Chapter 6

Emerging Directions in e-Government

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This chapter looks at two recent developments in the area of e-government – mobile government and cloud computing – with a view to understanding how small states can utilise these technologies to enhance their ICT offerings now, or in the future.

Since the emergence of e-government in the late-1990s, citizens have become accustomed to being able to access government services electronically (Grönlund 2004). The dominant focus of governments in the last decade has been to automate government services to ensure they are suitable for an online environment, but strategies for service delivery have had a limited purview, neglecting numerous technology channels already harnessed by the private sector (Al-khamayseh et al. 2006). In particular, the rapid growth of wireless technologies in the developing world has exceeded that of wired line – especially in small states – obligating states to ensure mobile devices are considered as a necessary front-end delivery channel to access public services, reduce corruption and increase accountability. Mobiles have also proved a more attractive proposition for government from a financial perspective, with the infrastructure required to support their proliferation cheaper than fixed-line alternatives, and the multiple points of access contained in a single device – voice, SMS, MMS (multimedia messaging service) and broadband.

The need to reduce the capital costs associated with e-government has also led to the increased use of cloud services within both government and the private sector (KPMG 2012). While definitions vary, cloud computing aspires to reconceptualise the use of ICT systems in government as a utility cost that enables ubiquitous access to multiple applications, while reducing both the technical and human resources normally associated with e-government. The primary attraction for small states is that cloud technologies are elastic and can be scaled according to demand. The removal of large, up-front capital costs also ensures that government policy is not driven by long-term technology solutions to which states can sometimes become locked into. Furthermore, emerging standards on procurement and implementation should go some way to allay concerns around the outsourcing of ICT systems, particularly with regards to privacy and performance.

6.1 What is m-government?

M-government can be viewed as an extension, or supplement, to more traditional e-government models. The latter describes the use of wired technologies to facilitate the flow of information within and without public sector institutions to improve the efficiency, accountability and effectiveness of state services. Building on this definition, Kushchu and Kuscu define m-government as 'the utilization of all kinds of wireless and mobile technology, services, applications and devices for improving benefits to the parties involved in e-government including citizens, businesses and all government units' (2003). This definition presupposes the need for an e-government strategy, and in most cases countries are likely to utilise mobile devices as an alternate or extended delivery channel for services already offered via wired devices. However, e-government is not necessarily a prerequisite for m-government, particularly in the developing world where mobile phone penetration often far exceeds fixed-line infrastructure (ITU 2011). Mobile devices also offer a unique platform to go beyond the scope of what wired technologies can offer, for example in providing location-based services for emergency service professionals.

However, the mere automation of government services does not fully exploit the transformative potential these technologies offer. Mobile devices, if fully harnessed, can potentially facilitate a paradigm shift by enhancing the capacity of citizens to engage with government, thereby increasing social inclusion. The latter approach is better encapsulated under the term 'm-governance', which implies the potential to 'bring about a change in the way citizens relate to governments and to each other' (UNESCO 2005) and 'brings forth new concepts of citizenship, both in terms of citizen needs and responsibilities' (ibid). Ultimately, the 'objective is to engage, enable and empower the citizen' (ibid).

6.2 Why m-government?

The rationale for the development of m-government applications can be disaggregated as follows:

- **Accessibility**: Mobile phone penetration in the developing world has now reached 79 per cent, with twice as many mobile-broadband subscriptions as fixed-line connections – a contrast that becomes more acute when looking at coverage among rural populations (ITU 2011). With the advent of so called 'smart phones', users have multiple channels to access services – voice, text, video and web – and even older devices continue to be useful tools in improving governance. While internet-enabled devices are not as ubiquitous as traditional cell phones, penetration is increasing, with mobile-web subscriptions growing by 45 per cent over the last four years (ITU 2011). Penetration levels are likely to continue to increase, with the most significant future development being the growth of mobile broadband services, as potentially provided by third and fourth generation mobile

(3G, 4G) and its enhancements (Germanakos et al. 2005). The dissemination of these technologies represents a paradigm shift that has seen the emergence of new data services, combining the benefits of broadband with mobility. To ensure government services are truly inclusive it is therefore imperative that mobile delivery channels are fully exploited – even when this comes before the development of fixed-line services.

