

A Maturity Model Framework for eGov Applications - eG_{SARMM}

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ABSTRACT

In this era of global competitiveness, countries are encouraged to provide services through Information and Communication Technologies (ICT) in order to provide better services to their citizens. Government agencies have to promote citizens' empowerment, improve service delivery, strengthen accountability, increase transparency, thereby improve governance efficiency. Many countries have been providing services to the extent possible to their citizens using currently available techniques, but there is lack of uniform architecture and maturity models. So it is difficult to evaluate the eGovernance applications while in development and implementation. It needs to analyse the international best practices currently available and the eGovernance Maturity Models for integrating assessment of technological, operational, organizational, human capital capabilities. This paper proposes to integrate security, availability and reliability issues into the eGovernance maturity model.

General Terms

Software Engineering Measurement and Analysis. Project Management. Quality Management, Governance Process Reengineering.

Keywords

eGovernance, security, availability and reliability, Maturity model, eGMM, SixSigma.

1. INTRODUCTION

"No country has so far implemented an e-Governance system for one billion people. It is a big challenge before us." - Dr. APJ Abdul Kalam, Former President of India [1]

"e-Governance" is more about "Governance" and less about 'e'. eGovernance is a multi dimensional concept to increase the transparency in administrative process and to enhance citizen participation[1]. In order to accelerate adoption of e-Governance and to reduce the "cycle time" of e-Governance project implementation, it is essential extensive business process reengineering, to create an enterprise architecture framework, to create shared platforms and promoting the usage of Open Standards to avoid any technology lock-ins. This reengineering supports new models of service delivery. For example Indian government has been made many Acts regarding proper usages of ICT techniques.

The UN e-Governance Survey 2012 report extends a special recognition to those countries with a population of over 100 million, which have made the tremendous effort to provide e-governance services to their people despite the challenges they face[10]. Figure-1 shows regional average of eGov Development Index.

This paper is organized as follows: section2 depicts eGovernance Maturity Models Section 3 explore Analysis

eGovernance Maturity Models, section 4 describes Six Sigma Methodology for Governance Process Reengineering, section5 tells Proposed Model eG_{SARMM}, Section 6 presents conclusions and future work.

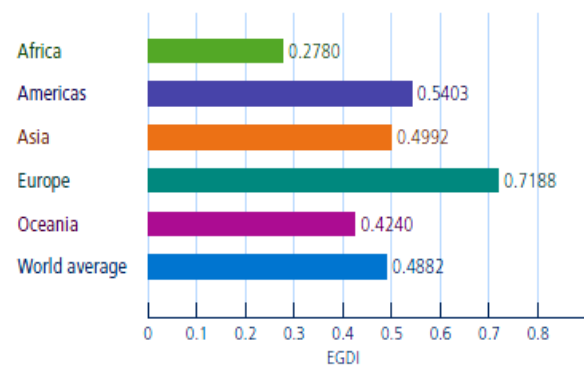


Fig. 1. Regional averages in eGovernance Development Index[10]

2. eGOV MATURITY MODEL (eGMM)

Maturity means mean time between failure(MTBF) trends over time. A maturity model is a method for judging the maturity of the processes of an organization and to identify the key practices that are required to increase the maturity of these processes. A maturity model can guide the government in selecting process improvement strategies by determining current process capability and its maturity and identifying the few issues that are most critical to eGovernance quality and process improvement. A maturity model is an enumeration of attributes for a sequence of maturity levels [9].

The model should have the four high level requirements in relation to the eGov applications: a) to identify its current state of maturity and capability b) To compare itself with other eGov application evaluated with same model, c) Suggest feasible improvement and follow them d) discretion on whether to follow or not [2].

eGovernance Maturity Models are developed by various government organizations, ICT Consultants and Academia. A maturity level in eGMM shows the stage of e-governance capability and its maturity; degree of technology complexity; degree of systems sophistication; and the level of interaction with its users. Also, it offers the governments the abilities to measure the implementation progress of e-governance applications.

eGovernance Maturity Model (eGMM) allows the Government to be evaluated against international best practices in the field of eGovernance with respect to assessment of technological, operational, organizational, human capital capabilities. eGMM and its assessment

methodology have been evaluated with feedback of various Chief Information Officer(CIO)s from many government departments through pilot study and The results may be useful for formulations of future government ICT policies at national and state level [2].

eGovernance Maturity Model are widely used in implementation and development of eGovernance Applications.

