Chapter 4
Towards Sustainability of e-Governance

4.1 The Challenge of Sustainability of e-Governance

Most countries in the Asia-Pacific have launched mega e-governance programmes. South Asian countries have been late starters in e-governance, but they have come up with some of the biggest and most complex of e-governance programmes such as India's 'National e-Governance Programme' and Bangladesh's 'Digital Bangladesh'. As these mega projects pick up, there is a big challenge for these countries to sustain them in a manner that more people are able to access sites of governance and are able to get relevant information which can be downloaded with speed and continuity. If more and more people access the Internet, they need to have IP addresses, and if the government intends to quench their thirst for information, the stored data should be readily available within departments and with all institutions of people. Authenticity and surveillance can be maintained when the government manages data with appropriate analytic skills applied for stored data. Much of what we call sustainability is the ability of governments to manage timely transition to higher technology and provide undisturbed e-governance to people.

When researchers analyse these programmes, they are either looking at affordability, accessibility or capacity issues even though managing transition in a cost-effective manner is the most potent requirement. Most people do not realise that every new registered user over the Internet occupies space, and the global shortage of this space is already a policy concern. Once these mega schemes of e-governance start working to their optimum, countries may have to create more spaces and more IDs. How can a country obtain this as these are technologies with developed nations, and how would this be regionally distributed and what would the cost be? The work of government does not end by preparing a mega project of e-governance but how to sustain it as it advances. The progress from IPv4 to IPv6 is reflective of government's seriousness towards sustaining e-governance.

Similarly, e-governance needs to have a good storage space for retaining institutional memory. For example, if X seeks a loan from a public sector bank, a single-window system can work appropriately if the computer can show a history of his transactions,

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credit bureau report of his credit history and liabilities along with assets. If all this information is to be collected without the e-governed departmental network, then the process would take nothing less than 2–3 months to enable the bank to sanction the loan. The constraint for retaining institutional memory is the storage space. However, nobody questions the government on its provisioning of 'Big Data management' and 'Cloud Computing' which provide customised local storage and Internet storage spaces, respectively, for the data produced by departments and enterprises. The world is producing without which e-governance may not have the capacity to deliver to the increasing number of people or may end up taking as long as non-e-services. This chapter is reflective of government's capacity to deliver, make services affordable and accessible. The way country governments conduct themselves in the international technology regimes such as Internet Assigned Numbers Authority (IANA) and Regional Internet Registry (RIR) for their perceptive and long term planning, calculated economic cooperation, skill development and choice of technology back home would decide the success of e-governance programmes in times to come.

The new world is heading towards some major challenges for services provided by the government. The traditional system of linear and pyramidical decision-making may not serve new interests. The challenge is phenomenal as both the number and quantum of Internet users along with an equivalent high amount of data produced and created are extraordinary and unique. The Internet adds eight new users every second, and this number is steadily and steeply rising. In a study titled 'Internet's New Billion', the Boston Consulting Group (BCG) said Brazil, Russia, India, China and Indonesia (BRICI) will have more than 1.2 billion Internet users by 2015, which is over three times the number of Internet users in Japan and USA combined.

India's Internet users would triple to 237 million from the current 81 million by 2015 (Aguiar et al. 2010). Asia had 44.8 % of Internet users of the world in June 2012 which shows an 841.9 % growth as compared to 2000 (Internet World Stats 2012).[1] Some visionaries, like the Google Executive Chairman Eric Schmidt quite upbeat on seeing the Internet statistics showing this steep rise even in the erstwhile laggard states, declared that by 2020 which is less than 7 years from now, everyone will be online. The impact of this rise in numbers is directly visible in the manifold increase of online data being produced by users from social, commercial and government sites which poses a new management challenge to all governments across the world. A combined data from all Internet sites produced 2.5 quintillion bytes of data (1 followed by 18 zeros) per day and 90 % of the world's data created in the last 2 years alone. It is being calculated through a number of analytic sites,[2] which suggest that the world society today is producing more data than it ever did since

[1] http://www.newmediatrendwatch.com/regional-overview/90-asian, http://www.internetworldstats.com/stats3.htm

[2] http://www.sandvine.com/downloads/documents/Phenomena_1H_2012/Sandvine_Global, internetworldstats.com

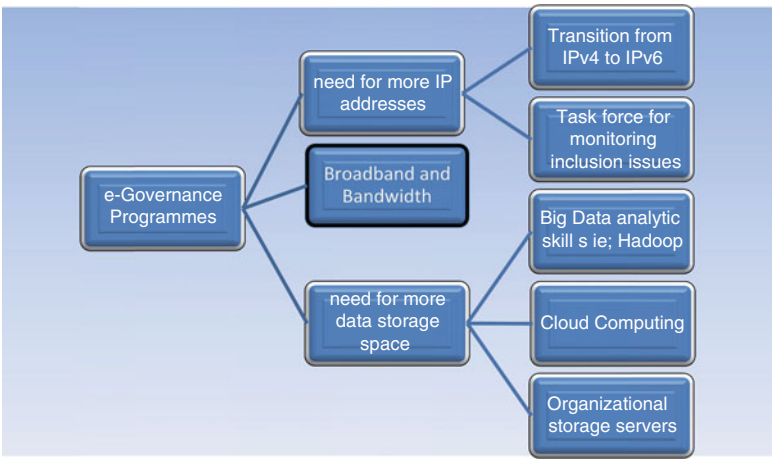

Fig. 4.1 Sustainable e-governance policy framework

the beginning of this earth. It is projected to be much more than the DVD stack reaching from earth to moon (Conner 2012).

Governments across the region of Asia-Pacific have introduced ambitious programmes to widen the net of e-governance. India has put in place a nationwide National e-Governance Plan comprising of 27 Mission Mode Projects and 10 components in May 2006. Services would be delivered through 100,000 Common Service Centres across the country, mostly through a public-private partnership approach. Bangladesh has Tk 2.81 billion e-governance projects to bring all the departments, agencies and associated organisations run by the ministries under the e-governance system to introduce a state-of-the-art service delivery system. This project titled 'Development of National ICT Infra-Network for Bangladesh Government (BanglaGovNet)' and the Digital Bangladesh project bring a sudden expansion of governance which demands deeper penetration of ICT and a more far-sighted approach towards issues of sustainability. Indonesia, Malaysia, Pakistan and other Asian countries have also introduced ambitious e-governance projects which demand deeper understanding and rigor of the government departments which are implementing e-governance projects. There are some macro-level skills and decisions related to the transition of IPv4 to IPv6, Big Data and Cloud Computing which would strengthen e-governance as an institutional policy rather than a politically correct ad hoc arrangement to attract foreign businesses and social capital at the local governance level.

A 'Sustainable e-Governance Policy' framework as given in Fig. 4.1 presents prospective challenges and possible solutions which need to be inbuilt in the policy structure right from its inception stage. The framework identifies two major challenges which all e-governance programmes are likely to face. First is the increasing number of users as Internet readiness of society expands. Second, challenge comes out of the first one as more users would create more data and need for information which

governments and businesses may together have to provide to people. This enormous flow of interactive Internet traffic creates Big Data and the need for organisations to be discerning about segregating the routine and mundane from relevant over which forecasting on value creation is obtained and knowledge economy is prepared. Such a rapid stride of informational need and the construction of governance and legal institutions based upon this available information have an embedded danger of digital divide. Therefore, the framework suggests that e-governance should work on an empirically tested set of impact studies produced by a standing task force to involve largest number of people into the e-governance loop irrespective of their regional and economic statuses, class-caste-gender divides and language dexterousness. This would mean that the task force collaborates with educational institutions and NGOs for mandatory, performance-based capacity-building programmes to bridge digital divides which mar the penetration of e-governance in society. There are two ways of storing Big Data. First is to undertake Cloud storage, but due to the fears of adequate data security in Cloud Computing, departments and enterprises use Hadoop to store the avalanche of data within their own organisational storage space with safety. Such arrangements on managing the scale and quantum of user and knowledge base would bring greater transparency, accountability and efficiency in information and services delivered online to citizens.

In the coming years, the sustainability of e-governance would largely depend upon how governments in the Asia-Pacific countries act and decide in three prime areas which ensure their global competitiveness. First is the dissemination of broadband services, second to ensure speedy and smooth transition from IPv4 to IPv6 and third is to initiate Cloud Computing. These are new areas in social science research even though a very high number of Internet users are growing everyday in the world and especially in the Asia-Pacific. Effort has been made to provide a simple and laymen understanding of these potentially powerful technology areas which are crucial for a continued promotion of the ambitious e-governance programmes in this or any other region.

