Assessing the Impact of e-Government Projects: The Case of Limpopo Province in South Africa

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Abstract—**This paper evaluates the impact of major e-Government (e-Gov) projects implemented in the Limpopo Province of South Africa. These projects involves investment of millions of dollars and huge amount of effort and time; yet little is known about their impact, partly due to lack or inappropriate use of measuring frameworks.**

The study proposes an Impact Assessment Framework based on Bhatnagar and Sigh's e-Government Impact Assessment Framework developed in 2010. The framework accounts for all possible stakeholders that could be affected by an e-Gov delivery project namely: clients receiving the service, the agency that delivers the service and the wider affected society consisting of citizens, government, business and the civil society. For data collection, 350 questionnaires were distributed to e-Gov users in five different sites in Limpopo Province and studying of secondary data sources of the e-Systems. A combination of qualitative methods and quantitative data analysis using SPSS were used for data analysis. Key dimensions for measuring impact was based on: cost to clients of accessing computerized-services, customer satisfaction with services, governance transparency and sustainability impact.

Findings showed wide variations in impact across implemented projects; but overall, clients revealed deep satisfaction with e-Gov services; reduced number of trips to service offering offices; less waiting time in queues to be served; reduced corruption and increased satisfaction in e-Gov services; and increased revenue collection. In conclusion, e-Gov has a positive impact on the way citizens access government services electronically and participate in democratic processes.

The study recommends adoption of a multi-dimensional impact assessment approach by the government when evaluating impact of e-Govt projects. The identified key success factors in some e-Gov projects should be incorporated into other legging e-Gov projects to become fully-transactional and reap the same gains for the full-benefit of the citizens and government.

Keywords- e-Government, Impact, ICT, Service-Delivery, Developing Countries.

I. INTRODUCTION

E-Government can be defined broadly as the use of information and communication technologies (ICTs) in the public sector to improve its operations and delivery of services [6]. It is perceived as a diagnostic mechanism for the chain of problems associated with government and its public service delivery system in its endeavours to give effective services to its constituencies. E-Gov is also seen as a tool to increase transparency in administration, reduce corruption, and increase political participation [1].

In the context of South Africa, the State Information Technology Agency (SITA) is tasked to roll out broadband network for all nine provinces, including Limpopo Province which is predominantly rural area, with 88% of its population residing in rural areas and 11% in urban areas [2]. Telkom is also contracted by the government to install public and virtual networks. However, progress has been very slow due to squabbles between SITA and the Limpopo Province as to who should spearhead ICT infrastructure setup. Nevertheless, there have been notable e-Gov projects, for example the District Health Information Systems (DHIS) [3], e-TB Register, SARS e-Filling Tax Returns and the e-Natis used by the National Traffic Departments. Driven by the success of a few projects in improving delivery of services to citizens and business [4] in other provinces, the Limpopo Province of South Africa embarked on these several e-Gov initiatives.

On the contrary, there has been evidence of failed projects resulting in huge losses of millions of invested dollars. A failure rate of more than 50% is widely cited in this context [8]. As a result it is very important to assess the impact of such e-Gov initiatives, not only in the traditional monetary value or return-on-investment terms; but as impacting three distinct groups of stakeholders: a) the clients receiving the services; b) the agency that delivers the services; and c) wider society consisting of citizens, business, government as a whole, and civil society [4]. In all these three dimensions, the focal point of evaluation is to arrive at a conclusive decision on the impact of e-Gov initiatives in the Province after employing multi-dimensional quantitative and qualitative indicators for analysis.

Existing literature review on researches undertaken in evaluation of e-Gov projects shows that there are basically two broad classes:

i. First group focused on assessing the post-implementation of e-Gov initiatives and these varied widely in terms of what was measured, employed methodologies and the measurement parameters used. These studies largely anecdotal and done in piecemeal fashion, provide project-level evaluations with little prospect for generalization [4; 5]. These studies revealed great variations as to what was evaluated: some focused on assessing whether the e-Gov project actually achieved its intended design goals or services, others dealt with long-term sustainability and scope for replication for the project [6], whilst the last group concentrated on net benefits brought to the stakeholders. It has been noted in [4] that these studies adopted the following methodologies: "surveys, expert opinion, ethnographic studies, and internal assessments carried out by lending agencies." Despite sound evaluation and analysis by these approaches, there were notable weaknesses: lack of notable benchmarks to be used for future analysis and replication in related projects; diverse results for various analysis of the same projects – showing lack of credibility of results [4] and this was attributed to lack of rigor in employed sampling techniques that resulted in results being not easily generalized and a total ignorance in analysis of the prior and post implementation of the e-Gov project.