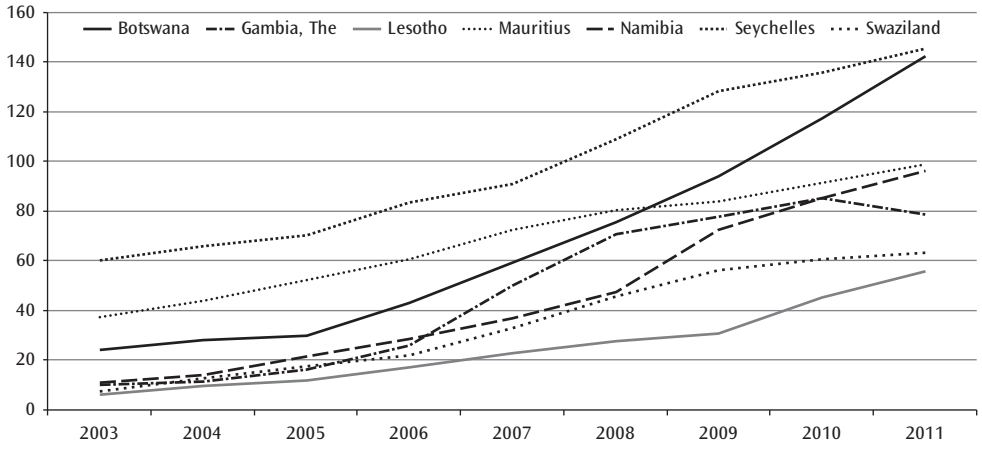
- **Affordability**: Mobile phone subscriptions in the developing world have fallen dramatically in cost over the last 10 years, with a 22 per cent fall between 2008 and 2010 alone (ITU 2011). Despite this fall, at 11.4 per cent of monthly gross national income (GNI) per capita, costs remain relatively high compared with only 2 per cent in developed countries (ibid). Nevertheless, compared with the high capital costs of infrastructure and devices associated with wired technologies, mobile technologies offer a significantly cheaper alternative for governments and users – particularly in countries with large distances between the location of the core infrastructural services and the outlying towns and communities, or which have a large rural community (Sciades et al. 2005). This cost efficiency equally applies to the development of mobile applications, which can be delivered with relatively little expense as opposed to more costly desktop solutions.
- **Mobility and personalisation**: Globalisation has meant people, objects and information have become increasingly mobile, with many now expecting delivery channels which fit in with their nomadic lifestyles (Vijayakumar et al. 2010) Wireless devices theoretically grant citizens access to government information and services 24/7 regardless of their environment. When allied with desktop services, this can be particularly useful in providing alerts or the equivalent service for a mobile device. Mobility also implies a potential change with regard to the physical location of the user, and the emergence of GPS has meant geography can be accounted for when personalising services, for example in reporting the location of a crime.[1]
- **Interactivity and participation**: Mobile technologies provide a new platform to facilitate interaction between government and citizens, which moves beyond the provision of transactional services such as e-payment applications. M-government has the potential to dramatically increase social inclusion by connecting government at the highest level with citizens previously excluded from participating due to the inaccessibility of traditional communication channels. Real-time mobile interaction also allows citizens to report immediately any instance of malfeasance on the part of government officials, thereby reducing corruption and improving efficiency. In widening the availability of channels for G2C and C2G interaction, citizen identification with the state is likely to improve, thus strengthening the social contract between state and citizen.

6.3 M-Government in small states

The introduction of low-cost mobile phone services more than a decade ago has transformed the telecommunications landscape, and increased access exponentially. Commonwealth small states in particular have witnessed dramatic rises in mobile tele-density, as reflected in Figure 6.1.

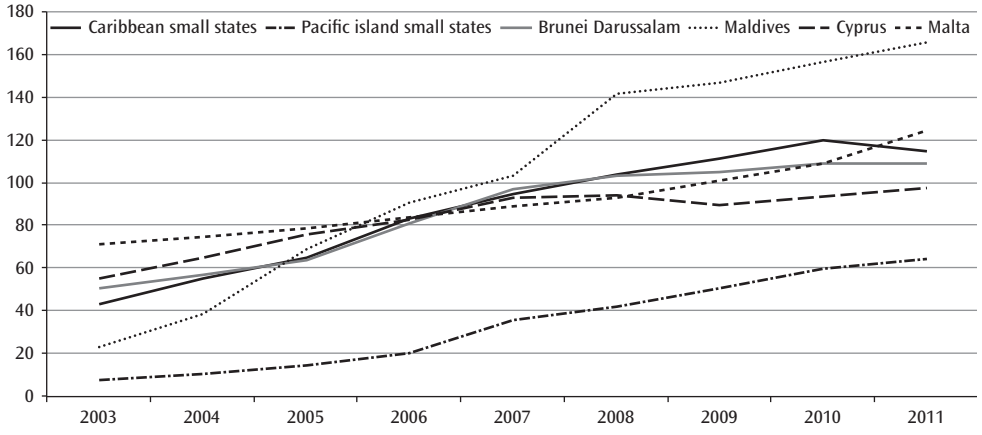
The figures for the Pacific region (Table 6.1) further emphasise the rapid growth in mobile cellular subscriptions. For example, in Papua New Guinea between

Figure 6.1 Mobile subscribers per 100 persons in Commonwealth African small states



Source: World Bank, *World Development Indicators*, http://databank.worldbank.org

Figure 6.2 Mobile subscribers per 100 persons in Commonwealth Asian, Caribbean, European and Pacific small states



Source: World Bank, *World Development Indicators*, http://databank.worldbank.org

Table 6.1 Fixed telephone line and mobile subscribers per 100 persons in the Pacific