3. ANALYSIS OF eGOV MATURITY MODELS

There are a number of models developed by international organization including academia, Government agencies, and ICT consultants.

3.1 Different approaches of Capability Maturity Model (CMM):

CMMI – USA approach (SEI 2006a) is focused on process improvement, European approach (ISO / IEC 15504 IT) is focused on Process Assessment, Latin American model : (MoProSoft and SEM 2005a), Mexican Approach ; (ISO / IEC 15504 and ISO 9001:2000) is focused on quality Management system[2].

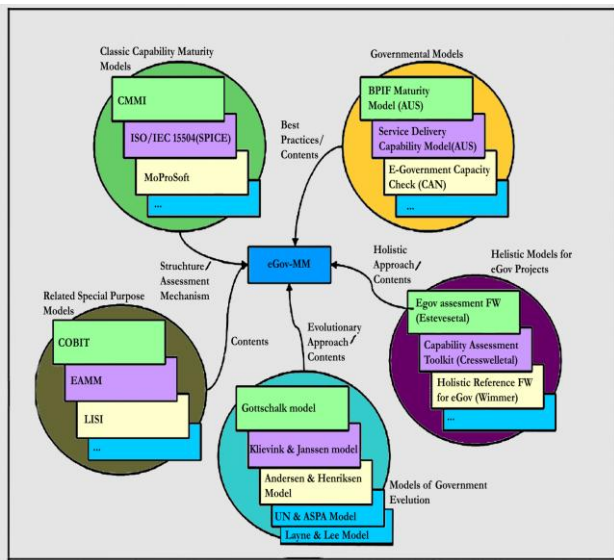


Fig.2. Evaluation of eGovernance Maturity models

3.2 Governmental Models:

The models developed by Governments, Consultants, academia etc. a) Business Process Interoperability framework (BPIF) (AGIMO 2007) by Australia: to identify business layer interoperability maturity model. b) Service Delivery capability Model: (AGIMO 2007) by Australia: to identify and describe the capabilities required to deliver services to Citizen. c) eGovernment Capacity Check :by Canada 2000 : Tool to diagnosis the capacity of egov application to deliver services.

3.3 Holistic models for eGov projects:

a) Wimmer’s Holistic Framework: (Austria) to support integrated modeling for eservices and its synchronization with technological development. b) Capability Assessment

ToolKit: (US) to determine whether or not the eGov project is success by taking 180 indicators.

3.4 Evolutionary Models: a)Gottschalk, b) klievink &Janssen c)Andersen & Henriksen, d) Layne & Lee, e) UN models

3.5 Special Purpose Models: a) COBIT: Control Objectives for Information and its related Technologies, b) LISI : Level of Information Systems Interoperability, c) EAMM : Enterprises Architecture Maturity Model.

International best practice of eGMM approaches: The following table 1 summarized the international best practices

Table 1. Summary of eGMM at a glance

	Level1	Level2	Level3	Level4	Level5	Level 6
Asia Pacific's six stage model 2004	Setting up an email system and internal network	Enabling inter-organizational and public access to information	Allowing 2-way communication	Allowing exchange of value	Digital democracy	Joined-up government
This model is based on citizen- centric and its functionality						
Word Bank's 2003	Publishing	Interactivity	Completing transaction			
Chandler and Emanuel's (4) 2002	Information (static) – one-way communication	Interaction – communication is two ways	Transaction	Integration		
This model is based on citizen- centric, its functionality and little bit technical security at transaction stage						
Moon's (5) 2002	One way communication	Two-way communication,	Transformation,	Vertical and horizontal integration	Political participation	
Hiller and Blanger's 5 2001	Information dissemination	Two-way communication	Service and financial transaction	Vertical and horizontal integration	Political participation	
Howard's 3 2001	Publishing	Interacting	Transacting			

In addition to the summarized details as given in Tables-1&2, the following key points are mentioned for each model.

The UN e-Governance Survey 2008 report has taken the concept of ‘Connected Government’, which means Governments transform themselves into a connected entity that responds to the needs of its citizens by developing an integrated back office infrastructure. This is characterized by:

1. Horizontal connections (among government agencies),
2. Vertical connections (central and local government agencies),
3. Infrastructure connections (interoperability issues),
4. Connections between governments and citizens,
5. Connections among stakeholders (government, private sector, academic institutions, NGOs and civil society) [4].