ii. The second group focused on establishing new e-Gov evaluation frameworks that could be used in their analysis of the impact of individual e-Gov initiatives considering prior and post implementation effects. Amongst the notable impact assessment frameworks are: "MAREVA (A Method of Analysis and Value Enhancement) [15] - focuses on calculating the ROI necessity for the project, level of risk, benefits to employees and society (which include gains of time, savings of money and simplification of accessibility); WiBe Economic Efficiency Assessment methodology [13] being used by the German federal administration to assess cost and revenue for e-government project; the eGEP measurement framework developed by the European Commission [14] on the basis of a review of MAREVA – built around the three values of efficiency (organizational value), democracy (political value) and effectiveness (user-value)"[4, 7].

These two approaches have been deployed and tested in developed countries with substantial achievements. Nevertheless, such models will fail to achieve similar commendable results due to the peculiar nature of surrounding circumstances in ICT-infrastructures in e-Gov projects in developing countries, namely: existence of high levels of illiteracy amongst rural e-Gov clients compounded with use of multi-languages; impact assessment of e-Gov projects in their juvenile phases of presence and interaction (which may struggle to reach transaction and integration phases due to constrained government budget allocations to e-Gov projects), use of common service centers found at district and provincial cities; and use of mobile phones to access e-Gov services from deep in the rural areas. This study adopts the second option of proposing a framework.

The next section of the paper outlines the major e-Gov projects implemented in the Limpopo Province of South Africa. This is then followed by an outline of our proposed Impact Measuring Framework and the adopted methodology for this study. The study results for the research are then presented and discussed to reach the conclusion in-order to postulate recommendations for future directions to vertically and horizontally enhance e-Gov services for policy makers in the Limpopo Province of South Africa to benefit the Province, country and other developing countries facing similar e-Gov adoption and evaluation challenges.

II. MAJOR E-GOVERNMENT PROJECTS IMPLEMENTED IN LIMPOPO PROVINCE

The E-Filing system for tax returns is one of the successful e-Gov projects spearheaded by the South African government through its South Africa Revenue Services (SARS) in 2001. This is a national e-Gov project, servicing all the nine provinces in South Africa including Limpopo Province – thus deserves recognition due to its enormous contribution to citizens' wellbeing. This is both a G2C and G2B initiative whose major goal is to facilitate electronic submission of tax returns and payments by taxpayers and tax practitioners, as well as extension use on collection of value added tax (VAT) [9] by the government. SARS Offices in Limpopo Province are located in four towns: Giyani, Lebowakgomo, Polokwane and Sebasa. First timer customers have no choice, but to go and join long-winding queues at any SARS offices in these four towns for registering and obtain a tax number that they can then use later on for any electronic filing of their tax returns online and thus greatly cut travelling cost and saving time spent in long queues. The SARS e-Gov system enjoys commendable success due to the following factors [9]:

- Provision of clear step-by-step guidelines on its website on how to file tax applications and returns – offering real-time taxpayer information and online services at lower operational costs.
- Strong government support that enforces zero-tolerance approach to corruption in the SARS electronic operations – thus resulting in the realization of billions of tax revenue.

National e-Health Informatics in South Africa is provided by the National Department of Health through the Provincial Departments of Health and Private Actors. This

is an initiative intended to bridge the digital divide of the poor rural and underprivileged community with its urban counterparts. However, it has been noted by the Minister of Health, Dr Aaron Motsoaledi in e-Health Strategy South Africa 2012-2016 [10] that "health information systems in South Africa have been characterised by fragmentation and lack of coordination, prevalence of manual systems and lack of automation, and where automation existed, there was a lack of interoperability between different systems." Nevertheless, the District Health Information Systems (DHIS) and e-TB Register are the two major successful e-Gov initiatives in South Africa thriving on the established Telkom and established mobile networks. These systems are used by health practitioners deep in the remote rural areas to collect health-related patient data and sent it for further processing in well-equipped major laboratories in major hospitals and feedback is relayed back immediately.