	Fixed telephone mainlines				*Mobile cellular subscriptions*						
	Per 100 population			*% change per annum*	*Per 100 population*			*% change per annum*	*% of total subscribers*		
	2000	*2005*	*2009*	*05–09*	*2000*	*2005*	*2009*	*05–09*	*2000*	*2005*	*2009*
Pacific	**39.6**	**36.8**	**31.8**	**–1.9**	**33.1**	**67.7**	**87.0**	**8.4**	**45.6**	**64.8**	**73.3**
American Samoa	17.9	16.5	15.5	0.0	3.5	3.5	–	–	16.3	17.5	–
Australia	52.4	49.6	41.2	–2.8	44.7	90.3	110.6	7.1	46.0	64.5	72.9
Cook Islands	32.0	34.0	34.2	1.1	3.4	20.6	34.7	15	9.5	37.7	50.4
Fiji	10.6	13.7	16.1	5.0	6.8	24.9	75.1	32.9	38.9	64.6	82.4
French Polynesia	22.6	21.0	20.3	0.4	16.8	47.1	77.8	14.8	42.6	69.2	79.3
Guam	48.0	38.9	36.9	0.0	17.5	58.1	–	–	26.8	59.9	–
Kiribati	4.0	4.6	4.1	–1.2	0.4	0.7	1.0	13.6	8.1	12.5	20.0
Marshall Islands	7.7	8.5	8.2	0.0	0.8	1.3	5.6	43.9	9.1	13.7	40.5
Micronesia (F.S.)	9.0	11.3	7.9	–8.5	0.0	12.9	34.3	28.1	0.0	53.2	81.4
Nauru	17.9	17.8	18.6	1.4	12.0	14.8	–	–	40.0	45.5	–
New Caledonia	24.1	23.9	27.3	5.1	23.5	58.1	84.9	11.8	49.5	70.8	75.7
New Zealand	47.5	41.8	43.3	2.0	40.0	85.4	108.7	7.4	45.7	67.1	71.5

(*Continued*)

Table 6.1 Fixed telephone line and mobile subscribers per 100 persons in the Pacific (cont.)

	Fixed telephone mainlines				*Mobile cellular subscriptions*						
	Per 100 population			*% change per annum*	*Per 100 population*			*% change per annum*	*% of total subscribers*		
	2000	*2005*	*2009*	*05–09*	*2000*	*2005*	*2009*	*05–09*	*2000*	*2005*	*2009*
Niue	52.6	59.3	72.8	2.4	21.1	35.6	–	–	28.6	37.5	–
Northern Mariana Islands	30.7	34.6	40.8	1.9	4.4	30.4	–	–	12.5	46.8	–
Palau	–	40.2	34.9	–2.9	–	30.6	64.9	21.3	–	43.3	65.0
Papua New Guinea	1.2	1.0	0.9	–1.5	0.2	1.2	13.4	86.1	11.7	54.1	93.8
Samoa	4.8	10.8	17.5	13.1	1.4	13.3	82.8	58.4	22.7	55.2	82.6
Solomon Islands	1.9	1.6	1.6	2.6	0.3	1.3	5.7	49.5	13.5	44.8	78.5
Tonga	9.9	13.6	29.9	22.6	0.2	29.6	51.2	15.4	2.0	68.6	63.1
Tuvalu	7.4	9.3	17.3	17.2	0.0	13.4	20.4	11.4	0.0	59.1	54.1
Vanuatu	3.6	3.3	3.1	0.7	0.2	6.0	54.1	77.7	5.7	64.5	94.6

Source: UNESCAP 2011

2005–2009, mobile subscriptions increased by 86.1 per cent per year, compared to –1.5 per cent for fixed telephone lines. These figures have materialised despite mobile operators arriving much later to the state than their fixed-line counterparts, and the low levels of saturation for both types of service.

The increasing levels of mobile phone penetration not only present small states with an opportunity to implement m-government services generally, but also address the key challenges which hinder their development: human and institutional capacity; susceptibility to natural disasters, environmental change and income volatility; and issues of isolation and openness. Mobile devices have demonstrated their value as a medium uniquely placed to address these issues, for example in improving the pedagogy of pre-service teachers (Ferry 2009) and increasing access to financial services with mobile banking. SMS in particular has proved to be a vital tool in countering the effects of climate change, of which small states have witnessed its most deleterious consequences (Box 6.1).

Box 6.1 Trinidad and Tobago, SMS early warning

The Office of Disaster Preparedness and Management (ODPM) partnered with the Telecommunications Services of Trinidad and Tobago (TSTT) to establish an Emergency Short Message Service (ESMS) broadcasting agreement in 2010. In explaining the intricacies of this simple and effective message tool, the ODPM's Corporate Service Manager, Major Chevalier Jackson, reiterated that this service will be used to disseminate information on possible threats, impending hazardous events or any major crisis. Mobile phone owners typically carry their handsets with them, so these are a much more suitable means of relaying information instantly to those in harm's way, instead of relying on intermediaries such as television and radio which lack the advantages of mobility.

The effects of isolation have also had a largely negative impact, with domestic and international arbitrage proving to be an insidious force on economic development (Favaro 2008). The dissemination of market information to smooth these inequalities has been expedited by mobile phones, by, for example, communicating price fluctuations in agri-commodities to farmers (Jensen and Thysen 2003) Measures to support open government in small states can prove expensive to develop and maintain, particularly where data collection is required in support of open data initiatives (Farrugia 2006). In such instances, states should consider devising regional solutions, or pairing with intergovernmental organisations to exploit economies of scale. The World Bank, for example, is committed to ensuring small states maintain reliable data sets to assist in decision-making, but has also incorporated these statistics into its mobile open-data application, freely available for download.[2]

6.4 Implementing m-government

In introducing mobile solutions to service delivery, a sequential approach is needed to ensure sustainability and foster trust among users. The various stages of m-government from 'Push' to 'Participatory' can be seen in Figure 6.3, which illustrates a suggested trajectory states may wish to adopt, with corollary examples from across the Commonwealth.