4.2 Bandwidth, Broadband and Spectrum Space

When Hart, Reed and Bar wrote ‘The building of the Internet: Implications for the Future of Broadband Networks’ (1992), little was known that in the twenty-first century this area would become the central ground of political power play. The phenomenal growth of Internet users and the extraordinary quantum of data which is downloaded or retrieved every second across the world demand special attention. The worldwide chain of banking transactions, taxation departments, commercial activities, entertainment and e-games industry, government data, procurements, statistics, meteorological and travel information depends on data retrieval and download. e-Governance may have to compete through these hurdles to sustain itself with consistency and continuity.

The data is transferred through Kbps, Mbps or Gbps. Kbps is the smallest data transfer rate which is one kilobit or 1,000 bits[3] per second. One megabit is equal to 1,000 Kbps, and one gigabit is equal to 1,000 Mbps. This helps to measure data transfer rate in a computer network connection.

Next is an explanation of the term 'bandwidth' in a computer network. It refers to the capacity a network has through which it can help better performance in accessing different Internet sites and downloading data. When the researchers had started work on the evaluation of selected best practices across the world in 2004, it was found that there was an extremely high rate of failure of e-governance programmes. Most areas in South Asia were struggling to sustain the elementary small programmes of e-governance over a dial-up Internet access, but relatively the condition in East Asia was better especially in Malaysia and China which were moving very fast in 2003–2004, both in the adoption of broadband as well as innovating e-governance alongside the much required monitoring strategies like TQM online or total quality management systems for the public sector organisations.

Due to an extremely narrow bandwidth, it was difficult to transfer multiple signals and traffic such as a song of an average 3.5 MB downloading would take around 30 min and a film of around 700 MB used to take more than a day, but most of us using dial-up during those days would never try downloading a film as the process was disrupted several times and would keep the telephone line occupied for that period of download which extended beyond a day many times. The change came with the introduction of the cable modem in 1997, but it reached people's desktops as late as 2004 or 2005 and that too only in urban areas.

The coming of the broadband can be treated as a revolution in the Asia-Pacific lifestyle both of the government as well as the people. Broadband is technically a little different from bandwidth as it refers to the mode of communication which can be speech cum sound cum high-frequency visual data distributed over a wide range of channels which also enables the use of telephone lines along with other channels on the same single wire. It can be referred to as a multichannel high-frequency transmission rather than the width of the band alone which indicates the amount of data that passes through the connection over time. In the USA, broadband is referred to as wideband. The popularly known DSL services are broadband due to their high-bandwidth channels.

Broadband penetration is the key to the advancement and success of e-governance. Broadband is a high-speed access Internet service in contrast to the previously used dial-up connection. It can be offered in four different forms: DSL (digital subscriber line), fibre optics, cable and satellite services. Broadband resolves most problems associated with connectivity and access. Following the government of India's National e-Governance Plan in 2006, public and private sector organisations set up National Broadband Network (NICNET) at the centre, State Wide Area Networks (SWAN) at the state level and district and block level Citizen Service and data centres

[3] Bits and bytes are different as one byte is equal to 8 bits, i.e. 32 bits equals 4 bytes. Generally bandwidth is measured in bits.

(CSC) at grassroot level. The purpose was to allow seamless and smooth access and flow of government information across ministries and departments, and for doing it, NICNET provided 512 Kbps,[4] SWAN gave 2 Mbps while the Common Service Centres with a KIOSK for integrated delivery of all government services in a dispersed set of bandwidth[5] supply link with SWAN, NICNET or Private Co's provided 2–5 Mbps speed. Inefficient bandwidth service provisioning has been a major hurdle for e-governance. Wider spectrum space provides more bandwidth for better and faster transfer of information. This helps providers to satisfy customers' growing demands for mobile telephony, convergence technologies, texts and Internet usage. It also speeds up download and undisturbed Internet connectivity. It also prevents crippling of the network due to data overload which is one of the main reasons why some companies keep expanding their spectrum space at the cost of many others who are not in a position to spend billions to buy spectrum space and the divide continues to deepen between them. Spectrum crunch would severely increase as more people join the Internet users every day, and companies compete to have more bandwidth to satisfy their customers.

Some interesting broadband adoption and usage trends emerge from the Asia-Pacific region. The Point Topic Broadband Statistics Data Report[6] has highlighted in its findings (Q2,2012,10–14) that the broadband adoption rate in the Asia-Pacific is largely dependent upon the growth in China and USA. If their growth slows down, it immediately gets reflected in the broadband decline in the region. East Asia's positive growth of broadband is due to their economy's close connection to that of China. Well, the issue of an increase in broadband is not directly a reason for e-governance, but its growth reflects increasing capacity of the nation in accessing more information and also government services. In the list of top ten broadband subscriber countries, China is at the top with 167 m subscribers and India at the 10th position immediately after Korea and Brazil with 14 m subscribers only. No other country from the East except Japan and none from Southeast Asia are seen in this list. Of the top ten broadband 'net additions' countries, the positions change. While China is firmly placed on the top, Japan goes down from its 3rd position to the 8th position, but India rises to the 7th position. The next list which places top ten countries showing their growth of broadband, the Asian performers like India, Korea, China and Japan are not found, but two new countries Sri Lanka and Vietnam emerge at the 8th and the 9th position, respectively.

[4] Kbps is 'kilobits per second', while Mbps is 'megabits per second'. One megabit is equal to 1024 kilobits, thus Mbps is more than 1000 times faster than Kbps. The difference between 'bits' and 'bytes' may be made here as one 'byte' or 'B' is equal to eight 'bits' or 'b'. Bytes is used to measure data storage capacity while 'bits' is used to measure data transfer rates.

[5] Bandwidth is the 'data transfer rate' or the amount of data that can be transmitted in a given amount of time. The bandwidth is expressed in cycles per second or Hertz (Hz).

[6] http://point-topic.com/wp-content/uploads/2013/02/Sample-Report-Global-Broadband-Statistics-Q2-2012.pdf

Population penetration is the key to expanding e-governance without deepening digital divides and frustration of capacity deficits. However, this list does not feature a single Asia-Pacific country except Korea in the 6th position. Worse still, it also reflects that despite the expanding broadband services in these regions, there is a clear indication that the digital divide is a serious problem which needs to be immediately addressed to sustain e-governance as inclusive governance.

4.3 Transition from IPv4 to IPv6

Every Internet user needs an address space, and with the explosive rise of Internet users in the Asia-Pacific, this space is at the verge of exhaustion. To make this understanding clearer, IP or Internet Protocol provides address space to users. The Version 4 or IPv4 which is being used so far has limited address space, and in many countries it is at the verge of exhaustion. This would stop the entry of new users over the Internet. Accessibility to e-governance would get severely restricted, and the goal for inclusive governance may not be met. IPv4 is a 25-year-old protocol having a major limitation of 32-bit addressing space. The total number of IP addresses which it could accommodate is 4.3 billion. With the world population in 2013 having crossed 7 billion, the number of cellular phone subscription[7] rising to almost the same number as the population, 40 % of world population always online and global commerce consistently shooting up new demands for IP addresses, the IPv4 version has already exhausted its address space. The rapid growth of Internet and wireless subscribers and deployment of next-generation network[8] (NGN) technology is leading to accelerated consumption of IP addresses, and this will result in exhaustion of IPv4 addresses in the coming years. It is expected that the existing pool of IPv4 addresses will exhaust by August 2012. To overcome this problem of shortage, Internet Protocol version 6 (IPv6) was developed by the Internet Engineering Task Force (IETF), which improves upon the address capacities of IPv4 by using 128 bits addressing instead of 32 bits used in IPv4**.**

e-Governance sustains upon its increasing user strength combined with the penetration of Internet in society. Maintaining a scalable Internet for everyone is the basic requirement of e-governance. Adoption and deployment of IPv6 will open a world of infinite opportunities for citizens. A study of country specific ‘road maps’ would lead to an understanding about the strategies which bring coordination, discipline and knowledge together for the fulfillment of a mission which would define its transition from IPv4 to IPv6.

[7] http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2013.pdf

[8] NGN technology is a new access network technology which enables the deployment of voice, video, data and signalling through the same IP thereby providing many sets of services by converging fixed and mobile networks.

4.3.1 Institutions for IP Address Allocation

IP addresses are centrally managed by the Internet Assigned Numbers Authority (IANA) located at Los Angeles in California. It has five Regional Internet Registries (RIR) for assignment of addresses in local territories to end users and ISPs. On 31 January 2011, IANA announced that it has exhausted its free pool of IP addresses. The RIRs would also exhaust according to the time frame mentioned below.[9] The IPv4 exhaustion time frame[10] across all the RIRs is projected as below:

ARIN (American Registry for Internet Numbers) June 2013
APNIC (Asia-Pacific Network Information Centre) April 2011
AfriNIC (African Network Information Centre) November 2014
RIPE (Réseaux IP Européens Network Coordination Centre) August 2012
LACNIC (Latin American and Caribbean Network Information Centre) February 2014

Nations generally use technologies through which they are able to provide Internet to more people than the assigned address space. India had 18.2 m IPv4 addresses with less than .018 IP per citizen, but it was able to provide Internet to more than 18 m people. This was possible due to the extensive use of Network Address Translation (NAT). In contrast USA has the largest chunk of IPv4 addresses bringing 5.3 IP address per US citizen. China has .15 addresses per citizen. The APNIC pool is drying out for releasing any more IP addresses to the countries in the Asia-Pacific, and therefore, the transition to IPv6 is already being adopted by some far-sighted nations as they restructure their Internet governance.