Table2. Summary of eGMM at a glance (contd..)

	Level1	Level2	Level3	Level4	Level5	Level6
Deloitte and Touche's 6 2001	Information publishing	Official-two way transaction	Multi purpose portal	Portal personalization	Clustering of common services	Full integration and enterprise transaction
Layne and Lee's four stage model 2001	Cataloging (static)	Transactional (two-ways communication)	Vertical integration (local and states govt) with similar functionality	Horizontal integration (a unified and seamless service) across different functionality		
	This model focused on technical, organization, managerial dimensions and combination of three dimensions					
United Nation's five stage model 2001	Emerging web presence	Enhanced web presence	Interactive web presence	Transactional web presence (two-way interactions)	Seamless/Networked web presence (Connected Government in 2008)	
Gartner's (4) 2000	Web presence (static)	Interaction	Transaction	Transformation		
	This model is based on citizen-centric, its functionality and little bit technical security at transaction stage					
West's (4) 2000	Billboard (static)	Partial service delivery	Full integrated service	Interactive democracy with		

Layen and Lee: it does not consider the potential benefit of political changes. In addition, the model design has fairly considers technical security related issues in particular at the transactional; and gave very low consideration non-technical ones, such as cultural and ethical, legal and regulatory, and economical.

Chandler and Emanuel's : The model ignores not only the specific non-technical security related issues but also the potential benefits of political changes.

Gottschalk Model (2009): it focused on interoperability.

Klievink and janssen Model (2009) : introduces notion of dynamic capability theory to move up from one stage to next.

Public sector Process rebuilding (PPR) Model : Focuses on activity and customer centric approach. Cultivation, Extension, Maturity, Revolution are four phases in this model.

A gist of each level of eGovernance Maturity Model is as follows:

Information: It is mainly about web presence, providing the external public (Govt to citizen (G2C) and Govt to business (G2B)), internally (Govt to Govt (G2G)) with relevant information. Government's information is publicly accessible to the common man; processes are explained.

Interaction: In the second level the interaction between government and the public via e-mail, use search engines to download all sorts of forms and documents. This can be done online 24/7. Normally this would have only been possible at a counter during opening hours in the Information phase.

Transaction: In this level the complexity of the technology is increasing with number of services, but customer (G2C and G2B) value will also be higher. The main complex of this phase is because of security and personalization issues – e.g., digital (electronic) signatures and Key Management are necessary to enable legal transfer of services.

Transformation: In this phase all information systems are integrated and the public can get services at one counter (virtual) instead of physical Common Service Centre. One stop solution for all the services is the ultimate goal. Thus, while increasing value for Citizens, complexity may increase during the transformation.

It is observed that there are no common yardsticks in all evolution models as compared to Capability Maturity Model Integration (CMMI). These models do not address the security, availability, and reliability issues of the eGovernance applications.

4. SIX SIGMA METHODOLOGY FOR GOVERNMENT PROCESS RE-ENGINEERING(GPR)

4.1 Six Sigma: Six Sigma is a methodology for process improvement. It follows PDCA (Plan, Do, Check, Action) improvement process i.e., to reduce the process error rate to six sigma level and optimising every procedure of organisation[5]. In order to provide citizen satisfaction, it is always better to use Six Sigma's DMAIC (Define, Measure, Analysis, Improve, and Control). It is a systematic five-step approach which is a quality improvement technique by reducing and eliminating variability. Hence better governance can be achieved with improved performance, lower cycle time, reduced complexity, minimized errors and maximize value by means of measurement.

Each phase of DMAIC is explained as follows: **Define phase** is to define eGovernance project goals aligned with governance goals, project scope, customers with their requirements, project charter and project teams. **Measure phase** is to collect data about current processes of eGovernance applications, and develop measurement systems to validate collected data. Evaluate data quality. Based on measured data, the current process performance is calculated. **Analyze phase** is to identify ways to decrease the gap between the current performance level and the desired goals of eGovernance projects. Explore data, Characterise process and problem, Update improvement project scope and scale. **Improve phase** is to identify, evaluate, and select the right improvement possible solutions. Focusing on the root causes identified in Analyse phase, the project team generates and selects a set of solutions to improve sigma performance. **Control phase** is to define control method to implement the final solutions and guarantee the maintenance of newly improved processes so that the improved sigma performance holds up over time [8].