6.5 Adoption factors

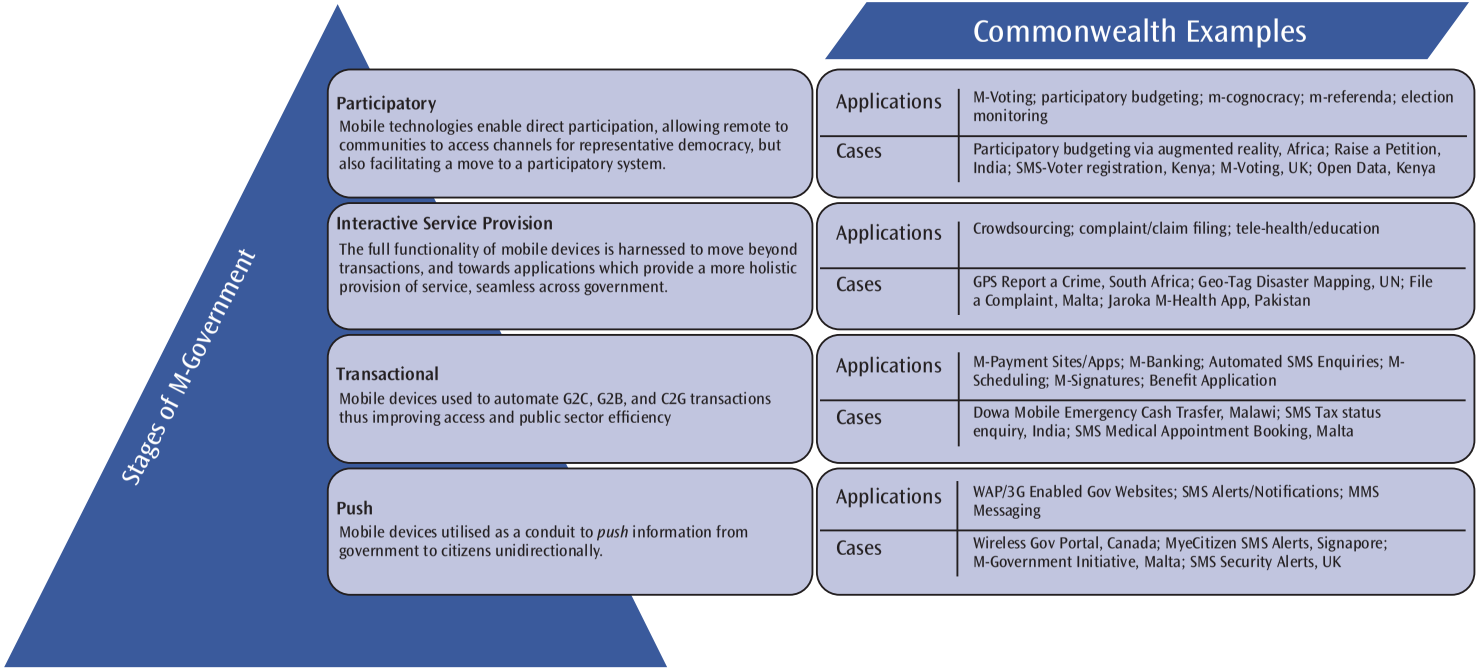
In moving up through the stages of m-government, states should adopt a strategic approach which outlines a coherent path, integrated across all government ministries. This can be achieved as part of a broader e-government strategy, or may be stand alone while allowing for the eventual incorporation into a wider ICT strategy. Regardless of which approach is taken, m-government should not be considered in isolation of any general discussions on service delivery generally, but rather as an additional channel available to government. It is also imperative that policy-makers place the requirements of their citizens at the forefront of their minds in developing applications (Hellstrom 2009). The 'Design-Reality' gap (Heeks 2003) has been cited as the primary reason for the failure of e-government projects, so governments should not only ensure products are addressing an identified need, but also fully comprehend the resource requirements necessary to develop notional ideas. A summary of the key adoption factors states should consider can be seen in Table 6.2.

Table 6.2 Key adoption factors for m-government

National-level policies	*Socio-cultural*	*Technological*	*Economic*
Fostering sufficient political support, with corollary human and financial resources identified Building ICT competencies within government Development of standards in mobile sector Development of a 'whole of government' m-government strategy	Bespoke content development appropriate for devices and end users, given country context – i.e. location, demographics, literacy levels, accessibility requirements Building competencies in the use of mobile ICTs	Infrastructure necessary for the use of mobile devices: base stations, WAP servers, GPRS Support Node Device and application development	Removal of tariff/ non-tariff barriers to ICT products Formation of multi-stakeholder partnerships including telecommunications companies, government, regulators, device manufacturers, infrastructure providers, citizen groups and application developers Measures to align purchasing power and cost of mobile devices