The National Traffic Information System (e-Natis) uses a state-of-the-art technology in providing essential e-services related to the South African Department of Transport. It is meant to handle services related to road-traffic law enforcement, specialized transactions like payment for the services over the internet and on automated teller machines, online car registration of cars by financial institutions, issuing and handling driving licenses and online real-time booking for learners' licenses. Nevertheless, most of the real-time functions are on the testing phase and not yet gone live for client use, but all others are functioning.

III. IMPACT MEASURING FRAMEWORK AND METHODOLOGY ADOPTED IN THIS STUDY

The study proposes an Impact Measuring Framework based on some fundamental aspects used in Bhatnagar and Sigh's Key Outcome Dimensions, MAREM, eGEP, EAF and WiBe Frameworks. The proposed framework adopts both quantitative and qualitative measurable outcomes that could be directly linked to e-delivery of a particular e-Gov service. This framework takes into consideration the key identified distinctive characteristics sharping e-Gov initiatives and e-delivery services namely: existence of high levels of illiteracy amongst rural e-Gov clients compounded with use of multi-languages; low internet connectivity and access which is often expensive for the majority of rural citizens; impact assessment of e-Gov projects in their juvenile phase of presence and interaction (which may struggle to reach transaction and integration phases due to constrained government budget allocations to e-Gov projects); use of common service centres found at district and provincial cities; and use of mobile phones to access e-Gov services from deep in the rural areas.

The framework focuses on key measurable aspects under study: net benefits delivered by the e-Gov system to various identifiable interested parties, ascertaining numerous measurable value components to be measured, showing various outcomes as experienced by the various identified stakeholders. Table 1 outlines detailed multifaceted set of values pertaining to identifiable stakeholders that can be measured by means of structured surveys, specifically in the context of developing country with the above key distinctive traits of an e-Gov project. The frameworks acknowledges that not every aspect of impact assessment can be quantified monetarily, but qualitatively – thus recognizing the essence of both qualitative and quantitative indicators.

Three key broad groups of impacted stakeholders in the framework are 1) clienteles receiving the e-Gov service, 2) service provider organizations (project champion, usually government department and its associated partners, usually international donor urgencies) and 3) the broader society (made-up of businesses, civil society, citizens, entire government and the international community). Reference [11] noted that "E-government systems frequently encompass strategic goals that go beyond efficiency, effectiveness, and economy to include political and social objectives, such as trust in government, social inclusion, community regeneration, community wellbeing, and sustainability"

The study adopts stratified random sampling methodology in selecting the four e-Gov service centres. The study population consisted of 350 respondents from villages located nearer and far away from the e-service centers and those within the towns and cities to whom the questionnaires were distributed. The questionnaires (usually using multi-languages) were designed based on the key impact assessment dimensions in Table 1 and distributed to 350 participants. Of these, 321 questionnaires were returned for analysis, 5 were spoiled and 316 questionnaires were used in the final analysis, representing 90% overall response rate. Key notable elements and features in the framework relevant to e-Gov projects in their various phases of growth in developing countries are:

- Measure of impact on the society through trust by citizens on the e-Gov services. This is closely associated with governance transparency (a direct measure of the extent of corruption/bribes requested in order to receive a service). The service delivery mode is a combination of both assisted service centres and self-use through online websites.
- Evaluate impact of cost on citizens of accessing the e-services as measured in terms of time spent in queues waiting for a service versus online access; number of trips made to service centres in cities and towns.
- Measure of impact on quality of e-service as measured in terms of customer satisfaction in using the e-Gov service, simplicity and reduced number of steps to access the e-service, customer-

care centres, error free transactions and clients' motivation to reuse the e-system.

- Sustainability effect/impact on the part of government (this have a huge effect on successive progression of the e-Gov system through the various e-governance phases)

IV. RESULTS OF E-GOVERNMENT PROJECT IMPACT ASSESSMENT

The fundamental objective of this study was to measure the impact of the four e-Gov systems on users in the Limpopo Province and validate the applicability of the framework across various e-Gov services for the same clients. The statistical analysis of the 316 questionnaires was carried out using the Statistical Analysis Software - SPSS. Secondary data was obtained from study and analysis of the actual e-Gov websites. The profound significance of the study called for the adoption of both quantitative and qualitative result analysis so that it can be of profound essence to all concerned stakeholders – considering varying levels of interpretations and education. Impact for the key assessment dimensions of costs, customer satisfaction, governance-transparency and sustainability-effect are presented. For all the analysis for costs, customer satisfaction, governance-transparency and sustainability-effect, the study uses *t-tests* to assess whether the differences between the manual and e-system were significantly different. The outcomes showed a significant difference at 99% confidence interval for all the four e-Gov projects under study.

