed on the ‘human’ aspects of public service delivery
- Public services are typically able to support those less able to use digital means, for many reasons

All public services need to prioritise digital inclusion in 2020, whether in how digital services are designed and delivered, or in addressing any internet access barriers that still exist in some regions.

A number of ICT and digital leaders describe the difficulties that they have in working with senior executives to help them understand the risks and opportunities of new technology and the changes required to realise those, as well as the willingness of employees to adopt new ways of working.

“The skills necessary to manage new technologies are a key barrier, the positive impacts can be a definition of the new types of jobs for public servants.”

UK Council

ICT and digital leaders will need to work hard in how they promote technology investment, explaining the benefits and risks in business cases. This includes working with other professional colleagues in supporting them in job redesign.

Training and development to ensure people have the latest, most relevant technical knowledge takes time. As does building capabilities to embrace significant digital change. Both impact upon jobs and organisational cultures. This reskilling must extend not just to users of systems, but also to those involved in technology buying decisions, including service leaders, politicians and suppliers.

Ethics and human rights

Whether it be chat bots, artificial intelligence (AI), machine learning or the growth of the Internet of Things (IoT), technologies are becoming mainstream that 20 years ago would have been considered science fiction. AI is already widely adopted, but largely goes unnoticed. Coupled with the introduction of these technologies is the ability to leverage better insights from the burgeoning amounts of data that they generate.

As a society, the increasing application of these new technologies brings about significant ethical and human rights questions; will they be a force of good or something we should be afraid of? How do we derive the benefits, without causing harm?

In a recent Nesta blog,¹⁴ Geoff Mulgan sets out five ways that ethics needs to be radically reshaped to deal with the issues arising from the application of AI:

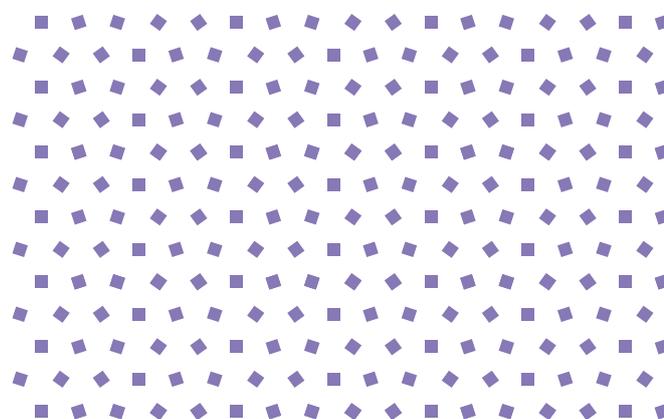
- Ethics as interpretation rather than code
- Attending to urgent current problems rather than vague long-term ones
- Thinking politically
- Addressing technological complexity
- Taking outcomes seriously and understanding how ethics intersects with social processes

Service design and the concept of 'design justice'¹⁵ is a case in point. The design processes used to harness new technologies can actively reinforce current patterns of discrimination as they exclude those who are most likely to be impacted negatively. Smart cities and places will automate not eliminate inequality without radical rethinking of the design process.

The Open Data Institute, Nesta, techUK and Socitm have all begun to explore these issues and to issue practical guidance.¹⁶

Elsewhere, Scottish Care has highlighted human rights issues arising from the application of new technologies in the complex and sensitive landscape of social care.¹⁷ Its Charter¹⁸ seeks to address human rights issues including proportionality, balance, engagement, inclusion and empowerment, non-discrimination and equality, accountability, legality and progressive realisation of rights.

Local public services will need to be leading the way in working with their communities to explore how they can address questions such as these in order to embrace and harness emerging technologies further in an ethical and safe manner. Their responsibility will be to prepare for the changes that result from the use and application of emerging technologies, using data in a more meaningful way and ensuring that it is embracing these capabilities to make improvements in public service delivery. They will need to improve digital capabilities internally, including the governance of ethical issues and the development of workforce competencies in response to the challenges.



Technology trends 2020

There are a range of emerging technologies and themes that are relevant to the public sector in 2020. These will form the bedrock of a re-invention of public services in all countries in the decade ahead.

Those raised specifically by public service leaders in this research are listed, starting with those seen as the highest priority:

- › Artificial intelligence (AI)
- › Internet of Things (IoT)
- › Cloud 2020
- › Data and information
- › Cyber security
- › Virtual and augmented reality
- › Driverless and assisted transport
- › Edge computing
- › Smart materials
- › Open-source, low-code and proprietary software
- › Drones
- › Biometrics
- › 5G developments
- › Quantum computing

The pace at which these emerge in the decade ahead will depend on many factors – geographic, economic and social. But all have a relevance and offer huge opportunities, as well as a number of sector-specific challenges.

Artificial intelligence (AI)

Although there are variations seen in this research across the various countries in terms of pace and level of investment, a growth in interest in and adoption of artificial intelligence (AI) in public services will be a significant global public services trend in 2020.

Until now, most AI applications in the public sector have been focused on improving workflows and in automating front-end citizen experiences, such as using Alexa (or similar devices) and chatbots in customer service settings. Robotic process automation (RPA) is also being used to simplify and reconfigure transaction processes, making them automated, less error-prone and more efficient.

For example, Napier City Council (New Zealand) is using AI and machine learning with virtual assistants and chat bots, linked with IOT, to improve its customer service centre response, and Bommerlerwaard Council (Netherlands) is trialling AI for customer response engagement.

These early instances of AI have been widely publicised, but are only just starting to reveal its possibilities.

In 2020 we will see the emergence of more sophisticated integration of artificial intelligence with back office systems, more automated decision-making and machine learning to anticipate individual customer needs, using natural language processing, augmented reality and other emerging technologies.

In the UK, AI pilots are already underway in a variety of cities to identify city hazards and patterns, checking in real time on operational 'events', such as overflowing waste, non-working lighting, illegal parking, pollution levels and public protection risks. In partnership

"Whose fault is it when a machine makes a mistake, error or a bad judgment?"

