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Addressing the Challenges of E-government in Developing Countries through Public-Private Partnership Model Based on Cloud Computing

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Abstract

E-Government is recognized globally as an enabler toward transformation of public sector from a bureaucratic agency centric organizational model to a SMART (simple, moral, accountable, responsive, and transparent) citizen-centric government model. Successful planning and implementation of e-Government requires abundant technical and financial resources for capital investment as well as for systems maintenance on a sustained basis, which inhibits the development of e-government in most developing countries. Public Private Partnership (PPP) is being increasingly recognized as a valuable source of new technology, management expertise, and investment capital. Traditional public sector IT environment is characterised by low asset utilization, duplicative systems, and long procurement cycle time. Cloud computing has made it possible to consolidate IT infrastructure for the entire government relieving individual agencies of the burden of investing and managing IT resources. This paper identifies and examines the e-government challenges faced by developing countries in general and Pakistan in particular proposes a solution that combines the benefits of PPPs and the leapfrogging potential of cloud computing technology.

Key Words: Public-Sector Reform, E-Government, Cloud Computing, Public-Private Partnerships

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INTRODUCTION

E-Government is recognized globally as an enabler toward transformation of public sector from a bureaucratic agency centric organizational model to a SMART citizen-centric government model. Countries that score high on public-sector openness and efficiency and e-Government readiness constitute the highest GDP per capita group of nations. (UNDESA, 2008 and 2010)

The rationale to undertake e-government and ICT in public sector is undeniable for almost all countries. Successful planning and implementation of e-Government requires an abundance of technical and financial resources for capital investment as well as for maintenance of the systems on a sustained basis. Lack of these resources inhibits the development of e-government in most of the developing countries. For governments, particularly in developing countries, facing chronic operational and institutional deficiencies, and limited fiscal resources, the private sector is increasingly being recognized as a valuable source of new technology, management expertise, and investment capital for meeting the growing demand of public services. Public-Private Partnerships are better options because the domestic capital markets are not efficient enough to provide reasonable capital to private sector for financing the ICT projects realized for the public. Public sector involvement in ICT and e-government projects is therefore necessary for attracting foreign capital to participate in financing the projects.

But the traditional public sector IT infrastructure is characterised by low utilization, duplicative systems, long procurement cycle time, and organizational silos. Cloud Computing allows organizations to reduce IT costs through improved

utilization, reduced administration and infrastructure cost and faster deployment cycles. (Boss et al., 2007)

The PPP Model based on cloud computing will shift focus of government agencies from IT asset ownership to electronic service management by tapping into private sector financial strengths and technological innovation.

E-GOVERNMENT ASSESSMENT AND BENCH MARKING

Benchmarking is a technique for comparing e-government performance, and is normally based on a set of indicators. Benchmarking can help e-government development, by drawing attention to best practices elsewhere in the world. The results of benchmarking are useful for formulating e-government strategy and streamlining planning process. (Lasse Berntzen, 2009)

The United Nations Department of Economic and Social Affairs (UNDESA) have been assessing e-government readiness among its member nations (all UN member states) since 2001. The Member States are analyzed according to two indices, e-readiness index and e-participation index.

The E-Participation Index assesses the quality and usefulness of information and services provided by a country for the purpose of engaging its citizens in public policy making through the use of e-government programs (UNDESA, 2005).

E-Government Readiness Index is a composite measurement of the capacity and willingness of countries to use e-government for ICT-led development. It is a composite index comprising the web measure index, the telecommunication infrastructure index and the human capital index. Web-measure index presents a picture of the status of the supply side of e-government readiness while telecommunication infrastructure index and human capital index highlights the status of the demand side of e-government of a country. (UNDESA, 2008) Governments of developing countries face challenges both at the supply side and demand side of e-government.

Table- 1 shows the top 10 ranking countries in the UNDESA e-Government surveys from 2005 to 2012. All of the countries in the top ranking are high income group of nations belonging to North America and Europe except Singapore and Republic of Korea from Eastern and South East Asia Region. South Asia region which include highly populous countries like India, Pakistan and Bangladesh has the lowest e-government readiness index in the world after Africa.