In view of the IPv4 exhaustion concern, five Internet companies, Facebook, Google, Yahoo!, Akmai and Limelight networks, got together on 8 June 2011 for a global scale 24-h trial of IPv6. It indicated that the major Internet service provider (ISP) companies, home networking equipment manufacturers and web companies should ensure that they had products and services ready for IPv6 use. This became a tough challenge, as it required coordinated actions of many actors within the Internet, including content providers, equipment vendors, application developers, Internet service providers, policymakers and many others. One of the major inputs to this coordination process is good, reliable data on deployment of IPv6, which sectors have built up competitive advantage on its adoption, the suitability of the time frame and the challenges of transition of the Internet to IPv6. Much of the comparative information is available at APNIC, which is the Asia-Pacific Network Information Centre and the Regional Internet Registry for this region.

APNIC, which is one of the largest data and space allocation organisation in the Asia-Pacific, has warned that this challenge of transition will require the coordinated actions of many actors within the Internet, including content providers, equipment vendors, application developers, Internet service providers, policymakers and

[9] Réseaux IP Européens Network Coordination Centre (RIPE NCC) is the Regional Internet Registry (RIR) for Europe, the Middle East and parts of Central Asia.

[10] National IPv6 Deployment Roadmap Version-II First Published : March 2013.

many others. It also suggests that there is a prime need for a reliable sectoral data on IPv6 deployment.

Some countries in the region have moved faster with the deployment of IPv6 and its subsidiary technology called the next-generation networks (NGN). NGN applications have the capacity to change the cost base, agility and service capabilities of telecom providers. Its key enabling technologies are IP (Internet Protocol), MPLS (Multi Protocol Label Switching), ADSL (Asymmetrical Digital Subscriber Lines), Metro Ethernet (an ethernet technology in a metropolitan area that connects subscribers and businesses to a WAN (Wide Area Network) and the Internet or connects branch offices to an Intranet), Session Initiation Protocol and H.248 (Media Gateway Control Protocol which is a standard protocol for handling the signalling and session management needed during a multimedia conference[11]).

Australian government's transition to IPv6 has been an effective activity of coordination within the government. A Strategy for the Implementation of IPv6 in Australian Government Agencies was first prepared for the Australian Government Chief Information Officer Committee (CIOC) in 2007. The Strategy was distributed to all Australian Government agencies and made publicly available in January 2008. The Strategy proposed the following requirements for every agency:

- That all government agencies should have IPv6 capable hardware and software platforms by 2012.
- Be able to operate dual stack IPv4/IPv6 environments by 2015.
- The Network Infrastructure Backbone should be the first hardware segment of the network to be made IPv6 ready. Other segments of the network can be staged as required.
- Upgrade of operating systems to be IPv6 ready.
- Agencies' operating systems should be upgraded to ensure IPv6 capability and compatibility.
- Upgrade of ICT gateways to be IPv6 ready.

A revised IPv6 transition strategy was endorsed by CIOC in January 2009. The CIOC provides oversight for the whole-of-government implementation of the Strategy through a Community of Expertise (CoE) to advise and share expertise. The Australian Government Information Management Office (AGIMO), a business group of the Department of Finance and Deregulation, is the central coordination body for the transition of Australian Government Agencies. AGIMO prepared a road map and a work plan through which government agencies would be subjected to a structured transition pathway. The agencies were alerted for a finale in December 2012 due to which monitoring and quarterly surveys by the Chief Information Officer Committee as the Reporting office were insisted upon by the government. The government ensured that all 110 Financial Management and Accountability Act (FMA Act) Agencies would roll out the IPv6. Larger departments such as Defence, Foreign Affairs and Trade, Human Services, Finance and Deregulation, Broadband, Communications, Digital Economy and the Australian Taxation Office

[11] http://searchnetworking.techtarget.com/definition/Media-Gateway-Control-Protocol

along with the smaller departments of sports and Anti-Doping Authority which would coordinate to launch IPv6.

China has a massive Internet user base but too few IP addresses. While its netizens reached 513 m at the end of 2011 – which accounts for 38 % of its total population (CNNIC Report 2012), China has only 330 m IPv4 addresses. It is estimated that a total of 34.5 billion IP addresses will be needed in China in the next 5 years. The 12th Five-Year-Plan period priorities for next-generation Internet development have been set to achieve this goal (Jones 2012). Way back in 2001, China initiated a discussion on the China Next Generation Internet (CNGI). Gradually, with the support which came from the National Development and Reform Commission (NDRC), an eight ministry-driven inter-ministerial effort coordination attempted to make Internet more viable and affordable towards commercial purposes. The ministries included the Ministry of Science and Technology (MST), Ministry of Education (ME), Ministry of Information Industry (MII), the State Council information Office (SCIO), Chinese Academy of Science (CAS), Chinese Academy of Engineering (CAE) and National Natural Science Foundation of China (NSFC). This level of coordination is missing out in South Asian countries. National Development and Reform Commission (NDRC) organised strategic experts committees on Internet deployment and instituted a full adoption policy of IPv6 by creating the China Next Generation Internet (CNGI) in 2006. CNGI was conceptualised to become the nationwide backbone for the convergence of services from fixed, mobile, GRID and research. China owes its rise to CNGI which has leapfrogged and shortened the gap with developed countries in not just the Internet development but in all subsequent value-added returns which came to China due to improved access to the Internet.

South Korea initiated its IPv6 journey in February 2001. The government started promotion of IPv6 by devising a new platform called IT839 and selecting some basic services minimal infrastructure. Boosted by the government support and willing adoption by communication carriers and a few others led to an accelerated development of equipment needed for deployment of the next-generation Internet address system. As part of their IT839 strategy, the Ministry of Information and Communication implemented first phase pilot project of KOREAv6 in 2004 and then conducted the second phase pilot service in 2005 to foster adoption of IPv6 technologies and energise the new communication service. The South Korean public sector has been engaged in deploying IPv6 on national level by building a nationwide IPv6 MPLS (Multi Protocol Label Switching) backbone which is a progress towards a router-free high-performance communication network. IPv6 has been deployed in 2004 in the e-government networks, postal office, universities, schools, ministry of defence, local governments, etc. (Table 4.1).

In **India,** TRAI (2005) declared that the usage of IPv6, a new Internet Protocol platform in e-governance projects, be made mandatory to give a head start to the deployment of IPv6. Its deployment would expand the available IP address space and provide better service, mobility support and security. Issuing its draft recommendations, the telecom regulator said this is considered necessary in view of fast expanding Internet usage and increased demand on the IP address space. The government said

Table 4.1 Total number of IPv4 and IPv6 addresses delegated

S.N.	Countries	IPv4/32 s	IPv6/48 s
1	Afghanistan	85,248	nil
2	Australia	42,103,808	546,177,072
3	Bangladesh	859,648	917,505
4	Bhutan	22,528	131,072
5	China	250,320,384	25,755,651
6	South Korea	87,109,120	341,049,345
7	Malaysia	5,481,216	2,555,909
8	Nepal	191,488	458,755
9	Pakistan	2,883,328	1,310,721
10	Philippines	4,586,496	1,966,081
11	Sri Lanka	520,704	458,753
12	India	22,525,184	3,276,804
13	Indonesia	10,170,880	2,818,059

Source of data: APNIC, Brisbane, Australia. http://www.apnic.net/__data/assets/pdf_file/0009/21222/. Accessed 30 Mar 2011

that 'the usage of IPv6 in the platforms/applications pertaining to e-governance is to be mandated for IPv6 deployments. The Government should also mandate IPv6 compatibility in its own procurement of IT systems and networks'. The suggestion of setting up of test beds for experimentation in IPv6 technologies, creation of a National Internet Registry in the country in addition to the current Regional Internet Registry, presently located in Australia and bringing awareness about IPv6 through the government agencies has been very slow process since then despite a hectic government activity with experts and ISP Companies. Recently in March 2013, Indian government brought out a comprehensive 'National IPv6 Deployment Roadmap Version-II' which introduces strategies for the transition.