A. Impact on Cost to Users

The impact of cost to users are two-folded: reduction in the number of trips to sort for e-Gov service and queuing time spent waiting to be served at the service offering offices for each respective system. Figure 1 shows variations in the number of trips made to access services to the nearest town or city with offices offering the service. For all the e-Gov systems under study, there has been a significant traveling cost savings in terms of reduced number of trips made by clients to get a service by 4.8 trips for the SARS e-Filling system to 0.5 trips for the e-Natis. The huge cost-saving in trips for accessing the e-Filling systems is attributed to that it is the only e-Gov service out of the four under study that offers transactional services over the internet and mobile phones for clients in the villages. For the DHIS, e-TB and e-Natis, clients do not have to travel to the towns and cities for enquiry purposes, all information can be accessed online. However, for the actual services, they do not have option; but to travel –hence the realization of marginal differences in reduced trips between the manual and e-System in Figure 1.

Figure 2 shows a significant reduction in the waiting time between the computerised and manualized systems at all the four service centers of between 44% for the e-Natis system to 66% for the e-Filling system. Such reduction in waiting time spent in queues possess a direct impact on worsted time

by workers trying to access a service and resembles an opportunity cost on clients on lost working hours, which translate to lost wages. Thus, the results revealed a significant reduction in waiting times of 138.9 minutes for the e-Filing system because clients have to travel and wait in queues to receive services (at least once for the first time to the nearest service-offering office in the four towns for registering) – thereafter, other subsequent services are done online. This is unique to the e-Natis and e-TB, were rural clients have to spent minimal waiting times to receive the services at the service offering centers. These e-systems websites offer informational services only like inquiries – but client-service is greatly increased due to intensive computerization of working procedures.

	e-Filing	DHIS	e-TB	e-Natis
Savings:	4.8	1.2	1.9	0.5
Standard Error:	0.27	0.08	0.11	0.05

Figure 1. Cost Saving in Number of Trips

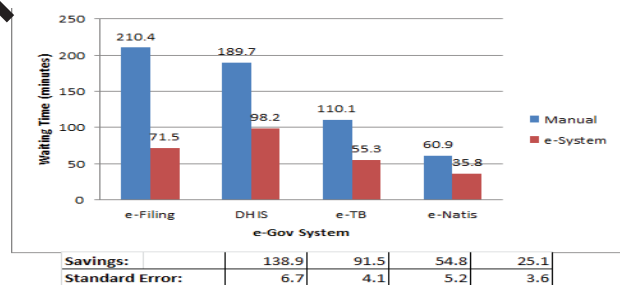|	e-Filing	DHIS	e-TB	e-Natis
Savings:	138.9	91.5	54.8	25.1
Standard Error:	6.7	4.1	5.2	3.6

Figure 2. Waiting Time at Service Centers (minutes)

B. Customer Satisfaction on Quality

This measure the impact of e-Gov systems on clients compared to the manual system and its benefit to the clients. A 7-point key scale has been used in Figure 3. For all the four projects, users highly rated the e-Gov services as satisfying. In the case of e-Filing system, there is a 2.2 variance in favour of the computerised system offering a quality and better service. This is attributed to the fact that e-Filing system is user-friendly, with well-explained step-by-step instructions on how to perform a transaction online with minimal steps to complete the service. Error rate in the system are minimal. With the DHIS, e-TB and e-Natis systems versus the manual system, customers complained of poor customer-care services; but greatly appreciated the use of e-system by the respective government departments. They also outlined reduced errors, that greatly benefited

both the clients in reduced further trips for services due to errors in reports and records and workers using the e-system, as their work becomes less strenuous with minimal errors.
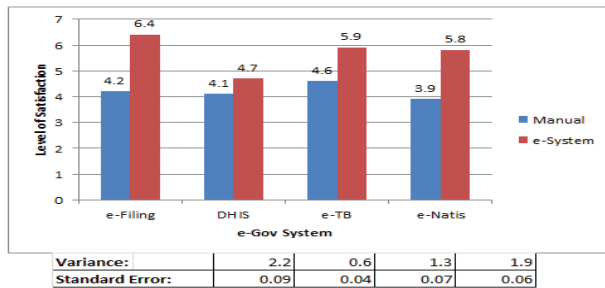