A UK Council

with Deacon University, the Police, Timaru District Council and the private sector, Ashburton District Council in New Zealand are exploring robotics, artificial intelligence and machine learning potential in a range of new public service application areas.

Just some of the other AI application areas being considered by public services that are likely to develop further in 2020, include:

- › Solving and preventing crime, linking social and Police data
- › Identifying cases of modern slavery, using automated related data intelligence
- › Anticipating natural disasters and mitigating their impact
- › Improving education and equality of access to learning
- › Managing transport, congestion and pollution problems in urban areas
- › Enhancing health and social care by seamlessly linking services and support
- › Reducing homelessness by better understanding its causes
- › Connecting public services together in the support of 'troubled families'
- › Predicting and preventing cyber-attacks, including those using AI as a weapon
- › Identifying those at risk of neglect or abuse through related data algorithms
- › Diagnosing complex social and medical conditions, risks and needs
- › Reducing the risk of accidents and the early diagnosis of health conditions
- › Managing traffic systems and reducing the impact of pollution

With the ever increasing volume of data, AI will help to manage processes and to analyse data to create new service responses and insight. Whilst this should help with efficiency and productivity, it will also significantly improve the customer service experience and join up public services across traditional organisational boundaries. In some cases, services will become not just automatic, but invisible.

In the private sector it has also been suggested that AI will drive productivity and automation, in order to reduce the hours that people work. But there is no strong evidence of this emerging from our research. The likelihood is that any productivity gains from AI will simply be absorbed by the growing demands being placed on public services.

Careful design will be needed to identify and mitigate risks and potential for AI abuse, as well as appropriate safety nets when things go wrong. This means that ICT and digital leaders need to consider governance and ethics around AI use, including using AI within a defined cyber security environment, especially in using personal data to manage the relationship between the state and its citizens.

A new era of AI-generated cyber risks and attacks is likely to emerge in 2020, for which public services need to be prepared. This includes detecting and neutralising democratic interference created by AI and combating the rise in manipulation seen in recent elections across the world, where social media and the marketing of false data have been used to influence outcomes.

Public concern will also grow, as AI applications become the norm, especially in how governments use these new technologies to categorise citizens and employees, using biometrics. China's Social Credit experiment and Google's work with smart clothing that can track what you do and where, and how you live have both received much publicity and are good examples of how these technologies can be exploited to implement unregulated use. Elsewhere, Singapore is leading with a national AI strategy¹⁹ designed to enable the governance and direction of AI developments.

Politicians in 2020 will be increasingly sensitive to growing public concern about how location data in particular is being used to create detailed personal profiles of us all. Whether regulation and control of the big tech companies follows remains to be seen.

ICT and digital leaders in 2020 need to ensure a strategic approach to the development of AI, avoiding a piecemeal adoption to drives efficiency and improve customer interface in silos. For example:

- › Reviewing digital and ICT governance to take account of AI
- › Developing a data ethics guide including risk management in AI algorithms
- › Defining how AI will be used and building a strategic plan
- › Identifying and tracking AI risks – both ICT and wider ethics/bias/privacy risks
- › Ensuring cyber strategies and technologies anticipate AI use and external threats
- › Developing internal training, awareness and communication for AI

Internet of Things (IoT)

The Internet of Things (IoT) is taking off rapidly especially in urban areas, with local authorities using sensors in a wide range of transport systems management scenarios in particular. There is also a range of exciting possibilities in tele-health and social care, helping people to stay in their homes for longer and providing remote support when needed.

“There is a perception that technology will always save money. IoT does drive efficiencies, but cost savings are usually not found.”

A UK Council

For the public sector, the next decade will see IoT used in a wider range of applications, such as asset management and control, equipment monitoring, and logistical planning. It will be used in new security access controls as well as optimisation of resources, tracking under or overuse, with centralised monitoring and reporting.

Currently IoT is still in its early stages of adoption, but this research reveals an expected surge in 2020. ICT and digital leaders will need to consider how to configure IOT infrastructures in such a way that it does not become a legacy management problem, or a security risk.

The concern is that IoT could grow organically and unchecked, appearing in more and more devices and systems, without control or adherence to standards, and create new unexpected costs. There is also some scepticism about whether the benefits are as tangible as some predict for 2020.

Many applications will depend on embedded sensors – in streets, buildings, workspaces and in other equipment. This creates new risks to networks from ‘back door’ intrusion, especially as some sensors do not yet carry their own security or access detection.

Equally of concern will be the task of managing all these new IoT devices, with their differing standards and protocols, often network connected, and it is likely to fall to ICT to find a way of tracking and monitoring these new assets for integrity.

At the same time, the opportunities for harnessing IoT in public services are unavoidable in 2020, even if the pace of take-up is slower than some expect.

For smart cities, IoT will create a backbone of civic intelligence. For example, IoT is being piloted in utilities in Timmins Council in Canada, and Glenn Eira City Council in Australia is using smart city sensors and AI to help with preventative maintenance of infrastructure assets. The challenge will be how to ensure some civic oversight, since these IoT applications will be introduced by a variety of organisations, in both the public and private sectors.

IoT will also yield rich data opportunities in 2020 that will help public services to manage resources more efficiently by detecting when intervention is required in transport, health, environmental wellbeing and many other areas.

Cloud computing

Cloud continues to offer a fundamental technology shift for the public sector, with most organisations surveyed expecting increased cloud usage in 2020. This trend will continue, replacing more traditional ICT outsourcing models, including a continued although gradual hybrid transition from 'on-premise' 'private cloud' to 'public cloud'.

The pace of migration to cloud in the public sector in 2020 will still be constrained by fears relating to security, data compliance, access management control, complexity of change and some supplier pricing models. The challenge of managing a large number of disparate and unrelated cloud services will prove to be a growing issue in 2020 for those ICT and digital leaders whose organisations have not ensured corporate control of cloud, resulting in data and access control overheads or risks.