In 2010, the Policy Document 'National IPv6 Deployment Roadmap' was released by the Minister. The function marked the completion of one year of activities on IPv6 entrusted to TEC by the Telecom Commission. TEC had conducted various workshops and seminars throughout the country during 2009–2010, and based upon the inputs from them the 'National IPv6 Deployment Roadmap', a policy document for transition from IPv4 to IPv6 in India was prepared and approved by the government for implementation by different stakeholders especially central and state government departments and Telecom Service providers. Sify Technologies Ltd., a private Internet service provider, rolled out IPv6 in 2005. Sify has a dual stack network through which commercial services on IPv6 are transported to customers. ERNET (Education Research Network) in the Department of Electronics and IT, Government of India, has been providing dual stack since 2006. ERNET provides Consultancy and Turnkey project Implementation to organisations migrating to IPv6 along with fulfilling their Training needs. ERNET is setting up an IPv6 central facility aimed at system and network administrators to provide hands-on training in the use and configuration of web, mail, proxy, DNS and other such servers on IPv6.

In a report released in 2011 (Ram 2011), the IPv6 Deployment Roadmap was drawn by the Department of Telecommunications in the Ministry of Communications and IT. The following outcomes were presented and agreed upon:

- All major service providers (having at least 10,000 Internet customers or STM-1 bandwidth) will target to handle IPv6 traffic and offer IPv6 services by December 2011.
- All central and state government ministries and departments, including its PSUs, shall start using IPv6 services by March 2012.
- Formation of the India IPv6 Task Force.
- Setting up of IPv6 innovation centre by 2012.
- All the government websites on dual stack in 2012.
- Regarding IPv6 Readiness of the Supporting Ecosystem the content delivery network readiness already available with Akamai, Limelite, Level 3, etc.

However, some pitfalls have also been mentioned in the report, i.e. in web analytics, geo-mapping database and security provisions much needs to be done. Also, it was found that only the large B2C vendors seem to be IPv6 compliant; BSNL, Vodafone, Tata Communications Ltd., Sify, HFCL Infotel Ltd. and Tata Tele Services Ltd. (TTSL) are some of the compliant companies which have already started the use of IPv6.

Sri Lanka The Lanka Government Information Infrastructure (LGII) which includes the Lanka Government Network (LGN) was formerly managed by Samsung Lanka Ltd. Much information of government efforts is available at the Sri Lanka Telecom Network site of IPv6.

Jayasekara et al. (2012)[12] suggest that as the exhaustion of IPv4 address space comes close and Sri Lanka continues to have tens of thousands people using one IP address, it will result in potential network breakdowns, decrease in value-added services (VAS) as well as security issues. Therefore, the only proper solution for this is switching to a more spacious method of IP addressing – that is, IPv6.

Internet Society (ISOC) has helped Sri Lanka for setting up the Internet in the early days and has worked with the Telecom Regulatory Commission of Sri Lanka (TRCSL) to set up a very crucial IPv6 Working Committee in 2011 to monitor the transition issues. The working committee is jointly chaired by ISOC and TRCSL. All ISPs, ICTA, LEARN, SLCERT, LGII, LK registry and Schoolnet are members of the committee and it holds regular meetings monthly under the patronage of SLTRC.

The objectives of IPv6 Working Committee are as follows:

1. Formulate IPv6 road map of Sri Lanka
2. Formulate the policies (such as allocating IPv6 addresses) related to IPv6
3. Gauge the status of IPv6 readiness of all ISPs in Sri Lanka
4. Test the IPv6 readiness and connectivity of IPv6 at Internet Exchanges (IXs) in Sri Lanka
5. Educate Enterprises, ISPs and the public on the importance of migration from IPv4 to IPv6

[12] http://www.saitm.edu.lk/fac_of_eng/RSEA/SAITM_RSEA_2012/imagenesweb/36.pdf)

Almost all ISPs have done the peer testing of IPv6 very successfully and have begun deploying it to various sites. Sri Lanka Telecom Network (SLTNet), Dialog, Suntel, Lanka Bell and Etisalat have already been allocated IPv6 addresses.[13] Interestingly Airtel, which is still to confirm its IPv6 compliance in India, has already been given an IPv6 address in Sri Lanka which indicates the presence of a heavy bureaucratic gauze of decision-making which prevents the speed of ICT dissemination in India. The Lanka Education and Research Network (LEARN) in collaboration with TRCSL, ISOC (Sri Lanka Chapter) and ICTA has been facilitating and promoting the adoption and deployment of IPv6. LEARN was the first organisation to adopt IPv6 in 2008 and continues to deliver IPv6 connectivity to its customers.

Bangladesh is on a very speedy move on the IPv6 highway. The government and private efforts are well coordinated and the administrators have provided a leadership which is much needed in such a dispersed, multi-organisational and multidimensional globally linked policy. The IPv6 Forum Bangladesh was established in January 2010. The leaders of this initiative, Mr. S M Altaf Hossain as its National Convener and Mr. Sohel Awrangzeb as Member Secretary, were experienced specialists in the field. Besides, the forum brought together members from the Bangladesh NGOs Network for Radio and Communication (BNNRC) and UN Global Alliance for ICT and Development (UN GAID).

The IPv6 Forum Bangladesh is mandated to bring the new-generation Internet technologies and create momentum in deploying IPv6 in collaboration with the key stakeholders drawn from government, industry and academia to design the IPv6 road map and vision together for Bangladesh.

Mr. Hasanul Haq, Chairman of the Parliamentary Committee for Post and Telecommunication IPv6 Government Deployment Plan, suggested a governance framework which directs Bangladesh Government towards IPv6 deployment. The efforts are summarised as follows:

a. An advisory group would be formed
b. Establishing an Interagency IPv6 Working Group
c. Open communication between task force and stakeholders
d. Interagency forums to share planning, best practices, challenges and experience
e. Initiation of an IPv6 collaboration and sharing information-sharing work space
f. Acquisition of IPv6 address space
g. Implementation of common IPv6 acquisition and procurement policy through the regulatory policy through the issuance of IPv6 standards and guidance as necessary

Qing (2012) maintains that technologically advanced nations like Hong Kong and Korea are slower in migrating to the new Web protocol than countries such as Thailand, Malaysia and Sri Lanka, and this is likely to impact upon their existing

[13] http://www.ipv6.sltnet.lk/, http://www.ipv6.lankabell.net/, www.dialogv6.lk/, http://ipv6.wow.lk/, http://ipv6.lankacom.net/, http://ipv6.airtel.lk/, http://ipv6.etisalat.lk/, http://ipv6.mobitel.lk/

competitiveness. The analysis also indicates that the APNIC's concern about the slow uptake by the mature markets could hamper competitiveness in the long run. According to a recent study by APNIC,[14] the estimated IPv6 users in Hong Kong and South Korea as a percentage of the overall Internet population are 0.02 % and 0.01 %, respectively. Comparatively, the study showed Thailand (0.17 %), Malaysia 0.03 %, Sri Lanka 0.03 % and Indonesia 0.10 % had higher IPv6 penetration than the two developed markets of Hong Kong and South Korea in the region. The **Philippine** government passed the Executive Order 893 in June 2010 to hasten the country's transition to Internet Protocol version 6 (IPv6). Since then the Commission on Information and Communications Technology (CICT) is actively taking steps towards the adoption of IPv6. CICT Commissioner Ivan John Uy enthusiastically remarked at the opening of an 'IPV6 Seminar The internet is changing: Are You Ready?' He indicated that the deployment of IPV6 will require a carefully crafted migration strategy – prioritisation of activities and identification of resources needed such as budget and human resources. CICT and Cisco brought together government officials and technology experts together (Chandrasekaran and Kapoor 2011).

An Akamai Report (2012) has given that the top 5 Asian markets in IPv6 adoption are led by Japan at 2.4 %, followed by China at 0.67 %. Australia had 0.42 %, while Taiwan had 0.19 % and Singapore 0.17 %. The number of Internet users is growing faster in emerging markets than mature ones such as Hong Kong and South Korea. In India, NIXI has been officially recognized as the National Internet Registry since 2012 and it is responsible for the coordination of the IP Address allocation with other internet resource management functions in the country. India's VSNL (Tata Communications) owns and runs one of the largest international networks. NIXI is setting up parallel IPv6 Exchange Routers in Mumbai and Delhi and dual stack routers in Mumbai, Delhi (Noida), Chennai and Bangalore. IRINN (Indian Registry for Internet Names and Numbers) is a division functioning under NIXI and provides allocation and registration services of Internet Protocol addresses (IPv4 & IPv6) and Autonomous System numbers to its Affiliates. NIXI has been moving fast towards issues such as IPv6 security, Internet Resource Management (IRM) and Internet Routing Registry (IRR) training and a large number of workshops for engineers and management staff.