Table 1: E-Government Readiness Index Top Ten Countries

Rank	2005		2008		2010		2012	
	Country	Index	Country	Index	Country	Index	Country	Index
1.	USA	0.9132	USA	0.9062	Sweden	0.9157	ROC	0.9283
2.	Denmark	0.9047	Denmark	0.9058	Denmark	0.9134	Netherlands	0.9125
3.	UK	0.8852	Sweden	0.8983	Norway	0.8921	UK	0.8960
4.	Sweden	0.8741	UK	0.8777	USA	0.8644	Denmark	0.8889
5.	ROC	0.8575	ROC	0.8727	Netherlands	0.8631	US	0.8687
6.	Australia	0.8377	Australia	0.8679	ROC	0.8317	France	0.8635
7.	Canada	0.8369	Singapore	0.8503	Canada	0.8172	Sweden	0.8599
8.	Singapore	0.8340	Canada	0.8425	Australia	0.8108	Norway	0.8593
9.	Finland	0.8239	Finland	0.8231	France	0.8038	Finland	0.8505
10	Norway	0.8178	Norway	0.8228	UK	0.7872	Singapore	0.8474

Table-2 below is a picture of the Pakistan's e-government readiness index since 2003 in UNDESA Global e-Government Readiness Survey Reports. The table shows that the world average of the global e-government readiness index continues to increase due to steady progress in ICT diffusion, human capital development and investment by member states in developing informational websites and facilitating online transactions with government. But instead of improving its ranking Pakistan's rank has been decreased compared to other countries of the world. (UNDESA, 2005, 2008, 2010 and 2012)

Table 2: E-Government Readiness Index of Pakistan

Year	Index	Rank	Rank Change	World Average
2003	0.2470	137		0.4020
2004	0.3042	122	+15	0.413
2005	0.2836	136	-14	0.4267
2008	0.3160	131	+5	0.4515
2010	0.2755	146	-15	0.441
2012	0.2823	156	-10	0.4882

The Telecommunication Infrastructure as given in the below table is very poor except cellular mobile density. But exponential growth of mobile sector becomes possible after opening the market to private investment. Mobile broadband (3G/4G) services growth in just 4 months, after issuing licenses to private operators in April-2014, is almost equal to the growth that other

broadband band technologies have made in 9 years. (PTA; Industry Report)

Table 3: Telecom Indicators of Pakistan

Year	Fixed Line			Mobile		Broadband			Teledensity
	FLL	WLL	Density	Subscribers	Density	Other BB	Mobile BB	Total	
2003-04	3.0		3.0	5,022,908	3.29				6.25
2004-05	3.43	0.17	3.6	12,771,203	8.30				11.89
2005-06	3.37	0.66	4.03	34,506,557	22.21	26,611			26.26
2006-07	3.04	1.08	4.12	63,159,857	39.94	45,153			44.06
2007-08	2.70	1.4	4.10	88,019,812	54.60	168,082			58.90
2008-09	2.20	1.6	3.80	94,342,030	58.20	413,809			62.0
2009-10	2.16	1.6	3.76	99,185,844	60.4	900,648			64.1
2010-11	1.9	1.7	3.6	108,894,518	65.4	1,396,608			69.0
2011-12	1.7	1.8	3.5	120,151,235	68.5	2,101,315			72.0
2012-13	1.7	1.8	3.5	127,737,286	71.4	2,721,659			74.9
2013-14	1.73	1.69	3.42	139,974,754	76.46	3,795,923			79.89
July-14	1.73	1.69	3.42	140,022,516	76.31	3888,256	844,701	4,732,957	79.73
Aug-14	1.73	1.69	3.42	138,589,661	75.35	3979,359	1,776,734	5,756,093	78.77
Sep-14	1.73	1.69	3.42	137,605,819	74.63	4048828	2,327,457	6,376,285	78.06
Oct-14	1.73	1.69	3.42	137,152,666	74.21	4151877	3,768,253	7,920,130	77.64

PUBLIC PRIVATE PARTNERSHIPS AND E-GOVERNMENT

PPP arrangements are basically contracts between a private sector entity and the government that call for the private partner to deliver a desired service and assume the associated risks. (Jonathan Loew et al, 2002) Recognizing, the success of employing PPP models in other sectors and the fact that the technological know-how required for most e-government initiatives lies primarily with the private sector, the PPP model is now gaining acceptance for ICT and e-government projects (infoDev: PPP Knowledge Map, 2009).

The private sector can build infrastructure cheaper than the public sector with savings amounting 15-30 percent. (Marian Moszoro et al, 2008) On the other hand the cost of capital for the private sector is on average 40-260 basis points higher than for public sector. Combining the advantages of lower cost of capital of the public sector and lower outlays on building infrastructure by private sector, an optimal total low cost solution with both public and private capital as part of the partnership can be reached.