Multi-cloud management mechanisms can help to reduce cost, improve payback and mitigate cloud risks for public services, and there are a range of actions ICT and digital leaders can take in 2020 to control their growing cloud service environments:

- Adopt recognised standards (technical and business) for cloud services
- Ensure data remains a corporate asset in distributed cloud services

- Test business continuity planning and ICT disaster recovery together, and with cloud suppliers
- Use cloud service management tools to mitigate the costs and risks of a 'multiverse' of cloud services
- Review due diligence assessments in selecting cloud suppliers and systems, ensuring risks and challenges are addressed
- Ensure ICT architectures embrace cloud, not as a 'bolt-on' but as an integral foundation
- Assess the skills, governance and policies for cloud adoption
- Define the changing balance between public and private cloud models
- Equip service leaders to be able to understand that cloud is a new business model, not a technology, and requires change in how people work and culture/practice regarding data

Public service providers not yet at this level of maturity will need to re-examine their approach to cloud in 2020. Especially given the growing dependence on cloud for the adoption of AI, robotic process automation (RPA), IoT, virtual reality (VR), integrated and automated services and big data.

Cloud will also stimulate changes in how public services are designed, delivered and governed, particularly in areas such as shared services, partnering with the private sector and mobile and flexible working for staff. Organisational change will need to embrace the full potential of cloud solutions and internal ICT teams will need to become a trusted broker of cloud solutions.

Data and information

Data is a critical resource for any public service organisation. But growing volumes of data and opportunities for its analysis will increase the challenges facing ICT and digital leaders in 2020, including how to connect and streamline data flows.

"The main risk of cloud computing is to lose control over resources and their boundary with respect to data privacy and ownership."

A UK Council



Despite progress, most public service organisations are still in the early stages of resolving the relationship between services and data, as well as how data can be used as the main ingredient for successful utilisation of customer insight, performance management and full service automation.

In 2020, public services will need to consider how harnessing data can improve services and enable AI, without creating big costs and new unquantifiable risks. This includes assessing data linkage opportunities that enable citizens to access their own data and automated services.

For all organisations involved in this research there is a growing focus on those data tools needed for visualisation and data mining, as well as exposing dark data and data risks. Data policies, principles, standards and architectures will be needed to underpin these developments, ensuring consistency and corporate control, rather than a data free-for-all across public service departments.

These are essential first steps in gleaning new corporate intelligence for re-orienting public services and their design, as well as ensuring control of data security, risk, compliance, privacy and ethics.

For example, South Grampians Shire Council in Australia is using LoRaWAN²⁰ gateways to run pilots for parking and monitoring waste management,

“Digital developments can increase resilience and security for public data, offering better life opportunities for citizens and better decision support systems for public services.”

A UK Council

using augmented reality and IoT that is more accessible and presentable, and thereby support improved data-driven decision-making.

In the UK, the London Borough of Barking & Dagenham has been undertaking a ground-breaking development.²¹ Its Social Progress Index (SPI) measures the social progress of residents at a neighbourhood level, with the aim of facilitating improvements to communities through intelligent, evidence-based action. Bringing together a rich variety of datasets, its metrics span health, wellbeing, noise and air pollution, rates of exercise and obesity, recycling and domestic violence.

In 2020, Socitm will be launching a harnessing data field guide to assist public services with these data challenges and opportunities.

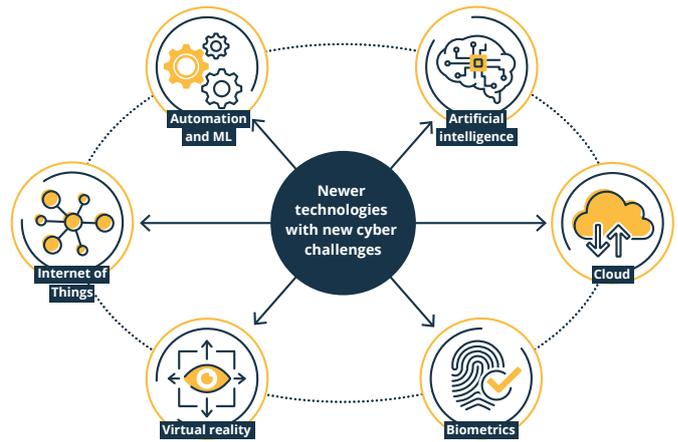
Cyber security

With the growing number of cyber-attacks and data breaches affecting all organisations, and predictions that most will suffer a serious incident at some point, all public services will be increasing the priority of their cyber resilience and sustainability in the year ahead. Indeed, 'cyber' usually appears as one of the top three corporate risks.

According to Gartner 2019 CIO Report,²² 95% of ICT and digital leaders expect cybersecurity threats worsen and many believe that their organisation is inadequately protected. Therefore, if cyber risk is not already being reviewed regularly at board-level in the public sector, then it needs to become so in 2020.

Not only will new technologies be employed by attackers, such as IoT, AI and natural language programmes, but the targets will change too, with potentially a greater focus on public services. We will also see a growing range of phishing attacks.

Although human error (and therefore the importance of awareness, training and accountability) are the top priorities in any cyber protection plan, work by Socitm in 2019²³ identified a range of technologies likely to be implicated as the source of increased risk in 2020:



At the same time, there will be a range of new tools available to ICT and digital leaders in 2020 to help to protect their organisations, using some of the same technologies as the attackers, such as AI.

As ICT and digital leaders grapple with a changing cyber threat landscape in 2020, three factors are cited by ICT and digital leaders as the main reasons that cyber security protection planning can be undermined:

- › A lack of visibility of vulnerabilities at all levels, from executive teams to ICT
- › Inadequate security resources (people and technologies)
- › A reliance on manual processes, rather than automated protection

These three should be considered specifically in 2020, assessing the adequacy of 'cyber hygiene' in public service organisations, especially as they begin to adopt new technologies such as IoT, AI and RPA.

"There is a lack of government standards for cyber security - for example, IoT. This would help to boost public confidence to adopt technology."

A UK Council

Some argue that the risks are lower in the public sector because the data is less valuable than, say, a large private company with intellectual property to protect, or a vast and valuable customer database. But they are missing key factors that today make public services a likely target.