4.4 Cloud Computing

'Cloud' refers to a remote computer which exists in cyberspace. As individual users we access 'sites'. All these sites are stored in the 'Cloud'. We access these sites through a local server (network computer) and reach the Cloud. If one server goes down, the connection goes undisturbed as services are switched to another server without posing any alerts to the end user. Thus, Cloud is a remote service provider

[14] APNIC documents (http://meetings.apnic.net/__data/assets/pdf_file/0010/30988/Kenny-Huang-APNIC31-policy-framework-v1x.pdf) March 30. 2013.

which allows us to take seamless flights through the most constricted and unreachable alleys of the big globe, connect to people, generate a dialogue and form groups and Internet communities. Cloud Computing is indispensable for delivering smooth, transparent and uninterrupted e-governance services to citizens. It is also as a way of both delivering new and existing services more cost-effectively besides attracting new business and investors in development. Consequently, it has a huge potentiality for creating new jobs and a participatory citizenry. But it is not just one machine or a software device; it is a mix of software-enabled resources and services that can be delivered to the user on an 'as needed' basis. America's most potent institution of science, the National Institute of Standards and Technology explains it as 'Cloud computing is a model for enabling ubiquitous, convenient, on-demand 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'.[15]

Cloud Computing is a broad term that describes a 'stack' or a broad range of services. It can be useful to the organization in various ways such as providing Software as a Service (SaaS), Platform as a Service (PaaS) or even providing Infrastructure as a Service (IaaS). In short, it can be understood as a provider of on-demand network access to many types of services which enable organizations to overcome their lack of or shortage of governance and computing services. The wide and unbridled precincts of the present day social media which nevertheless has exploded into increased knowledge and understanding of diversities, multicultural identities and ideologies, product marketing and subsequently empowerment of an individual against the state have been possible due to the Cloud storage activity. Before drawing a relationship of 'Cloud' to 'e-governance', it becomes pertinent to spell out some of the Cloud activities. The 'Cloud' has been doing many support functions such as storing files, creating movie halls such as the YouTube and running an office as it is through the Microsoft Office Suite available presently on the Cloud as Office 365. Similarly Google has 'Docs', and it also provides a number of indispensable office software used for running commercial offices and business transactions through Zoho.com. For example, 'SAP' software is especially used for corroborating data and forecasting, while 'Tally' is used as an accounting software.

As all email sites, i.e. hotmail.com, Yahoo.com or gmail.com, are stored on the Cloud, one can exchange messages while running filters and tagging them can save appointments, dates, add Word and Excel graphs made online, calendar events, songs and videos. The user is not even aware that sites like Dropbox.com and Box.net do enormous business as they help people carry on their routine professional and other activities through. Such sites have been providing a large number of support services to the public sector including activism to draw their attention to certain problems of industry and management. One of the most recent examples comes from Facebook, whose co-founder Mark Zuckerberg launched a site and a political action group 'FWD.us' (pronounced Forward US). Considering the long-standing

[15] (http://cloudscorecard.bsa.org/2012/).

battle between the IT companies and the US Government, the new site claims to solve and streamline the immigration policy from which USA could benefit in the long run. The group believes that the US policy is biased against women H1B visa seekers. One of the advocates Karen Panetta of the Institute of Electrical and Electronics Engineers asked members of Congress to delay any reforms until the Department of Homeland Security responds to her request for a gender breakdown of the programme. The group members believe that most visas go to men. The group also advocates that the STEM (Science, Technology, Engineering and Mathematics) graduates should not be made to return to their country arbitrarily, but the government should increase the number of visas for skilled workers, develop a 'simple and effective' system to verify employment, create a clear path for immigrants to become US citizens and reform the legal immigration system. The group is growing as a strong lobby to influence Congress. Tsukayama (2013) highlights that while Zuckerberg is the group's leading famous face, its list of supporters reads like a who's who of the tech industry: LinkedIn co-founder Reid Hoffman, John Doerr of the venture capitalist firm Kleiner Perkins Caufield & Byers, Jim Breyer of Accel Partners and angel investor Ron Conway, Yahoo chief executive Marissa Mayer, Google Executive Chairman Eric Schmidt and other CEOs of big name firms, such as Netflix's Reed Hastings, Zynga's Mark Pincus, Path's Dave Morin, Instagram's Kevin Systrom, Tesla's Elon Musk and Airbnb's Brian Chesky. The article further says that the group also has the backing of Paul Graham, who founded the start-up incubator Y-Combinator. To imagine that such a potentially powerful activity of influencing the decision-making process of government and help gain access to the highest political body of legislators is taking place over the Cloud speaks the need for governments to start acting fast on this issue.

Australia, South Korea and Malaysia are relatively moving faster than other countries in the region in adopting Cloud Computing. At the same time, Australia, India, China and many others including some from the developed regions have been cautious and slow due to the fear of data security and breakdowns. Moreover, an aggressive broadband is a precursor to convenient Cloud services. Most South Asian nations are still struggling to achieve an adequate bandwidth, electricity and other basic infrastructure which are few of the many preconditions to accessing the Cloud.

Australian Government's phased Cloud Implementation Strategy is largely driven with caution. The Australian Government has been concerned due to the uncertainty over storing data in offshore data centres as e-government is currently also managing many offshore projects. The ICT budgets have gradually been shrinking due to economic crises; therefore, the Cloud adoption is limited to the few agencies given below (Chandrasekaran and Kapoor 2011)

- Australian Taxation Office (ATO) has moved eTax, Electronic Lodgement System (ELS) and Tax Agent.
- Board administrative support systems into the Cloud.
- Australian Bureau of Statistics has implemented a virtualisation solution to enable transition to a private Cloud environment.

- Treasury/ATO has migrated Standard Business Reporting (SBR) and Business Names projects into the Cloud.
- Department of Immigration and Citizenship (IMMI) initiated a proof of concept for the provisioning of an end-to-end online client lodgement process on a Cloud platform.
- Australian Maritime Safety Authority has implemented a Public Cloud for SaaS and PaaS deployments from Salesforce.com.
- Department of Immigration and Citizenship (DIAC) has implemented a Hybrid Cloud for IaaS as a proof of concept.

The government has recently put together a draft framework to guide its Cloud Computing strategy on a more broad-based manner. It has consolidated all its data centre requirements for the next 10–15 years, a move which is expected to save $1 billion during that time period. The government is looking to expand this approach to Cloud.

The **South Korean** Government has been investing into Cloud Computing to drive the ICT industry's competitiveness. It has been collaborating with the Electronics and Telecommunications Research Institute in the Open Cirrus collaborative Cloud Computing research programme to strengthen its efforts. The South Korea Communication Commission (KCC) has allocated about $500 million for the development of Korean Cloud Computing (KCC) facilities. In achieving better security and data privacy, KCC has partnered with the Ministry of Knowledge Economy and the Ministry of Public Administration and Security for the creation of Cloud-based IT infrastructure that supports the government as well as the ICT industry. The government appears to be promoting the usage of Cloud services at the local government level for ensuring that data privacy, security and cyber crime do not overshadow the larger national performance at this transitional phase. However, usage by local officials would then depend upon the training and capacity building of local users and local managers in the global enterprises. As the Frost and Sullivan Report (Chandrasekharan and Kapoor 2011, p. 12) suggests, 'this is aimed toward garnering a 10 % of the global cloud computing market as well as a reduction of 50 % in public sector's ICT spending by 2014'.

Malaysia has been moving ahead in a strategic manner to become a developed economy by 2020. Cloud Computing is closely linked to its economic transformation programme, the Digital Malaysia Masterplan[16] and the Multimedia Super Corridor Programme. The Malaysian Government is making planned efforts to adopt Cloud services in e-governance. The SME Cloud Computing Adoption Programme which has been showcased as an incentive programme by Multimedia Development Corporation (MDeC) of Malaysia has focused upon SMEs which comprise 99 % of businesses in Malaysia, 56 % of employment, 31 % of GDP and 19 % of exports, thereby leading the 10th Malaysian Plan to its desired destination (Galligan, and Mansor 2011). Malaysia has been strict with deadlines and for that

[16] http://www.investkl.gov.my/News-@-M'sia_scores_big_in_cloud_computing.aspx

reason had achieved its earlier public sector ICT plans of 2003 and 2010. In the 10th Plan (2011–2015), four strategic thrusts have been identified in order for the government to realise its vision for 2020, i.e.:

- People First, Performance Now
- Government Transformation Programme (GTP)
- Economic Transformation Programme (ETP)
- 10th Malaysian Plan

In a Microsoft Study (Cheah 2012), it has been observed that the SMEs enjoy substantial security on the Cloud, and this seems to be the beginning of a huge activity under the Digital Malaysia programme. MIMOS is a national research institute of Malaysia for Information and Communications Technology under the provision of Ministry of Science, Technology and Innovation (MOSTI). In mid-2009, MIMOS took the first step towards public sector Cloud Computing by joining the open source Cloud Computing test bed called Open Cirrus, created by HP, Intel and Yahoo to learn from global adoption methods. MIMOS Cloud Computing has been developing and managing many layers of technology such as SAS (Software as a Service), IaaS (Infrastructure as a Service) and SDP (Services Delivery Platform). This direction takes into account that Cloud services are a megatrend towards the delivery of ICT applications. This is slated to complement the National Broadband Initiative and promotes e-governance. The Malaysian Information System Officer Association looks towards greater transparency in e-government through the Cloud system. Furthermore, Malaysian e-government and the National Archives database use certain elements of the private Cloud platform as well. However, there is significant room for the expansion of Cloud services in the country.