Source: Adapted from Dholakia and Kshetri 2001

Figure 6.3 Stages of m-government



6.6 Financing m-government: multi-stakeholder partnerships

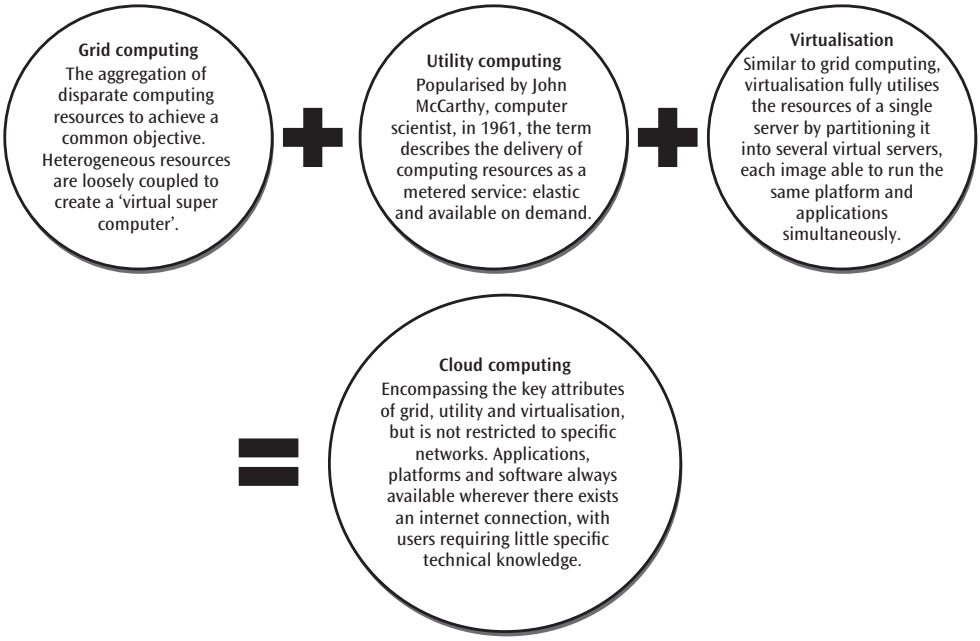
Locating sufficient funding for m-government initiatives can ultimately determine whether fledgling projects get off the ground or not. Funding arrangements should not only consider capital costs and infrastructure development, but also the technical resources required to maintain applications and financial commitments for future development. Public–private partnerships (PPPs) are often an attractive model for governments, with several successful examples already well established.[3] However, there exists an inherent conflict in partnering with the private sector, with many operators, who thus far have driven the development of mobile applications, motivated by either profit or brand enhancement via corporate social responsibility programmes (Hellström 2010). States should consider the role of multi-stakeholder partnerships in resolving this conflict, a model that not only includes the public and private sectors, but also representation from civil society. Unlike PPPs, they focus on sharing, rather than shifting risks, and exploit synergies to deliver mutual benefits for all collaborating parties. The Global Knowledge Partnership has described them as, 'Alliances between parties drawn from government, business and civil society that strategically aggregate the resources and competencies of each to resolve the key challenges of ICT as an enabler of sustainable development, and which are founded on principles of shared risk, cost and mutual benefit' (2003). It is a model that has seen success in various sector-specific e-government initiatives,[4] and could easily be applied in the development of m-government services.

Balancing the need for novel approaches to e-government with the costs accrued in procuring new technologies is a constant challenge, particularly in an environment where any new investment by government is closely scrutinised. Cloud computing claims to offer a solution in that it grants access to new applications as and when required, while also reducing the capital outlay normally associated with IT procurement. Cloud services are already ubiquitous in the private sector, with governments now seeking to harness their benefits for use in improving public administration. For small states, these benefits go directly towards addressing the challenges they face – human and institutional capacity; susceptibility to natural disasters, environmental change and income volatility; and issues of isolation and openness – but where internet access remains intermittent, holistic cloud solutions are likely to remain a technology for the future.

6.7 What is cloud computing?

Cloud computing is an emerging concept, encompassing nomenclature previously associated with terms defined separately (Figure 6.4). Definitions of cloud computing vary (Wyld 2009), but the one most often adopted by government comes from the US government's National Institute of Standards and Technology (NIST) which states that, 'Cloud computing is a model for enabling ubiquitous, convenient, on-demand

Figure 6.4 Concept of cloud computing



network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction' (Mell and Grance 2009).

Depending on the specific requirements of the users, cloud computing can be further disaggregated as follows:

- Software as a Service (SaaS): The client identifies the applications required, and the vendor ascertains the resources needed to meet anticipated demand. The vendor retains control of the infrastructure and operating system, with the client gaining access to the application locally.
- Platform as a Service (PaaS): The clients gain access to a hosting environment in which they can design, implement and deploy web applications and services. No software download is required, and the vendor retains control over the operating system, hardware and network infrastructure.
- Infrastructure as a Service (IaaS): The client gains access and control over infrastructure in the form of a virtual environment. From the client's perspective it is *tabula rasa* (blank slate), though they do not, in fact, have control over any physical infrastructure, rather virtualised storage, networks and process power, which in reality are running concurrently to other virtual environments.