Five reasons why public services are a target for cyber attacks in 2020



1. Public services hold a wide range of valuable, sensitive and personal data about employees, politicians, partners and citizens
2. Vulnerable people depend on public services. The impact of a cyber event may severely affect lives and wellbeing and create wider disruption
3. With joined up public services, attackers may target those weaker organisations to gain access to most valuable data or systems
4. Public services own and manage a significant amount of high-value assets in money, buildings and equipment - a major target for fraud
5. A local civic event can cause as much disruption, press coverage and political focus as a national event, which is what terrorists seek

A specific area of focus for ICT and digital leaders will be identity management for staff and for citizens. Some national governments have made impressive progress in developing national standards for digital identity which offer considerable protection. Others, such as the UK, are still considering how to rationalise the wide range of different authentication and ID methods, as well as the how to address cultural concerns of the public about national identity schemes.

In the absence of a national lead, public service organisations need to state in a coherent and consistent way, how they will ensure appropriate authentication and identity management in delivering and designing digital services, both for employees and citizens.

Finally, GDPR breaches and investigations will increase in 2020, after a period of some relaxation as the new Act was given time to bed in. We can expect to see more public service organisations challenged by their Information Commissioners and held to account for breaches where they have been negligent or insufficiently aware of data risks.

We may also begin to see more civil action taken by citizens against public services where there are poor practices in the management of personal data.

However cyber risk is managed and security protection implemented, it is not a topic that can be left to ICT and digital leadership alone; it needs executive (and where appropriate, political) oversight and accountability as well, and a culture that makes everyone responsible for their part in protecting the business of public services. With growing public concern about how governments use personal data, trust in digital government may become a defining issue in 2020, especially as more intelligence and automation are built into public services.

“As organisations digitally transform, they might not know how to operate without these information systems in an emergency. If a natural disaster occurs, can the service continue? What happens if there is a cyber attack locking out our systems by malicious encryption?”

A UK Council

Virtual reality and augmented reality

Virtual reality (VR) immerses users in a fully artificial digital environment, and augmented reality (AR) overlays virtual objects and other information onto this, or onto a real-world environment. Both of these technologies are growing and will become more commonplace in 2020, offering a wide range of potential applications for the public sector.

Today the leading applications are in the leisure industry and gaming. But there are emerging case studies for the public sector, including civic design, planning, employee training in areas such as firefighting, education, engineering and rehabilitation in health care.

In Queenstown Lakes District Council in New Zealand, visualising data using AR is helping with planning rules and proposed developments, including hidden assets such as underground walls.

The high cost of initial adoption of VR/AR has limited the pace of development and the range of available applications suitable for the public sector, so 2020 is unlikely to see more than localised experimentation in specific application areas, rather than mainstream adoption.

5G developments

2020 will see the introduction of promised 5G mobile solutions in many countries, including the UK. However, 5G benefits will take time to emerge,

“Augmented reality and virtual reality have a massive potential to transform government services and city interactions.”

Kaipara District Council, New Zealand

and may not be as big for business as some governments and many suppliers suggest, at least in the public sector. The majority of countries are still auctioning spectrum availability, which means that the availability of 5G compatible equipment may only begin to appear in the latter part of 2020.

Some involved in this research report that “5G is just too new” (New Zealand council), whilst others are already exploring possibilities: “5G pilots are already happening in several places across Tasman District Council area in New Zealand.” Other suggest that the advent of IoT with 5G capabilities will offer opportunities to detect and respond to a wide range of events, leading to the creation of a ‘zero emergency city’.

In any event, for public service organisations the priority has to be to ensure universal broadband and mobile coverage, given many rural areas today lack even basic internet speed and access. This is surprisingly true even in densely populated countries such as the United Kingdom. For example, on the Isle of Wight in the UK, the council is working with businesses to provide gigabit fibre broadband to more than 50,000 homes and businesses across the island.

In 2020, broadband, mobile and Wi-Fi in the home are becoming universal needs and differentiators of equality, more critical to the development of digital public services than the rollout of 5G.

Drones

Drones are becoming increasingly used in a range of public service applications, especially in local government. Examples include traffic monitoring, safety assessments, remote emergency support and insight into difficult to reach areas.

For example, New Plymouth District Council in New Zealand is using drones with radar mapping in rescue and disaster situations, and Hampshire in the UK is using drones to map maintenance issues on physical assets, e.g. education buildings.

In 2019, Socitm published a report²⁴ looking at the future of the technology for the public sector, the ethical, social and practical implications of drone

usage, and the practical steps that local councils need to take. A very recent report by Nesta predicts that drones could save the UK public sector £1bn.²⁵

Public services in general and local councils in particular should seriously consider the scope for using drones to improve public safety and civic infrastructure management.

Biometrics

Biometrics are already used widely on smart phones, using fingerprints and facial recognition in particular. These technologies are increasingly being used to retrieve and to link data, offering new service opportunities as well as creating new risks.

While applications today are restricted to areas such as retail and security, its use will broaden in 2020. Biometrics will be used to help secure a range of sensitive public services. Particularly in more complex and AI-driven, self-service applications where stronger authentication is necessary.

Open-source, low-code and proprietary software

Open-source is not new, but in 2020 it is changing from the binary proprietary or free open-source into a more subtle mix of the two, and ICT and digital leaders in the public sector should be considering this in their policies for ICT procurement and their applications environment.

The original aim of open-source was to drive down cost and create a more open environment for sharing tools, development, common standards and data, free from proprietary constraint.

Governments were quick to support this, seeking to unlock themselves from inflexible and costly ICT vendor environments. In the UK, for a period at least, the Government Digital Service (GDS) mandated open-source – which led to a range of procurement misjudgements being made, following dogma, not common-sense. Today, more pragmatism holds sway.

For most public sector ICT and digital leaders, ICT cost will be a major factor in 2020 in deciding on the mix of development tools. The choices are not easy, with a range of cost profiles for both open-source and propriety options. Linux, Python, GitHub, Vim and more all have their place in the armoury of software development, but typically alongside proprietary tools.

In 2020, openness, flexibility, common standards and low cost is achievable in both proprietary and open-source environments, with different profiles of risk and complexity dependent on the scale and integration required of the application. There are a range of free or cheap apps, low-code development tools (where the technology is hidden) and open-source options, alongside more widely recognised proprietary offerings – most available only in the cloud.