India has been demonstrating fast strides on Cloud adoption in e-governance. Even though the Frost and Sullivan Report has indicated that planned Cloud strategy has still not been adopted in India (Chandrasekaran and Kapoor 2011), the Indian government has moved much faster in Cloud adopting services than even the NeGP, the main e-governance plan for the nation. Interestingly, many state governments have moved faster than the central government in using Cloud services such as the Jammu and Kashmir state government, Madhya Pradesh, Himachal Pradesh and Uttaranchal states have used State Data Centres in provisioning e-governance services to citizens through the Cloud. Many India-based companies such as Bharti Airtel, Netmagic and Wipro Infotech have been in the forefront of pushing the adoption of Cloud services in government by assisting in the creation of test beds, multiple Cloud service initiatives and Cloud grids. On the issue of security, authentication is a crucial component in e-governance services which is likely to be provided by the 'Unique Identification (UID)' or Aadhar Cards which have already been distributed across states. This could also be complimented with an integrated platform stack as early as possible. The government has already taken a decision to move the critical information infrastructure on the Cloud, and DIT has taken steps towards a national Cloud-based network that connects all state data centres. Once this is done, the National e-Governance Plan is likely to get a shot in the arm in delivering most government services more efficiently and with complete data back-up for enhancing

speed and quality of e-services to citizens. This would form the backbone of the NeGP which would be developing capacity through the Cloud Computing to disperse many government services.

e-Government in **Indonesia** has been functional since 2003 but has become mandatory since the presidential decree on the implementation of e-government at central and local government agencies in 2008. Indonesia has lately started moving very fast towards Cloud Computing-based e-governance. This has been supported and pushed by the rising numbers of Internet users in the country. Microsoft influences Cloud Computing solutions in Indonesia and is in tough competition with Indosat, one of Indonesia's largest IT companies in Indonesia Cloud Computing. Indonesia's Technology Assessment and Application Agency (BPPT) has selected Fujitsu to provide Cloud services for one of its critical information technology operations[17] Fujitsu is a leading provider for business solution, technology information and communication, which believes that a private Cloud model will be used by BPPT's Network Centre of Science and Technology (IPTEKnet) and Centre for Data and Information. This has also helped at least two city governments of Cimahi and Pekalongan to adopt Cloud services for delivering their e-services. Indonesia's Technology Assessment and Application Agency is also attracting many other city and municipal governments and SMEs to adopt Cloud Computing. The high cost of information technology infrastructure must have a positive impact in terms of presentation and service to the people of Indonesia. Hariguna (2011) emphasised a 'service-oriented architecture (SOA)' for e-government in Indonesia. The high cost of such an information technology infrastructure is expected to have a positive impact in terms of presentation of policies and basic to people provided it is protected from frequent breakdowns and disruptions which demotivate citizens. Cloud Computing is supposedly an innovative strategy to answer such issues in e-government.

China has taken strides in refining its e-governance access and affordability for its citizens and at the same time retains and attracts foreign investors and commercial enterprises (Luo 2013). Its first country level Cloud Computing data centre in Wuyuan, Jiangxi Province, has been launched with a total investment of 500 m CNY, and the Chinese Academy of Sciences has taken special interest in supporting it. The data centre with a computing speed of 300 trillion times/second, and a super computer storage space, it will become the largest headquarter data centre and supercomputer data centre which would provide supercomputing and storage services for many industries including banking and education and provincial governments of Jiangxi, Hubei and Anhui. Next is the Beijing Super Cloud Computing Data Center, a cooperative project between the Beijing Municipal Government and the Chinese Academy of Science. There are some provincial level Cloud Computing centres coming up in China to be used for commercial and informational purposes. The Jinan Public Security Bureau and Inspur, one of China's leading Cloud Computing solution providers, signed a strategic cooperation agreement for the

[17] http://www.fujitsu.com/id/news/pr/20111202ii-en.html

Jinan Public Security Bureau's Cloud Computing data centre, to become the first public security Cloud Computing data centre for a large scale use in China. Cloud adoption in the public sector in China is also being driven by local government's efforts especially in the cities of Dongying and Wuxi. The Mayor of Dongying Municipal Government plans to transform the city of Dongying with the help of the Cloud Computing. The Yellow River Delta Cloud Computing Center, being built by IBM is a major breakthrough in China's e-governance efforts and would definitely enhance adoption of services over the Cloud.

In **Sri Lanka**, 'Lanka Government Information Infrastructure (LGII)' launched their first Cloud platform 'Lanka Cloud' in August 2012. This has furthered the government of Sri Lanka's vigorous adoption of e-governance over a Cloud Computing platform (Mascarenhas 2012) called the 'Lanka Cloud'. LGII has been mandated to administer the information infrastructure of the government which includes the Lanka Government Network formerly administered by Samsung Lanka Ltd. Lanka Cloud is implemented by ICTA, maintained by LGII and promoted by the motivated political and administrative leadership which considers it a dream which needs to be realised for Sri Lanka's development as Lalith Weeratunga, the Presidential Secretary declared during his launching of the Cloud platform in Colombo.

Philippine government lacks a central coordinating government agency, and thus it seems to be scattering out its efforts from the main pathway to the Cloud. Many companies have been treating Cloud Computing, mobility and social media as separate silos – serving different business needs. However, they are all interrelated and their true potential can be unlocked only when companies utilise them as a single entity to address different business goals and needs. Chandrasekaran and Kapoor (2011) reports that Singapore, Hong Kong and Malaysia alone would drive the market for Cloud Computing by 36.5 % increase between 2013 and 2016.

4.5 Country's Competitiveness on Cloud Computing

Cloud Computing indicates the next-generation role of software and computing technologies which would take the world towards development, transparency and a better connected world. As the key to all global information over the Cloud would be the unique password of the operating agency or government, concerns for data security and cyber crimes have become the greatest deterrent against Cloud Computing. Most countries across the developed and developing world face security concerns which prevent and slow down access to the Cloud. Analysts (Qing 2013) suggest that while there is a demand from local and provincial governments for Cloud infrastructure buildout, the security and connectivity issues dampen adoption.

At least one data management company known as the Business Software Alliance (BSA) has measured preparedness of 24 countries which cover 80 % of global ICT

market to support the growth of Cloud Computing. The ranking on Cloud preparedness is based upon seven policy categories given below:

1. Data privacy
2. Security
3. Cyber crime
4. Intellectual property
5. Support for industry-led standards and international harmonisation of rules
6. Promoting free trade
7. ICT readiness and broadband deployment

Some interesting facts are highlighted through this Cloud preparedness or readiness assessment exercise. The first two positions in the world for Cloud readiness ranking belong to the Asia-Pacific countries, even though ranking for the adoption of an advanced technology is not an easy one and may also lead to results which make comparisons fuzzy and unreliable. However, the ranking of countries as done by BSA is the first global attempt built on a lowest common denominator of seven indices which create a measurable scale for comparing Cloud Computing efforts of individual countries. Japan leads the 24 selected countries of the world with rank one. The present work has been focusing on Australia (rank 2), South Korea (rank 8), Malaysia (rank 13), India (rank 19), Indonesia (rank 20), China (rank 21) and therefore analysis would be restricted to these six countries only. China has the lowest score on data privacy (3.5), security (2.0) and cyber crime (4.6) which is even lower than India and Indonesia despite its otherwise high economic ascent. Yet, the high e-readiness score has been pushing China to speed up access to Cloud Computing. Efforts to promote free trade is perceived as a condition which improves Cloud preparedness of a country. Interestingly Malaysia has the lowest score on efforts to promote free trade whereas Australia, South Korea and India do better on this category. India has the lowest score out of these seven countries on ICT Readiness and broadband deployment which indicates a bleak future on Cloud Computing despite huge efforts and high investments being made in the deployment of the Cloud services. High scores on intellectual property is an indicator of a country's ability to nurture talent and incentivise innovation. India's low score on this category in comparison to the other six, points out towards the need for a strong legislation to protect intellectual contribution and retain talent. Even though Singapore, Thailand and Vietnam are not selected for the present comparative study, their extremely low scores on security (3.6, 1.6, 2.8, respectively) is an indicator of brewing problems for Cloud Computing in Asia (see Fig. 4.2).