Figure 3. Overall Customer Satisfaction on Quality (7-point scale)

C. Governance Transparency

This measures the impact on the society (customers) through trust on the e-Gov services. These are G2C (government to citizen) e-Gov services and it has been discovered that due to low wages and remunerations, government workers resorted to soliciting for bribes from customers in addition to the service cost in order to get the service, often quickly through jumping long queues at the service offering office. Figure 4 shows a highest level of bribes of 15.5% for the manual system and 8.3% for the e-system in the Department of Transport. This is attributed to the fact that most of the clients soliciting for services at the Department of Transport cannot forego the wanted service like obtaining a driver's licence; hence they are willing to pay bribes to get the service. Low levels of bribes has been recorded in the e-TB and DHIS systems because most of their clients are less privileged patience with low disposable incomes, who cannot afford to go to private hospitals. The only bribes reported to be paid were in the form of "token-of-appreciation" in return for preferential-treatment to receive a service in their next visit, usually quickly by bypassing long queues. For the e-Filing Tax Returns system, bribes of 2.2% were reported to be paid by first-timer visitors to obtain preferential quick service and avoid long queues. However, for the online tax returns and claims, bribes are virtually absent.
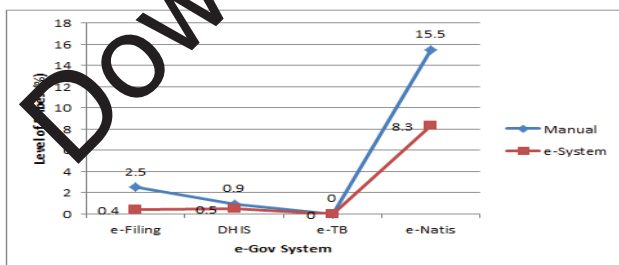

Figure 4. Levels of Paying Bribes

D. Sustainability Impact

Due to the classified nature and significance of data in this area, the study relied mainly on secondary data for analysis – from relevant journal articles, government reports and websites. Reference [12] outlined that for the 2011/12 fiscal year SARS realized a sharp increase of 10.2% in total revenue collection and a "growth of 32.5%" in the number of individuals registered for tax income. These percentages are on year-on-year-growth and were made possible by the effective use of the efficient e-Filing system for tax returns – thus having a huge impact for its future expansions. With regard to the DHIS and e-TB systems, the actual statistical figures on their successes with regard to sustainability impact are spatial – nevertheless, they are very vital e-Systems for data collection for further integration and processing in major cities. The e-Natis system has tremendous potential to advance from informational stage to transactional phase of e-Gov, thus its current sustainability impact could not be easily established.

V.   KEY FINDINGS, IMPLICATIONS AND CONCLUSION

The study found that the majority of the respondents who had used both the manual and e-system revealed vast inclination for the computerized system service delivery system as indicated in Figure 3. For all the four e-Gov systems, the costs of accessing services in the form of number of trips travelled to respective offices and total waiting time in queues to receive services were tremendously reduced by an average of 2.1 trips and 77.6 minutes (reduced by more than 50%) respectively. The level of corruption was drastically reduced below 3% for the e-Filing tax returns, DHIS and e-TB systems and this could be attributed to the fact that the e-Filing e-Gov system is the government's cash-cow on revenue collection – thus there is a zero tolerance on corruption. The DHIS and e-TB systems are servicing the less privileged poor sector of the community at highly subsidized (almost nothing) cost; thus no motivation and room for corruption. However, for e-Natis, the study found high levels of bribes of 15.5% for the manual system and 8.3% for the e-system. This could be attributed to the fact that most of the clients soliciting for services at the Department of Transport cannot forego the wanted service like obtaining a driver's licence, hence they are willing to pay bribe to get the service.

With regard to sustainability of the e-Gov system in the long run, the study found that the SARS e-Filing tax returns system is self-sustainable due to the full-transactional-functioning of their e-Gov systems and stringent policies on revenue collection and penalties on tax evaders. For all the four projects the study showed that the implementation of e-Gov systems did not result in any job loss; which is a great concern for both the policy makers and the workers who are mostly rigid and not willing to adapt to new technology.