ICT and digital leaders in 2020 should reassess their software portfolios, development methods and ICT procurement policies, building a portfolio of tools and software assets that offers sufficient flexibility to meet changing and often ill-defined digital priorities. Their choice between open-source and proprietary solutions, should consider more than functional needs, costs and risks for a specific purpose in an acquisition.

For example, underlying proprietary cloud platforms which once were low cost may become more costly as suppliers gradually increase pricing, and care is needed to avoid lock-in:

- How proven is the chosen solution and is it complex to use?
- Is it a niche solution in a closed environment – e.g. a discrete line of business app?
- Is it a key part of an infrastructure where resilience is critical and are there specific cyber issues such as the sensitivity of data or access requirement?
- Does it offer common, open APIs and standards, especially regarding data structures?

- › How complex is the integration, data sharing and data linkage requirements?
- › Can direct and indirect costs be quantified and is there an option to exit easily if costs start to increase?
- › Is this an agile and low-code environment where it matters less about 'tech under the bonnet' and how does the wider supply chain work?
- › What skills, training and support costs will be required internally?

Beyond 2020

2020 is the start of a new decade. Not everything will happen in 2020 and some technical developments will take a little longer – but their journey will begin this year.

Driverless and assisted transport

Autonomous vehicle technology continues to develop, but as Socitm correctly predicted last year, at a much slower rate than some had expected. There are still technical issues to resolve, but significant problems of risk, liability, insurance and legal aspects are proving more challenging.

It is likely therefore that we are still a few years away from seeing mainstream adoption of fully autonomous, self-driving vehicles which would require potential changes to traffic management systems and urban design of parking and amenities.

2020 will see growth in assisted driving and use of driverless vehicles in specific circumstances where legal and risk concerns are contained, which will pave the way for driverless cars in the future.

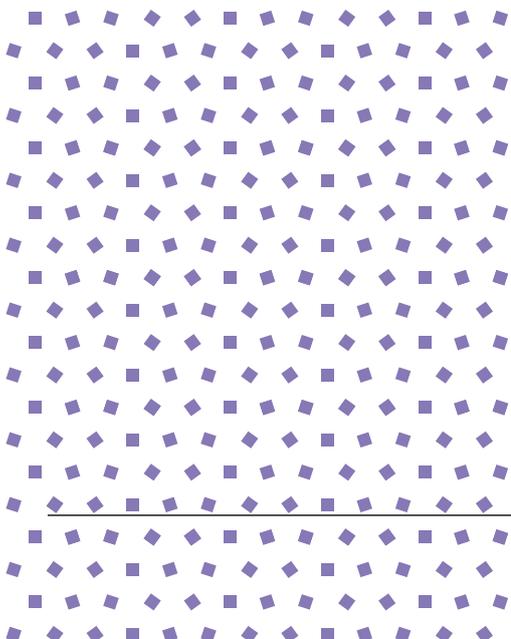
For example, driverless cars are being trialled in pilot projects in Greenwich and Milton Keynes, UK and in Western Bay of Plenty District Council, New Zealand, with the prospect of changing the way that parking, public and private transport and roads are managed. Palmerston North City Council in New Zealand is exploring how electric vehicles, drones and the future opportunities for driverless cars can reduce environmental impacts. Micro co-ops for power generation are being considered to complement this development.

Local authorities in particular will need to consider these opportunities from 2020 in road management and infrastructure planning, including the location of electric charging points and sufficient parking with integrated public transport where required. In the longer term, reductions in the need for parking will likely have significant impacts on local authority revenue streams.

Smart materials

'Smart materials' is a growth area in tech development, rapidly moving from the laboratory into the mainstream. These materials are designed to respond to changing conditions in their surroundings – such as heat, pressure, moisture level, or electricity. They may become more tense, change colour or shape, or trigger an alert for example.

Although the public service applications are likely to be initially in areas such as health and social care, there are other areas in future where this technology has relevance, such as safety, energy management, civil engineering (bridge and building stress alerts), environmental protection and reducing waste.



Edge computing

Predictions about the growth in edge computing mean this cannot be ignored for the public sector in 2020. Edge computing involves extending and moving cloud infrastructure, data and apps and processing closer to where the data originates. This offers faster processing, essential for a wide range of developments, such as voice recognition, in IoT processing and AI.

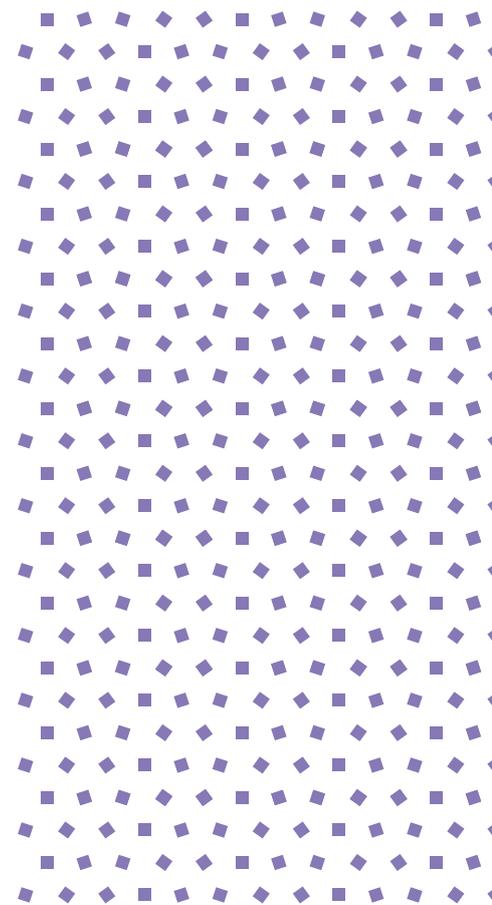
This approach will require ICT and digital leaders to consider how they structure overall processing of data volumes, not just for 2020, but for planning beyond this, probably as part of three main trends covered elsewhere:

- AI development in general and specifically voice-activated interfaces
- IoT growth, creating data volumes and a need for local processing
- Development of the next generation of distributed public cloud applications

Whilst edge computing may not be an immediate issue for ICT and digital leaders, it does need to be kept in scope with its potential for harnessing emerging technologies effectively and balancing the data processing loads that they generate. Understanding the implications in terms of assessing supplier offerings, managing distributed data and GDPR compliance, and exploiting the changing nature of public and private cloud-based services will become increasingly important.