According to Salyards (2013), opportunities are already ripe in the Asia-Pacific region towards growth and adoption of Cloud and mobile technology. The results are already beginning to show – according to Frost and Sullivan, a few countries like the Singapore, Hong Kong and Malaysia are the next hotbeds of Cloud adoption and the Asia-Pacific market for Cloud Computing is expected to grow at 36.5 % between 2013 and 2016. The most successful companies will be those that are able to easily transition their existing infrastructure to integrate Cloud

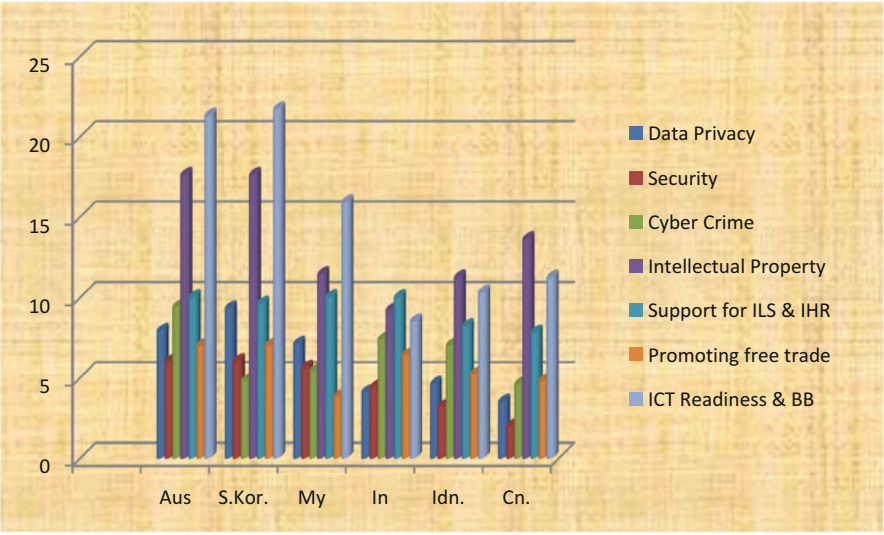

Fig. 4.2 Ranking on Cloud readiness. Source of data: Business Software Alliance (BSA Global Cloud Computing scorecard) (http://cloudscorecard.bsa.org/2012/assets/PDFs/BSA_GlobalCloud-Scorecard.pdf)

Computing, mobility and social media into their daily business process. A global survey of KPMG found that:

1. The top challenge companies using Cloud Computing face is the high cost of implementation and transition into the Cloud from existing infrastructure
2. The second most common problem faced by companies adopting Cloud was data loss and privacy threat
3. With the rise in BYOD kind of practices, convergence of technology is the gateway to improved and sustainable efficiency

4.6 Achieving MDGs Through Partnerships and Collaborations

Any study on reforms done in isolation of an understanding of the reasons and the nature of these gaps would simply be a theoretical exploration which may enlighten the formulator without bringing substance for implementation. MDG targets have paved the way for country governance to link their paths of development to measurable targets. As discussed in the first chapter, United Nations has for the first time taken the initiative to set minimum empirical limits to government action on bringing well-being of citizens. Criticism aside, MDGs have put countries on regional and global scales of evaluation and competition. This has resuscitated and pushed smaller powers to undertake a committed and disciplined direction towards goals common to

all, build local capacities and emerge out of the shadows and clutches of big dominant donor countries. It has also given a fair chance to struggling nations to reinvent peace, well-being and capacities out of their differently abled resources. The strides of countries like Afghanistan, Bangladesh and Maldives have never been so well directed, focused and speedy. The myth of Pakistan as a terror industry for the outside world is watered down with its record of strategic progress being fed into well-being. The marketing dragon, China, is also made to share its neighbourhood with many erstwhile ignored states of Southeast Asia. To many analysts MDGs sound unrealistic[18] and authoritative[19] and carry embedded gender[20] concerns in their design and construction. However, since MDGs carry a penchant for development, a need for innovation and radical reforms, they have set in motion even those states which were heading towards a political and administrative doom. Focus upon the macro-economic policy has been retrieved as required under MDG 8, and these erstwhile low-performing governments have discovered a new incentive to perform.

e-Governance becomes an indispensable tool with most governments to achieve partnerships and collaborations. Whereas partnerships and collaborations are important, they need a direction and a focus. The following parameters precede the task of achieving them:

1. **Creating one's own Internet company:** India has yet to create an Internet company of its own despite the fact that the number of Internet users is expected to cross 250 million mark by 2015. The forecasters in business predict that India, China, Australia and Japan which generated around US$258 billion in commerce sales in 2012 (Nielson 2013) may create an explosively profitable market very fast. China already worked on setting up three globally competitive Internet companies Tencent, Baidu and Alibaba. Russia is also not far behind with Mail.ru and Yandex (Lacy 2012).[21] Creating one's own company may bring cultural synchronisation with the emerging needs of non-English-speaking Indians going online and help deepen the web penetration which is crucial for the success of e-governance.
2. **Preventing e-catastrophe:** e-Governance is based on knowledge-driven governance, but knowledge about what? Administrators and bureaucrats in charge of ministries and departments of e-governance carry the challenge of knowing about the future of technology used in e-services, e-welfare and data used prior to formulating plans for development. Lack of knowledge may lead to an e-catastrophe

[18] 'MDGs assume that development is essentially a linear process which can only be achieved by following neo-liberal and capitalist dictates'(Chant and McIlwaine 2009, p. 22).

[19] Amin, Samir.(2006), who is the director of the Third World Forum in Dakar, Senegal, observed that the MDG policy is against the policy of 'consensus' practiced in the UN as USA and its European and Japanese allies are now able to exert hegemony over a domesticated UN.

[20] MDGs have become a primary global development framework within the UN system which would clash with the larger goals of women's movement across the world (Barton and Prendergast,2004).

[21] **Lacy S (2012) Yebhi.com Raises $20 m: Is this the Indian Internet Giant We've Been Waiting for?**

http://pandodaily.com/2012/07/10/yebhi-com-raises-20m-is-this-the-indian-internet-giant-weve-been-waiting-for/

which would bring the whole nation to a standstill, trains would stop, flights may not take off, ATMs screens may turn black and suddenly all communities, commerce and investment would disappear. Nations would become lifeless and staid as statues. Knowledge about the consequences of deploying or adopting an e-programme may become the centre-stone of serious administrative training process.

3. **Preparing e-leaders:** In a visionary developmental programme which is concerned about sustaining development through technological progress, political leadership does matter. Chandrababu Naidu in Andhra Pradesh or the Secretary of IT Ministry Mr. Chandrasekaran, President Rajapaksha in Sri Lanka or Prime Minister Mahathir Mohd. in Malaysia have dashed through the platform of stronger and dominant nations to bring benefits to their countrymen. Lack of leadership has derailed many good initiatives. This factor of political leadership becomes relatively more important in present times when split-second decisions may destroy many good achieved successes.
4. **Coordinating e-decision-making:** 'IPv6 adoption needs coordination with different types of stakeholders'.[22] Left to politics, e-governance would find it difficult to move beyond the web pages which provide the structure of government. Left to administration, the number of services would be mentioned without putting them within the rights-based framework of Citizens' Charters, Right to Public Service Act or laws which demarcate property, land and wealth. Left to technologists, e-governance would entail a huge expenditure to bring the world's most sophisticated technology systems which would have little or no relevance to citizens' requirements and understanding. Many governments just pull through a morass of decision-making by marketing themselves on fancy portals. Improved interdepartmental coordination would prevent unnecessary and repetitive investments and overstaffing.

The above parameters empower governments to generate a vision for the future and take pre-emptive action to sustain e-governance. Picked up from the vivid descriptions about the future of e-governance, two indispensable efforts may help in understanding the role that governments are expected to play in their adoption and deployment of IPv6. First is the adoption and deployment of IPv6 before the IPv4 completely gets exhausted. Second is the adoption of 'Cloud Computing' for ensuring larger data storage space and with greater reliability of transfer and application.

4.7 Is Technology a Substitute for Organisational Reform?

There are authors who are driven by faith in the Internet so much so that they have addressed it as an 'organisational substitute' and also 'an equal opportunity technology' (Buechler 2011, p. 221). Another author (Salter 2003) refers to computer-mediated communication as nonhierarchical and a self-reflexive discourse which is difficult

[22] National IPv6 Deployment Roadmap Version-II First Published: March 2013.

to achieve in conventional settings but remain central to progressive activism. If there are believers of 'e-governance as a magic wand' which can reform organisations and transform work culture, they are highly mistaken as e-governance can be easily highjacked by powerful lobbies who have stakes in the continuation of the existing regime. In most Asia-Pacific countries, organisations which were associated with tax collection, revenue generation and foreign direct and institutional investments were faster in implementing e-reforms in governance as compared to community or local service delivery organisations. In reality the issue of organisational reform cannot be achieved by introducing technology alone.