E-government PPPs include a broad range of contracts in which private partners and government bodies each share a different level of the e-government project's risks. In some PPPs, governments may be responsible for financing and owning the project's underlying electronic network infrastructure and equipment facilities, while the operation of a new e-government service that uses this network becomes the contractual responsibility of the private partner. In other cases, the private partner could become responsible for design, financing, installation and construction, as well as the operation of a new electronic network, including the delivery of electronic government services.

Located in South Asia, Pakistan is one of the most populous countries of the world with a population of more than 175 million. Neighbored by Afghanistan, Iran, India, and China, Pakistan has one of the most strategic geographical locations in the world. Being first line state against war on terror, Pakistan faced serious domestic political uncertainties and undesirable law and order situation which seriously affected the economy. Table-4 below shows the annual budget position of the country for the last 6 financial years. (Finance Division, 2009-15))

Table 4 : Economic Status of Pakistan

	2009-10 (Rs.in Mln)	2010-11 (Rs.in Mln)	2011-12 (Rs.in Mln)	2012-13 (Rs.in Mln)	2013-14 (Rs.in Mln)	2014-15 (Rs.in Mln)
Total Expenditure	2585557	2559367	3,109,732	3,478,354	4,057,293	4,301,746
Total PSDP +Other Development expenditures.	628302	241517	477,821	571,300	858,707	838,500
PSDP as %age of Total Budget	24.3	9.4	15.3	16.4	21.2	19.5
Budget Deficit (Loans)	667094	742041	1165355	1819032	1090383	1096516
Loans as %age of Total Budget	26	29	30.2	52.3	26.9	25.5

Keeping in view the economic crisis, fiscal constraints, budget deficit and heavy public debt, and recognizing the importance of improving and expanding infrastructure assets and services for sustainable economic and social development, the government recognized the importance of including the expertise and finance of the private sector for infrastructure provisioning. The Government of Pakistan Issued Pakistan Policy on Public-Private Partnerships which was approved by Economic Coordination Committee (ECC) on January-26, 2010, but e-Government projects specifically were not included in PPP policy (Pakistan's PPP Policy, 2010).

The deployment and use of ICT and e-Government require telecommunication infrastructure to provide network access, electrical infrastructure to make ICTs work, skills infrastructure to keep all the technology working, money to buy or access ICT, usage skills to use ICT, and Literacy skills to read

content. The mismatch between the investment needs of Pakistan and the resources available from the government has increased the reliance on Public-Private Partnerships.

E-Government is one of the areas which are eminently suited for PPP, because the technological know-how, managerial expertise and financial resources required for e-government lies primarily with private sector. International experiences show that if a suitable framework for PPP in e-government is designed it can become a big leap forward in the efficient, convenient and cost effective delivery of public services to citizens.

Cloud Computing and E- Government

Simply stated, cloud computing is the outsourcing of IT infrastructure via the Internet. Cloud Computing allows both public and private sector organizations reduce costs through improved utilization of computing resources, reduced infrastructure building and administration cost and faster deployment cycles (Boss et al., 2007)

According to National Institute of Standards and Technology (NIST), 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 (Peter Mell & Tim Grance, 2009).

According to Jeffery Voas & Jia Zhang (2009), cloud computing is the sixth evolutionary phase of computing that follows on from mainframes, personal computers (PC), networked computing, the internet, and grid computing.

The economics of cloud computing

According to Armburst et al., (2009) the economic appeal of Cloud Computing can be described as "the conversion of capital expenses to operating expenses", using the pay as you go pricing model. A report by Ted Alford and Gwen Morton (2009) of Booz Allen Hamilton concludes that government agencies moving to public or private clouds can save from 50 to 67 percent.

Albert Greenberg et al., (2009) provide a rough guide of data center costs:

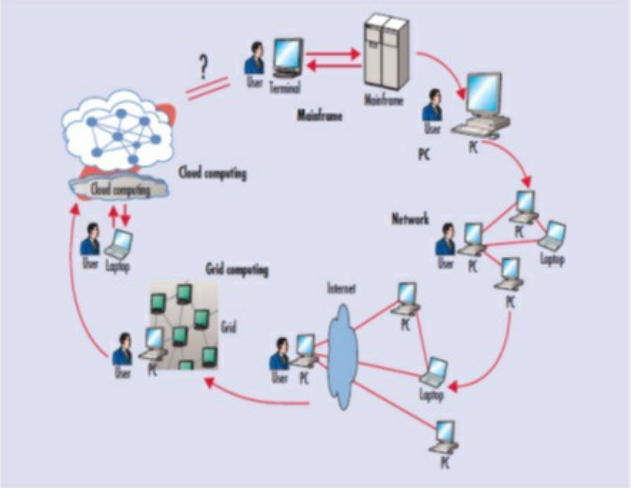

Figure 1: Evolution of Computing Technology

Table 5: Cost analysis of Datacenter

Amortized Cost	*Component*	*Sub-Components*
45%	Servers	CPU, memory, storage systems
25%	Infrastructure	Power distribution and cooling
15%	Power draw	Electrical utility costs
15%	Network	Links, transit, equipment