Quantum computing

Quantum computing has the potential to make a significant contribution in a whole range of public service applications, particularly in areas such as complex health analytics and security in sophisticated and advanced multi-agency sharing arrangements. However, whilst the science is exciting, it will be some years before this has a practical take-up in the public sector and will need to be proven in the private sector first.





Conclusion

This is the first time that a global study of public sector technology trends has been attempted, reflecting the common issues and priorities of public sector organisations shaping their diverse places and delivering services. The trends identified in the report give an indication of the technology and digital trends likely to feature in early adoption by innovative public sector organisations.

These organisations are facing a growing range of international, national and local challenges. Common amongst these are democratic renewal and reinvigoration, environmental sustainability, social and healthcare pressures, and expectations generated by emerging technologies and the data that they produce. Underpinning all of these challenges are the softer culture, leadership, organisation, community and digital literacy issues that warrant consideration if digital leaders are to make a success of the growing technological capabilities available to them.

With limited resources, the opportunities for technology to support public service design and transformation will create a new focus and roles for ICT and digital leadership in the public sector for the decade ahead. This is a chance for ICT to take time to review ICT strategy, what needs to change and what might be the next 'big thing' in ICT.

All the ICT and digital leaders we spoke to in this research are grappling with a balance between digital transformation and the need to rationalise traditional legacy ICT infrastructure. Sharing best practice amongst the LOLA and MCE organisations involved in this research can help to support learning, and also to tackle the complex digital issues such as data ethics, digital identity management and the new risks associated with the fast-emerging technologies covered in this report.

The technologies that will become mainstream in 2020 and beyond, such as AI, IoT, VR, wearable technology and personal apps, offer enormous, untapped potential for public service organisations to rethink not just how they operate but, fundamentally, to reconsider what they do. This research also found a strong and consistent concern for greater control or regulation, to ensure that as services become more personal, intelligent, automated and integrated, new risks are understood and addressed.

Overall, however, there is much optimism amongst public service ICT and digital leaders across the world about the opportunity for technology to truly transform the nature of what they do for the public they serve, and also for their part in that transformation. 2020 heralds a new era of citizen-centred digital services.

Appendix 1

Methodology

The work for this research has been based on interviews, a global survey of public sector ICT and digital leaders and a small group of experts assessing and producing the report. The pre-agreed objectives included:

- › Bringing together the views of professional associations and their members, representing public services across the world, analysing similarities and differences
- › Considering the real impact of technologies – which new technologies will emerge from experimentation and speculation to mainstream and practical usage in the year ahead and why?
- › Rationalising the views of consultants, academics, researchers and ICT suppliers in the context of the view of public sector leaders
- › Keeping it simple, with a focus on practicality and avoidance of jargon. Sometimes technology predictions are so focused on fashionable ICT trends and terminology that they can lose sight of the application risks and limitations
- › Identifying which technologies will have the biggest and most positive impact on the challenges, issues and opportunities facing modern public service organisations
- › Noting case studies, quotations from professional leaders, and practical and referenceable examples to accompany the analysis
- › Considering if there are similarities and differences between the public and private sector in terms of specific technologies

- › Considering whether there are differences between countries or between rural and urban local councils (e.g. cities and wider rural communities) in how technology is prioritised and used

This research has also been about digital, not just ICT trends; the cultural and business impact of changing working styles and cultures will be as significant as the technology that enables them. For example, the implications of digital operating models and how they are changing our public services and the role of ICT. This might include cyber being much more than just ICT security and AI impacting topics such as democracy and data ethics.

In particular, the research considers how public sector organisations in 2020 can set a lead in delivering ICT for public good, and what this might mean in terms of regulation, standards, policies and digital strategies.

Survey questions used

LOLA and MCE administrative groups were asked to coordinate responses from their members. This included CIO/ICT leader quotations and case studies (online links or single paragraph descriptors) relating to the main topic headings.

The questionnaire used by MCE and LOLA groups to canvass views of their members was as follows:

Q1: Can you name the top three emerging technologies that you regard as having the potential to make a positive impact on local public services over the next one to three years?

Q2: Are there technologies being talked about that you see as a longer term interests, rather than immediate priorities?

Q3: For each of these technologies, can you identify any existing pilots and/or implementations, case studies and quotes?

Q4: What do you see as the main barriers and positive impacts, both digital and technological?

Q5: What are the main risks and concerns about technology trends for local public services?

Appendix 2

Feedback on ICT/digital barriers and challenges

Challenge or barrier	"What are the barriers and concerns you face in 2020?"
<p>Legacy ICT constraints and a lack of skills (ICT and wider)</p>	<ul style="list-style-type: none"> ➤ "Existing legacy systems and having sufficient in-house technical/business analysis staff [to tackle them]" – New Zealand council ➤ "We can't change the [ICT] infrastructure overnight" – Belgium council ➤ "ICT specialist's mentality" – UK council ➤ "Being able to implement these new technologies easily" – Australian council ➤ "ICT strategy needs to be adjusted and corrected", "living labs are possible, but how will we be able to get those 'proof of concepts' to be mainstream?" – Belgium council ➤ "Aging infrastructure and cost of investment in technology" – New Zealand council ➤ "Skill sets locally to support new technology and to dedicate resources to digital transformation and away from BAU" – Australian council ➤ "Skills necessary to manage technologies are the key barrier" – UK council ➤ "The main risk is that we want to evolve too fast" – Belgium council ➤ "Time and money, but expertise is a close third" – New Zealand council
<p>Capacity and prioritisation constraints</p>	<ul style="list-style-type: none"> ➤ "Prioritisation with other time-critical projects" – New Zealand council ➤ "Municipalities are struggling with the sheer amount of change taking place" – European city council ➤ "Competing and incompatible network solutions" – New Zealand council ➤ "The sheer volume of competing solutions and the pace of change" – New Zealand council ➤ "We have the tool sets; we just need more time!" – New Zealand council ➤ "Having enough time to keep an eye on the emergence of new technologies" – New Zealand council