To understand organisational dynamics at the dawn of ICT, organisations may be distinguished from other gatherings of individuals by their stability, longevity, routineness of formal structures and ability to use environment to produce outputs. Every organisation has internal rules and procedures to gain compliance and grant punishments. The behaviour of organisations is dependent upon the organisational culture, structure, politics, business processes, environment, privileges, obligations and responsibilities that are delicately balanced over a period of time through conflict and conflict resolution (Laudon and Laudon 2008, p. 85). Most descriptions of organisations have an embedded cultural context and therefore may not be suitable for use in every setting. It is for this reason that organisational definitions may not be predictive of life outside.

ICT has helped a two-way communication and interaction with the outer world. Internet, mobiles, social media (Skype), software apps and the access to 'Cloud Computing' have transformed organisational systems. Organisations respond faster and with greater rigor so that modern day emergencies, quick decisional needs and international collaborations and partnerships are simpler to manage than previous times. The cost of transactions, capital investments in labour and overstaffing is minimising. ICT may greatly benefit governance through lower cost and better services that could be offered (Bowersox and Closs 1996). In fact many organisations have been able to reduce the cost of infrastructural expenditure by an intelligent use of ICT. International ICT Companies like Accenture and IBM have extended the 'work from home option'[23] to a large number of its employees so that they can save millions of dollars in office space infrastructure maintenance cost. The e-governance model of the Asia-Pacific is increasingly moving into the direction of increased interaction on policy issues and information dissemination on governance. This is already challenging the outdated administrative models which are resistant to change and sometimes create obstructions with the intention of rent seeking (Krueger 1974).

Peter Drucker (1993), the legendary management Guru, suggests that the rise of knowledge and competence in organisational management has replaced authority-based hierarchies which worked on formal positions. Thus, ICT has flattened hierarchies and its knowledge-based networking skills may also improve coordination (Drucker 1988).

[23] An informal discussion with young engineers in Accenture in Gurgaon city and IBM in Gurgaon and Bangalore cities also revealed that they are even paid a 'work from home bonus' for having made that choice.

From the above description, it appears that ICT will usher in a smart work culture, efficient personnel and a transparent or corruption-free organisation. However, in reality even the most e-ready and e-advanced countries like Singapore and USA, where government procurement is totally through 'e' system, have been plagued by financial bungling, corruptions and administrative scandals involving big national projects. As e-governance works within the larger framework of politics,[24] the pre-existing organisations continue to control the new and reformed e-based organisations. There are many others who believe in the power of organisations to control the impact of systems over structures (Laudon and Laudon 1988).

ICT is merely a device, and it realises its full potential when it becomes part of a strategy. Every strategy has a context, an ideology of performance and a field of politics due to which it brings many stakeholders together to achieve its objectives in a desired manner. As Garrido et al. (2007) explain, 'a strategy specifies how a business intends to compete in the markets it chooses to serve'. Today's business strategy model should be integrated, consisting of a market and a policy component (Baron 1996). An inability of ICT alone to transform organisations is due to the fact that it has to align itself with a strategy, but in this alignment it serves the predefined lanes of the political field, ideology and priorities of the decision-makers. Innovations help to overcome the baggage of politics, ideology and negligence. Organisational changes through e-governance programmes have been mild and nonimpactful as the presence of dominant bureaucratic ideology in the implementation field not just lacks adequate skills but also seems unprepared to accept any change due to their utter lack of exposure to knowledge and global currents of governance. As part of the Governance Knowledge Centre (GKC 2008) of the Department of Administrative Reforms and Public Grievances, Government of India, more than 80 e-governance projects across the world were studied. The following reasons were discovered for their lack of impact in the areas they were designed to serve:

Strongest reasons

- Lack of institutional memory due to which once the administrator gets transferred the next incumbent fails to generate ideas and motivation to carry it forward.
- Lack of cooperation/coordination from state or central (federal) government which if governed by two different political parties fail to synchronise policies on infrastructure support, fund disbursement, dissemination of knowledge and disinterested district level government.
- Absence of leadership which could promote, market and motivate citizens to participate in e-governance initiatives.
- Patriarchal social structures which prevented the participation of women in technology-driven governance even though many policies were exclusively for them.
- Relevant information and user-friendly softwares were not promoted.
- Outsourcing of many requirements of e-governance like softwares, hardwares, infrastructures, management of Kiosks, skill development and evaluation tasks was based upon flawed principles due to which citizens, clients and service providers had more issues to battle than to cooperate. This increased cumulative cost of the project.

[24] The next chapter on the case study from Australia has studied this particular aspect in detail.

Routine reasons

- Connectivity issues demotivated most service seekers. This had many reasons such as power availability, bandwidth, etc.
- The NIC supplied programmes and softwares required constant upgradation, maintenance and monitoring, but this could not be undertaken on a consistent basis.
- The consultants appointed under the schemes had personal agenda, and due to their proximity to senior administrators or Ministers, they could influence administrative decisions favourable to the donor agency.
- Most middle and junior level officers in government offices thought that it was a new policy fad to obtain foreign investment, without which the policy has no local connect. So they felt that their task was almost achieved with attractive websites and everything else will just follow.
- Funding was not streamlined and standardised due to which the real doers got much less than the NGOs who could show high turnover and could network better.
- Stakeholders were dispersed, and no department got involved in a consistent and committed skill building and e-training workshops.
- The linguistic and cultural disconnect with local regions prevented participation.

Bretschneider and Mergel (2011) believe that technology does not drive the change but enables new forms and approaches or helps in the creation of new and improved organisational structures. However, these authors are apprehensive about technology-driving change as even though technology is important, it is not sufficient for institutional and organisational change. They suggest that the bottom line is that the diffusion process spreads technology, but pre-existing structures and human actions affect the final impacts and potential from these changes (p. 190).

As much as the adoption and deployment of new technology is important for an effective and sustainable e-governance, organisational issues cannot be delayed. The fear that technological determinism may lead bureaucracy towards the adoption of e-governance as a substitute for effective governance is also not unfounded. There is much that needs to be undertaken to see that adopted new technologies do not become a substitute for administrative and organisational reforms and create a new niche for rent-seeking middlemen in service delivery. Lastly, the issues of diffusion, transition and replication indicate a set of political and administrative processes which turn passive adopters to dynamic leaders.

4.8 Conclusion

The present chapter is an interrogation of the issue of sustainability. As Asia-Pacific countries progress towards megastructures of e-projects with more complicated networked technologies and concerns which surround these technologies such as Big Data and Cloud as storage spaces and broadband and IPv6 as connectivity requirements. Thus, the work of government does not end by launching a megaproject of e-governance but to make efforts on sustaining it.

The traditional system of linear and pyramidical decision-making is changing as both the number and quantum of Internet users along with an equivalent high

amount of data produced and created is extraordinary and unique. The Internet adds eight new users every second, and this number is steadily and steeply rising. In a study titled 'Internet's New Billion', the Boston Consulting Group (BCG) said Brazil, Russia, India, China and Indonesia (BRICI) will have more than 1.2 billion Internet users by 2015, which is over three times the number of Internet users in Japan and USA combined.

Every Internet user needs an address space, and with the explosive rise of Internet users in the Asia-Pacific, this space is at the verge of exhaustion. The IPv4 version has already exhausted its address space. The rapid growth of Internet and wireless subscribers and deployment of next-generation network[25] (NGN) technology is leading to accelerated consumption of IP addresses. In view of the IPv4 exhaustion concern, five Internet companies, Facebook, Google, Yahoo!, Akmai and Limelight networks, got together on 8 June 2011 for a global scale 24-h trial of IPv6.

As IPv6 is indispensable for accommodating the explosive growth of new Internet users, Cloud Computing is indispensable for delivering smooth, transparent and uninterrupted e-governance services to citizens. It is also a way of delivering both new and existing services more cost-effectively besides attracting new business and investors in development. Consequently, it has a huge potentiality for creating new jobs and a participatory citizenry, tax collection, revenue generation and implementing e-reforms in governance. ICT is merely a device, and it realises its full potential when it becomes part of a strategy. Every strategy has a context, an ideology of performance and a field of politics due to which it brings many stakeholders together to achieve its objectives in a desired manner. Technology does not drive the change but enables new forms and approaches or helps in the creation of new and improved organisational structures. However, these authors are apprehensive about technology-driving change as even though technology is important, it is not sufficient for institutional and organisational change which takes place within a much larger and complex field of administrative and political processes.

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[25] NGN technology is a new access network technology which enables the deployment of voice, video, data and signalling through the same IP thereby providing many sets of services by converging fixed and mobile networks.

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