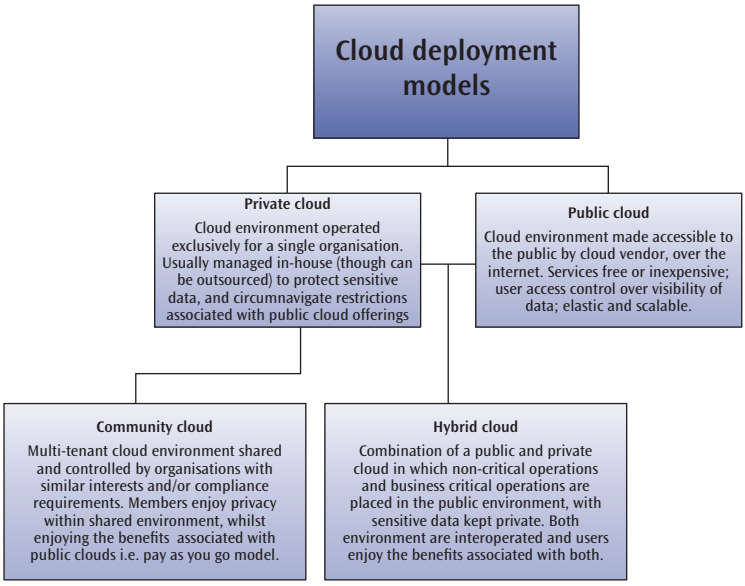
For small states no one particular service model holds increased appeal. Nevertheless, when arriving at a decision factors such as security, privacy, knowledge retention (i.e. the ability to bring services in-house) and cost should be balanced appropriately.

Figure 6.5 illustrates the four deployment models available to government.

Government agencies have to reconcile their need to accommodate both business-critical private data with information designed for public consumption. For this reason, hybrid clouds are finding favour over public or private solutions. Hybrid platforms meet the stringent security needs of government, but also deliver the benefits associated with public access models, i.e. scalability and cost savings.

Large federal governments, in recognition of their size and breadth, have deployed their cloud technologies on a community cloud basis – despite the constituent entities not being strictly delineated (McEvoy and Koop 2008). Community clouds better reflect the emerging paradigm of 'Digital-era Governance' (DEG), which scholars argue has replaced 'New Public Management' as the dominant focus for public administration (Dunleavy et al. 2006). In contrast to Weberian disaggregation, cloud technologies contribute to a key tenet of DEG, namely reintegration and the de-silo process, with community clouds in particular drawing on synergies between disparate government agencies to re-governmentalise issues of inherent concern to the state (ibid).

Figure 6.5 Cloud deployment models

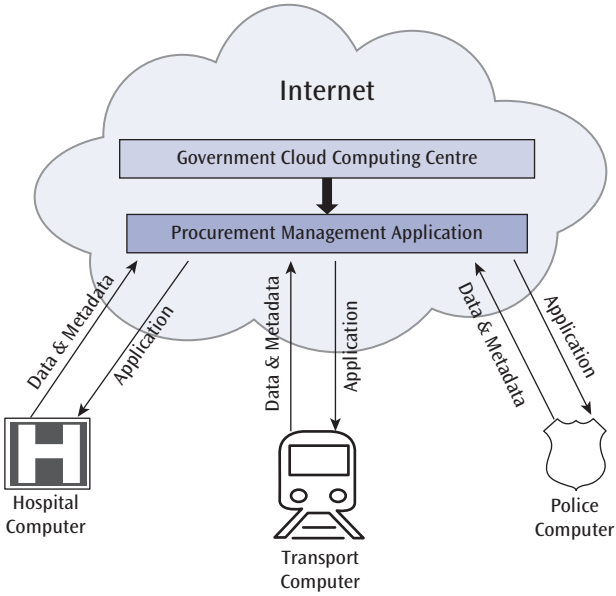


Given the opportunity to access services via remote data centres, and the need to maximise cost savings, small states should consider a regional community-hybrid approach, whereby non-sensitive services such as payroll applications are purchased collectively with other neighbouring islands, while business-critical applications are purchased at the state level.

6.8 Why cloud computing?

The public sector lends itself to the use of cloud technology in that it contains similar organisational and functional units (Cellary and Strykowski 2009). For example, police stations in a single sovereign territory will be subject to the same legal and operational requirements. Cloud technology can house applications useful to all such units in a single container, accessed as a service by geographically disparate police stations. Metadata from individual units can also be collected, which allow for the modification of software to create bespoke solutions according to the requirements communicated. Governments also require similar functions to be performed across all its units (e.g. procurement or payroll) and here the cloud would operate in a similar manner (ibid) (Figure 6.6).

Figure 6.6 Similar functional units' access to government cloud



In addition, cloud computing confers the following benefits:

- **Elasticity.** Cloud computing's primary appeal is that it reconceptualises the procurement of IT resources as a utility, allowing governments to scale resources up or down as required: instead of capital investment in infrastructure and software, governments purchase access to remote, location independent computing resources via a ubiquitous area network, i.e. the internet. The cloud vendor would then invoice the government either on a subscription basis or, in common with other utilities, on a pay-as-you-go basis.
- **Cost savings**. In comparison to the traditional provision of IT services, the move towards cloud solutions offers significant cost reductions. Apart from the savings conferred by elasticity, maintenance and administration costs are reduced due to the decreased need for highly trained staff (a benefit for small states, in particular, where human capital is low); resources normally dedicated to maintaining traditional IT systems are freed up, thereby increasing productivity; and the aggregation of resources dedicated to servicing larger units of government reduces the cost of maintaining separate iterations of similar applications.
- **Ubiquitous access.** Untethered from using individual, usually wired, hardware, civil servants can access applications and documents from any location with internet access (including properly secured and encrypted mobile devices). The consolidation of services also improves citizen access to e-government applications.
- **Green cloud.** Utilised correctly, cloud technology has the potential to reduce the carbon footprint of government. This reduction is achieved largely by consolidating data centres; making cooling systems more efficient; virtualising physical storage; and reducing power usage (Rouse 2011).
- **Improved disaster recovery.** Cloud vendors offer various cost-effective services for recovering data, applications and operating systems. For small states where natural disasters are increasing in frequency this is particular important. Services include the provision of duplicate cloud infrastructure supplied by the vendor to migrate to in the event of a disaster, and subscription services such as access to the cloud environment at designated data centres.
- **Service quality and security.** The onus to ensure uptime, and apply patches and updates, is shifted to the cloud vendor. Implementation time for new solutions, particularly in response to changes in regulations, is reduced.
- **Diffusion of best practice.** For larger countries, the move to the cloud ensures that modern technology is accessible even at the lowest levels of government. Good practices are often hermetically sealed in organisational silos, but cloud architecture encourages the dissemination of best practice across all units of government. Uniformity in e-government not only reduces cost, but improves 'brand identity' with the public. A consistent approach also contributes to a

'whole of government' e-government strategy, essential for the successful integration of IT in public service delivery (UNDESA 2012). For small states, as cloud computing is increasingly integrated in governments around the world, they are likely to benefit from the institutional knowledge accumulated by service providers.

- **'Big Data' analysis.** An issue for larger rather than small states, 'Big Data' describes the large amount of unstructured data countries accumulate in the course of their business. These data sets can be mined to identify trends that can potentially contribute to improved service delivery and economic development, but due to their size are too costly to analyse. Cloud vendors have the ability to pool resources to provide sufficient computational power to analyse Big Data sets in real time (NIST 2012).

6.9 Key adoption factors

NATIONAL-LEVEL POLICIES	**Development of a cloud migration strategy** (Figure 6.7) **The revision of procurement guidelines:** The cloud market is relatively immature and approaches to procurement are inconsistent across governments. Several have separated the purchasing of cloud technology from their core procurement practices, instead developing 'cloud stores' from which agencies can buy cloud applications (Hodgkinson 2012). This model has yet to show success, however, and what appears to be more important is that government agencies have sufficient information to understand their IT needs, enabling them to 'shop' for cloud solutions intelligently (ibid). **Establishment of a legal and regulatory environment:** The ITU has published a comprehensive list of recommendations for cloud regulation that are applicable universally (ITU 2012). In summary, these recommendations require legislation to cover 'the transposition to the national level of subregional, regional or international texts on data protection; revision of relevant legislation to take account of the status of cloud-hosted data; strengthening of legislation, codes of conduct and standards applicable to the ICT sector; and clarification of relations between data centre managers, cloud computing and data protection' (ibid: pviii).
HUMAN RESOURCES	**Building ICT competencies:** Cloud applications are generally designed so as to require only minimal ICT skills on the part of the user, and with resources outsourced to the cloud fewer technicians are needed to maintain infrastructure. Nevertheless, civil servants and citizens alike need to be sensitised to the new ICT environment, and trained in new skills where necessary. **Bespoke content development:** Similar to m-government, local developers should be empowered to develop content suitable for the domestic market. Focus groups should be utilised where possible to ensure content and applications meet an identified need.