<p>Public perceptions and support</p>	<ul style="list-style-type: none"> ➤ “Public opinion forcing adoption of a technology before it is fully mature” – UK council ➤ “Public perceptions, and employment fears [are barriers]” – New Zealand council ➤ “The main concern is how the public would regard failure” – UK council ➤ “Dealing with the digital divide – we need to maintain parallel systems” – UK council ➤ “Adoption [of digital methods] by older people” – New Zealand council ➤ “User experience” – UK council ➤ “Automation is at the cost of a closer relationship with the public” – New Zealand council ➤ “Making [digital] user friendly” – UK council ➤ “Public perception and the [potential] loss of community connection” – New Zealand council
<p>Privacy and security concerns</p>	<ul style="list-style-type: none"> ➤ “Security of citizen data and information” – UK council ➤ “Cyber remains a concern, especially ransomware” – New Zealand council ➤ “Cloud insecurity and loss of control of data when moved to the cloud” – UK council ➤ “Lack of government standards for cyber security – for example, IoT” – UK council ➤ “Maintaining the trust of our citizens in an increasingly risky environment” – UK council ➤ “Security and privacy is the biggest concern” – Netherlands council ➤ “Software and data security issues” – UK council ➤ “Being secure and not introducing high risk or reputational loss” – New Zealand council ➤ “Creation of a less reliable city environment from technology vulnerabilities and dependency on the market” – UK council ➤ “Protection of citizen privacy” – UK council
<p>Lack of government standards</p>	<ul style="list-style-type: none"> ➤ “Lack of a national strategy or approach” – New Zealand council ➤ “We need a single national standard for citizen identity across multiple services” – a variety of councils ➤ “Anachronistic legislation” – UK council ➤ “AI has ethical issues that need to be addressed” – Australian council

<p>Staff resistance to change and new methods</p>	<ul style="list-style-type: none"> ➤ “Resistance from people wanting to stick to traditional methods and systems” – New Zealand council ➤ “New ICT investment benefits are not realised” – Australian council ➤ “As barriers, I see human resistance as an important factor” – Belgium council ➤ “Old habits that stick” – Australian council ➤ “Municipalities are historically slow to adapt and to change attitude/work practices” – European city council ➤ “Lack of organisational maturity [for digital] and skills” – New Zealand council
<p>Financial constraints</p>	<ul style="list-style-type: none"> ➤ “Fiscal constraints”, “cost of implementation”– Various responses ➤ “There is a risk of investing in technologies, not real-use cases” – UK council ➤ “‘Proofs of concept’ are necessary but time-consuming and expensive to do without realising immediate benefits” – New Zealand council ➤ “We tend to be quite risk-averse due to resourcing” – UK council ➤ “No funding and no collaborating makes for a difficult transformation from the old to the new” – Australian council ➤ “The main barrier is the budget shift necessary to fund new technologies”, “living labs are possible, but how will we be able to get those ‘proof of concepts’ to be mainstream?” - Belgium council ➤ “The R&D cycle and the budget to implement - Canadian council ➤ “Lack of funding for necessary digital investment and change” - UK council ➤ “Not wanting to lose lots of money on existing investments in old and wrong software and processes” - Australian council
<p>Lack of executive and CEO buy-in to digital change</p>	<ul style="list-style-type: none"> ➤ “Getting executive buy-in [for digital methods] and the value they bring” – New Zealand council ➤ “It’s not a ‘safe to fail’ environment – every dollar counts” – Canadian council ➤ “Decision-makers have too little understanding of the technology to be able to be able to think of applications” – UK council ➤ “Awareness and management” – Netherlands council ➤ “[Lack of control over] shadow ICT and the ease with which people can purchase and implement” – New Zealand council ➤ “HR resources and capability” – UK council

Problems with partners or shared services	<ul style="list-style-type: none"> ➤ “Resistance from local government agencies to collaborate” – New Zealand council ➤ “Going in a different direction to other councils so that opportunity for interconnection, data exchange and just collaborating are missed” – New Zealand council ➤ “Digital services would be more valuable for our customers if we could coordinate them and do joint development across regions” – New Zealand council
Business change capability	<ul style="list-style-type: none"> ➤ “Change is our main barrier, both managing the change to something different and the cost of shifting people/cultures/processes to align with new ways of doing things” – New Zealand council ➤ “We just don’t move fast enough” – Australian council ➤ “Culture and attitude to risk” – UK council ➤ “Getting the balance right between existing and emerging technology to meet our customer needs” – New Zealand council ➤ “Procurement processes and costs” – UK council ➤ “Living labs are possible, but how will we be able to get those ‘proof of concepts’ to be mainstream?” – Belgium council ➤ “Bureaucracy in local government” – New Zealand council ➤ “Integration [of new tools] with ERP systems” – UK council
Supplier and industry issues	<ul style="list-style-type: none"> ➤ “Lobbying from industries to delay change always slows things down” – New Zealand Council ➤ “Cost of integration and deliverable solutions from software providers” – UK council ➤ “Pricey software that does not always provide a return in savings to ratepayers” – New Zealand council ➤ “Partnering with the wrong organisation or in using technology that become obsolete” – New Zealand council ➤ “We need a lower cost entry point due to size of budgets for those that are not large councils” - UK council ➤ “Finding affordable implementation partners who have a track record” – New Zealand council
Poor broadband and internet access	<ul style="list-style-type: none"> ➤ “In our case, the main barrier is internet speed” – New Zealand council ➤ “Accessibility [that] provides public access to relevant data” – Australian council ➤ “There is not enough fibre in the ground to enable the speed [required]” – UK council

Insufficient political support for risk and investment

- › “Cost vs the willingness of councils to invest” – Australian council
- › “Superficial interest by politicians” – UK council
- › “Management and politics!” – Belgium council
- › “Managing change with a risk-averse council environment” – New Zealand council



Appendix 3

Participating organisations and acknowledgements

This research is based on input from many people and many organisations, too many to list and name individually. It would not have been possible without input from different ICT professional associations representing local public service organisations across the world.