According to study of Microsoft Corporation (2010), cloud computing allows core IT infrastructure to be brought into large data centers that take advantage of the combination of supply-side economies of scale, demand-side aggregation of workloads, and the multi-tenant efficiency which leads to powerful economies of scale. Supply-side economies of scale result from consolidation of overhead costs, purchasing power, and power efficiency, making large datacenters up to 50% more cost effective than smaller data centers. Demand-side economies of scale shows that pooling computing improves the utilization of IT resources and reduces costs by another 50 percent because less computing resources will be needed to serve the aggregated demand. In multi-tenancy environment, multiple customers sharing the same application divide the costs of operating the

application and can reduce costs by an additional 20 percent. By improving utilization rates, large-scale clouds can lead to 40% saving in power consumption of server, storage and networking hardware. Due to these economies of scale a 100,000-server datacenter has an estimated 80% lower total cost of ownership (TCO) compared to a 1,000-server datacenter.

The traditional public sector Information Technology (IT) environment is characterized by low asset utilization, a fragmented demand for resources, duplicative systems, and long procurement lead times. It is estimated that 70% of IT budgets go to the maintenance of traditional IT systems (computing, storage, servers and networks) and labor costs, 85% of which remain unutilized. These inefficiencies negatively impact the government's ability to serve the citizenry. (Vivek Kundra, 2011, Darrell M. West, 2010).

With cloud computing, IT infrastructure resources are pooled and shared across large numbers of applications and organizations. Cloud Computing creates economic value for public sector organizations in various ways.

Resource Optimization

If the demand of different government agencies is aggregated and served from a common pool of resources from the cloud far less resources will be needed than that if each agency deploy individually. This argument is based on the assumption that "Sum of the peaks is always greater than Peak of the Sum". (Joe Weinman, 2008)

Optimum Capacity Utilization through statistical multiplexing

In real world the demand of each organization is not always flat but goes through different peaks and troughs depending on demand. The larger the peak is relative to the average, the smaller the utilization. The effective cost of a resource is a function of how much excess capacity needs to be maintained. The higher the excess capacity the higher will be the effective cost of the resources. By aggregating the demand from multiple government agencies the utilization of resources will increase which results in reduction of effective cost of government IT resources.

Loss due to imperfect demand

In real world when there is a mismatch between capacity and demand, costs arise in two ways. First if demand is lower than capacity, there are costs associated with resources that are idle, and second, if demand is higher than available capacity, there can be costs associated with not serving that demand, e.g., lost revenue, lost productivity, and dissatisfied customers etc. In an ideal world or perfect capacity, resources would exactly mirror demand, so there would be no such losses. (Joe, 2011)

In case of cloud computing the resources can be provisioned without delay when required and released when no more needed. There is no need to forecast the resource requirement by individual agencies for special occasions and build capacity according to demand peak.

For governments of developing countries, the cloud not only provides a chance to lower their costs of infrastructure and help drive savings across their ICT ecosystem, but cloud computing may enable them to leapfrog a whole generation of government computing, analogous to how wireless technologies have made available Internet and telephony in the absence of wired alternatives.

To harness the benefits of cloud computing, the government must institute a Cloud First Policy, requiring public agencies to evaluate safe, secure cloud computing options before making any new investments. (Vivek Kundra, 2011)

CONCLUSION

The ultimate goal of e-government is to provide public information and services for convenience, effectiveness and empowerment of citizens via a single portal seamlessly integrated with government agencies. However achieving this goal is not an easy task. Governments of developing countries like Pakistan face challenges both at supply and demand side of e-government. To cope with these challenges public private partnership has emerged as a viable solution enabling financial resources, technical skills and managerial expertise of the private

sector to be utilized for public sector ICT projects. In countries like Pakistan where e-government is in its initial stages of maturity instead of investing in ICT infrastructure for every individual public sector organization, the government must consider the option of aggregating the entire demand and serve it from shared pool of the IT resources using cloud computing technology. PPP model based on cloud computing combines the advantages of lower cost of public sector capital and financial, technological, and managerial strengths of the private sector along with the benefits of cloud computing technology to come up with an optimal least cost solution.

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