In summary, the study found out that the framework can be of great use and applied to assessing the various e-Gov

projects qualitatively and quantitatively in their different project lifecycles across the country. The study assesses direct economic impact of the e-system on clients, efficiency of the system using customer satisfaction on quality and long-term project sustainability on the part of the government. The study recorded tremendous achievements in all the four implemented e-Gov projects and the few existing elements of corruption in the e-Natis system must be uprooted.

VI. LIMITATIONS OF THE STUDY AND RECOMMENDATIONS

This study has been exploratory in nature and that bears limitations of studying a relatively small sample (four e-Gov projects from one Province only) which is inadequate to give a clear picture of all e-Gov systems in the country. Financial limitations prohibited an impact analysis of major national e-Gov projects, which could give a clear picture of the success and failures of government e-Gov initiatives. Since the manual systems have been decommissioned many years ago, participants under study had to rely entirely on recalling and the facts could somehow not be verified. Not every key impact assessment outcome dimension like impact of e-Gov system on Millennium Development Goals and on citizen democracy could be evaluated due to time constrain – these are reserved for future assessment.

The study recommends the adoption of a multi-dimensional impact assessment approach like this framework by the government when evaluating impact of e-Govt projects across the country. Furthermore, the study recommends that the identified key success factors in the SARS e-Filling tax returns system can be incorporated into other legging e-Gov projects to become fully-transactional and reap the same gains to benefit the citizens.

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Table 1. KEY IMPACT ASSESSMENT OUTCOME DIMENSIONS

Key Stakeholders	Key Impact Assessment Dimensions

Clienteles	1) Cost of accessing e-Gov services:
	  • Travelling costs (number of trips and distances covered to offices offering the e-Gov services). EAF, MAREVA, eGEP, WiBe.
	  • Total time spent out of office in queues waiting to receive services at the government offices (minutes/hours, translated to hour-rate compensation) – MAREVA, eGEP
	  • Bribe paid for by-passing queues and quickly receive services
	2) Quality of governance and services – 7-point key scale measurement:
	  • Extent to which functionaries can be held accountable for their actions (eGEP)
	  • Transparency of rules and procedures (eGEP, MAREVA)
	  • Availability of a mechanism to provide feedback to the agency and its effectiveness (EAF, eGEP, MAREVA)
	  • Satisfaction with query handling and offered services
	  • Easiness of use by clients with minimal assistance (as measured by the number of step executed to complete a transaction)
	  • Perception about the confidentiality and security of data (eGEP)
	  • Accessibility of the e-Gov service (does it offer 24/7 services?)
	3) Overall impact assessment on the clienteles
	  • Perceived net benefit and motivation to re-use the e-Gov system over traditional "brick-and-mortar" long-queues

Service-Provider Organizations(including government-department, partners and donor agents)	1) Measure for economic impact
	  • Increase in revenue through increased compliance by taxpayers, wider base of taxpayers, collection of user fees from clients, reduced leakage due to less fraud and corruption (EAF, eGEP, MAREVA, WiBe)
	  • Reduced cost of office space, paper, manpower, and travel (EAF, eGEP, MAREVA, WiBe)
	2) Measure of impact on quality of governance transparency:
	  • Extent of corruption/bribes requested in order to receive a service
	  • Accountability, measured as the ability to trace decisions and actions to employees (eGEP)
	  • Transparency of decisions, procedures, and information for internal and external clients (eGEP, MAREVA)
	  • Participation, measured as the involvement of employees in internal decision processes (EAF, eGEP)
	3) Social impact performance measurement (all non-financial fulfilment of goals through satisfactory stakeholders services and charity obligations of the e-Gov project)
	4) Internal process improvements leading to reduction in employee workload, improved work environment, and supervisory control, (EAF, eGEP, MAREVA, WiBe)

Broader society	1) Long-term impact on Millennium Development Goals measured on a 5-point scale (Bhatnagar & Sigh) [4]. 2) Sustainability effect/impact on the part of government, measured on gliding-scale of affordable, manageable, expensive or unsustainable. 3) Measure of impact of the e-Gov system on facilitating citizen-democratic participation (measured by the extent to which citizens can fairly participate in council, senatorial or presidential electronic voting through the IEC e-Gov system - using a gliding 4-point scale)