Particular thanks go to the UK's Society of innovation, technology and modernisation (Socitm) and the Association of Local Government Information Management in New Zealand (ALGIM) who jointly coordinated the work with the Linked Organisations of Local Authorities ICT Societies (LOLA) and Major Cities of Europe (MCE).

Specific thanks are due to three organisations and people in particular: LOLA and its Secretary also CEO of ALGIM New Zealand, Mike Manson; Socitm UK and its Director of policy & research, Martin Ferguson; and MCE and its Vice President, Glyn Evans. Without their personal support, time and cajoling, this research would not have been possible.

Thanks also to the presidents and ICT and digital leaders of the main councils in the different countries who gave their personal time and support to this work, encouraging discussions and giving survey contributions.

International member organisations

International professional associations supporting this research directly and/or through involvement of their members:



ALGIM - www.algim.org.nz

ALGIM (Association of Local Government Information Management) provides professional development and thought leadership across a range of local government professions in New Zealand. We support traditional ICT roles, ICT infrastructure, web and digital, information and records management, customer service and GIS. Our vision is a digitally transformed, local government sector. Our mission is bringing people and technology together to deliver better services.



GMIS - www.gmis.org

GMIS International is a professional ICT association of worldwide government ICT and digital leaders based in the USA, dedicated to providing best practice solutions through professional development, training, conferences, awards and networking.



Kommits - www.kommits.se

Kommits is a forum for Swedish municipalities to exchange experience and discuss digitization issues and to access advance information from suppliers.

Local CIO Council - <http://bit.ly/39YfUDD>

The purpose of the Local CIO Council is to set and lead the vision and strategic direction for ICT and digital policy for local public services in the United Kingdom and to facilitate local commissioning and implementation of strategies and initiatives for digitally-enabled, local public services reform.



LOLA - www.lola-ict.org/who/executives/gmis

LOLA (Linked Organisation of Local Authority ICT Societies) is a non-profit organisation of international ICT professional associations. These associations comprise professionals who work in local authority and other local public service delivery organisations and their suppliers, in different countries worldwide. We aim to make a significant contribution to the development of European and/or international ICT standards, codes of good practice, cross national projects coordination and potentially drawing on national and European funding to achieve these objectives.



Mav Technology - www.mavdigital.com

MAV Technology is an independently funded group of local government ICT, digital and business transformation practitioners, who are committed to demonstrating leadership to improve council and community services in the Australian state of Victoria.



MCE - www.majorcities.eu

Major Cities of Europe – ICT Users Group is composed of leading experts of innovation in cities and focuses on maximising the value its members gain from their investment in ICT. It shares and disseminates best practice and identifies the key and emerging topics of city innovation.



MISA/ASIM - www.misa-asim.ca

MISA/ASIM (Municipal Information Systems Association/ Association des Systèmes d'Information Municipale) is the national voice of municipalities relating to information and communications technology in Canada, facilitating collaboration and sharing of information among municipalities and member associations.



Socitm - www.socitm.net

Socitm is the society for innovation, technology and modernisation for local public services in the UK. Its vision is to be the preferred network for professionals who are shaping and delivering public services. Its members benefit from being part of a growing community where collaboration is key. It brings people together to share experiences and best practice while learning from each other to the benefit of the public sector as a whole. Established for over 30 years, it continues to challenge convention, inspire change and power progress.



VIAG - www.viag.nl

VIAG is the professional association for persons working in the local government in the field of information and communication technology.



V-ICT-OR - www.v-ict-or.be

V-ICT-OR is the umbrella organisation for information and technology at the local government level, and the creator of the Flemish Virtual Municipality.

Public service organisations

The main contributing organisations that completed the survey and/or provided valuable insight and quotations are as follows:

Australia

- > City of Geelong
- > Surf Coast Shire
- > Northern Grampians Shire Council
- > Glen Eira City Council
- > City of Stonnington
- > Southern Grampians Shire Council
- > Monash City Council

Belgium

- > Westerlo
- > Stad Eeklo
- > Kortrijk
- > Berlaar

Canada

- > Timmins

France

- > Aix-les-Bains

Italy

- > Florence
- > Prato

Netherlands

- > Bommelerwaard

New Zealand

- > Selwyn District Council
- > Northland Regional Council
- > Palmerston North City Council
- > South Waikato District Council
- > Wellington Water
- > Napier City Council
- > Kaipara District Council
- > Ashburton District Council
- > Tasman District Council
- > West Coast Regional Council
- > Timaru District Council
- > Horowhenua District Council
- > Environment Canterbury
- > New Plymouth District Council
- > Kawerau District Council
- > Western Bay of Plenty District Council
- > Queenstown Lakes District Council
- > Whangarei District Council
- > Horizons Regional Council
- > Central Hawkes Bay District Council
- > Whakatane District Council

United Kingdom

- > Scottish Fire & Rescue Service

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- ⁶ Smart places: <http://bit.ly/2Vnfmnm>
- ⁷ A good example is Barking and Dagenham Together - Borough Manifesto: <http://bit.ly/38O0Urx>. This is featured in Socitm's Inform Briefing: <http://bit.ly/37J5g21>
- ⁸ Health and Social Care Integration - The Case for Place: <http://bit.ly/2HFCZPj>
- ⁹ <https://nationalperformance.gov.scot>
- ¹⁰ United Nations Sustainable Development Goals: <http://bit.ly/39S8Wjh>
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- ¹² Digital politics: reframing our politics for the digital age: <http://bit.ly/2vQ0bYm>
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Jos Creese is an independent, digital consultant, researcher and analyst. As an associate director for Socitm and a past president, he has undertaken a range of activities and research projects for Socitm, including a tech trends report for the past few years. He has also worked for a number of LOLA organisations, including ALGIM.

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