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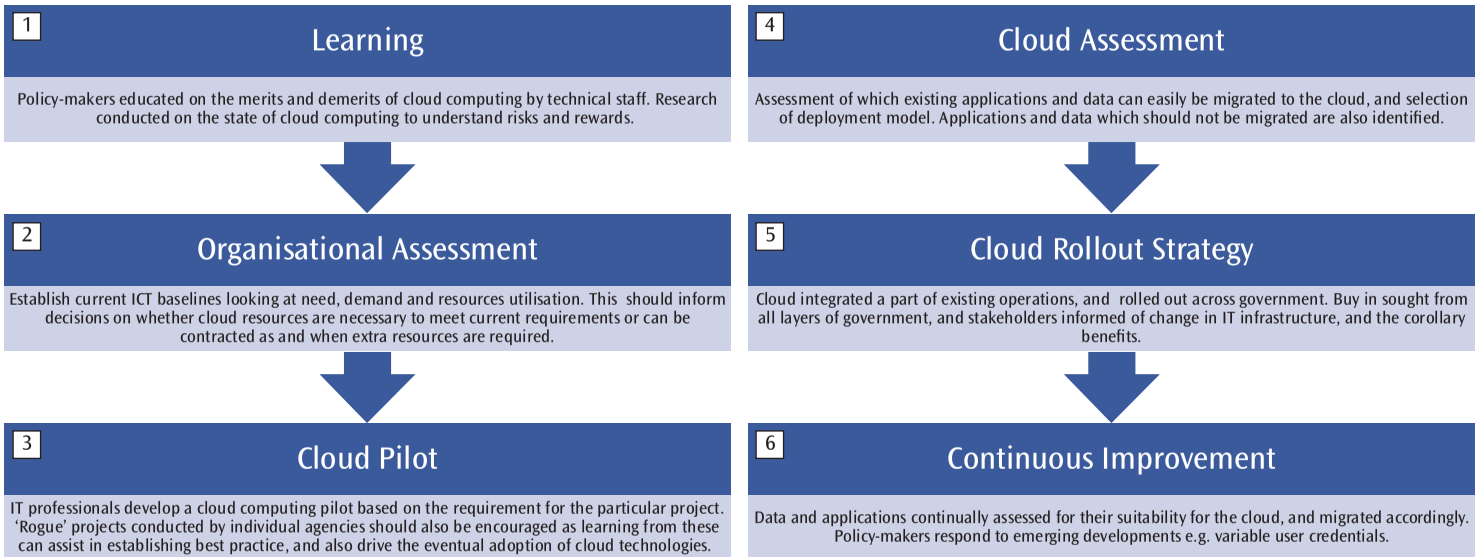
HUMAN RESOURCES (cont.)	**Fostering a collaborative environment:** Cloud computing encourages uniformity in e-government across all units of government, and with that comes new opportunities for collaboration. Governments should not only ensure applications encourage joint working and the sharing of data, but foster a silo-busting collaborative environment.
TECHNOLOGICAL	**Reliable network access:** For small states, this remains the biggest obstacle to the implementation of cloud services. Reliable and readily available internet access is essential if governments are to realise the economic and technological benefits of the cloud. **Cloud security:** This is a concern that in reality requires a multifaceted solution encompassing not only technological safeguards, but also robust legal mechanisms and suitable training for staff. Any security policy should be designed to ensure compliance with regulation; protect data, information, applications and infrastructure; safeguard privacy; and contain a business continuity and backup plan in case of a security breach. Depending on the deployment model selected, multi-tenancy can pose a significant risk to any government contracted to a cloud vendor (Subashini and Kavitha 2011). Public clouds are the least secure in this regard, as several subscribers may be sharing a single machine, each of which represent a potential security risk. Hybrid clouds technically allow for data to be stored in locations appropriate to their sensitivity, but governments should pre-agree a policy on 'cloud-bursting' – where an application contained within the private cloud requires extra computing resources and 'bursts' into the public cloud – with their vendor (Badger and Grance 2010). The NIST has developed security standards which provide guidance as to how and where applications should be stored depending on the sensitivity of the information collected (Barker 2003). Where data is highly sensitive – for example, where it pertains to national security – it should be stored in a private cloud, owned and maintained in country. However, this is expensive and states should therefore be cognisant of the costs and benefits of different security decisions. Costs should also be shared appropriately between the contracting state and cloud vendor, without compromising security. Where possible states should develop a certification system awarded to suppliers that meet stringent security standards (KPMG 2012).
ECONOMIC	**Return on Investment (ROI):** To realise the savings associated with moving with the cloud, governments must engage in complex ROI analysis. When approaching this task, governments should ensure that benefits obtained from moving to the cloud, e.g. reduced risk profile or improved functionality, are costed and netted from investment costs to obtain a more accurate ROI profile. Other factors that affect ROI include human resource costs; infrastructure savings; improvements in speed; costs of the green cloud; changes in software; and future cost implications (i.e. falling cost of the cloud vs. rising cost of maintaining internal ICT assets). Metrics that governments may find useful include: 'Discounted Payback Period', 'Benefit-to-Cost Ratio', and 'Net Present Value' (Jackson 2009).

Figure 6.7 Cloud migration strategy



6.10 Cloud migration

The move to the cloud should contribute to achieving the goals already laid out in an e-government strategy. For this reason leadership is paramount, as an overarching view is required to ensure cloud technologies meaningfully contribute to a holistic and consistent view of e-government. A top-down approach is therefore required, and the migration process should focus on eliminating redundancy; ensuring interoperability; and harmonising processes regardless of technology. IT professionals have devised a six-step 'cloud migration strategy' for governments considering moving their IT assets to a cloud environment (Wyld 2010) (Figure 6.7).

6.11 Mobility now, cloud later

Given the high and ever-increasing penetration levels of mobile subscribers in small states, m-government can no longer be regarded as an option for the future by government policy-makers. However, the technological and regulatory requirements associated with the government cloud do make it an option for the future. Once universal and 'always-on' internet is achieved, and the cloud market has matured, the adoption of cloud services in small states represents a genuine opportunity for them to offer the full panoply of e-government services otherwise found in much larger countries. These challenges are not common to all small states, however, and where there is an opportunity to move to the cloud, countries should consider working with regional organisations to deploy applications via a community-hybrid cloud.

Notes

1 Citizens in South Africa can report the location of a crime using GPS as part of the wider 'Turn it Around' project. See: www.turnitaround.co.za/report_a_crime (accessed 21 December 2012).

2 See: http://blogs.worldbank.org/opendata/mobile-apps-for-health-jobs-and-poverty-data (accessed 11 November 2012).

3 For example, South Africa's 'Turn it Around' project. See note 1.

4 For example, DFID's Imfundo Programme aims to create partnerships to contribute to the delivery of universal primary education and gender equality in Africa through the use of ICTs. See: http://webarchive.nationalarchives.gov.uk/+/www.dfid.gov.uk/research/imfundo.asp (accessed 21 December 2012).

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