Six Sigma has been adopted to identify problems in eGovernance projects and processes, and find optimal solutions for the identified problems, and quantitatively

improve the development processes in eGovernance applications.

4.2 Steps involved in GPR

Problem Identification and definition → Define vision and objectives for GPR → Process Study and Documentation → Process Analysis → Process Reengineering and defining to be Processes → Process Implementation and IT enablement and validation

5. PROPOSED MODEL OF eGSARMM

The Present eGMM models lack security, availability, and reliability services. The security issues are already addressed [3,7] to some extent.

A maturity stage in eGMM reflects the level of eGovernance maturity, degree of technology complexity, degree of systems sophistication, and level of interaction with its users. eGMM measures quantity than quality of e-governance i.e., implementation and service delivery.

eGSARMM proposes a model that integrate security, availability and Reliability in to the eGovernance Maturity Model at various stages as eGovernance security, availability and Reliability Maturity Model (eGSARMM). eGSARMM is a theoretical framework which is multidimensional concept with six sigma approach. This model uses the National Institute of Standards and Technology Risk Management Framework (NIST RMF) to mitigate the security issues and Six Sigma's DMAIC principles are applied for availability and reliability issues to achieve optimal capability levels to the successive stages. The component of this model is as follows:

Table-3. Process Areas

KDA	Variable	Process Areas
eGov Strategy	Vision, Strategies and Policies	Strategy Alignment, Senior Management Commitment, Communications to Stakeholders, Resource commitment to eGov
	Enterprise Architecture Strategy	Implementation strategy, Alignment to Reference Model, Service Reuse Strategy, Business Architecture
	IT Management and Organization	IT orientation Planning, IT Infrastructure planning, Organisation Structure definition, IT Process map
IT Governance	IT Architecture	Security, Application, Data, Technology, Network
	Portfolio and Risk Management	Risk Management, Project management, Portfolio Management
	IT Service delivery	Help Desk, Incident Management, Infrastructure change / Configuration management, Service Level Agreement management
	Asset Utilization	IT Investment Planning, IT Resource acquisition/Maintenance, Usage Level
Process Management	Business Processes Management	Process Modelling, Process Simulations, Process Monitoring / Accountability
	Performance Management	Client Satisfaction, Benefit / Cost Monitoring
	Services to Citizens / Business	Online Services, Public Information System, Electronic Channel quality
	Interoperability Practices	Organisation, semantic, Technical
	Norms Compliance	External regulation, Internal Regulation
	Quality Security Assurance	Quality Management system, Information Security Management system, Measurement / monitoring system
Organization and People Capabilities	Change Management	Planning and Communication, Management Support, Stakeholder Analysis, Organisation climate and culture
	Infrastructure and e-Gov Tools	Fundamental Tools, Value added Tools, Hardware / Software functional infrastructure

eGovernance application's Reliability by definition translates to citizen satisfaction (i.e. defect-free e-applications), as it is the quality aspect most exposed to citizen observation. Therefore, eGovernance application's Reliability is a key

citizen-oriented measure in Six Sigma measure of any e-application.

5.1. eGovernance key Domain areas and its variables

Leverage Domain: eGovernance strategy, It Governance, Process Management, Organisation & People. The model is structured around three main elements: Leverage Domains, Key Domain Areas and Critical Variables, The leverage domains consist of key domain areas "E-Governance Strategy", "IT Governance", "Process Management", and "Organization and People".

eGMM provides 54 Process Areas (PAs) for improvement within an organization. The process areas are shown in Table 3. A PA is a cluster of related practices in an area that, when implemented collectively, satisfies a set of goals considered important for making significant improvement in that area. A PA is further specified in terms of Specific Goals (SGs) and Generic Goals (GGs) which are the required components of a PA to achieve good results in eGovernance.

Generic capability model of key domain areas: Level 1: Initial Capability, Level 2: Developing Capability, Level 3: Defined Capability, Level 4: Managed Capability, Level 5: Integrated Capability (Optimizing).

The integration of eGMM and six sigma provides improvement standards for eGovernance project execution. Six sigma performs as leverage in eGovernance process design and applied to the various maturity levels. Integration of eGSARMM with six sigma is shown in Figure 3.

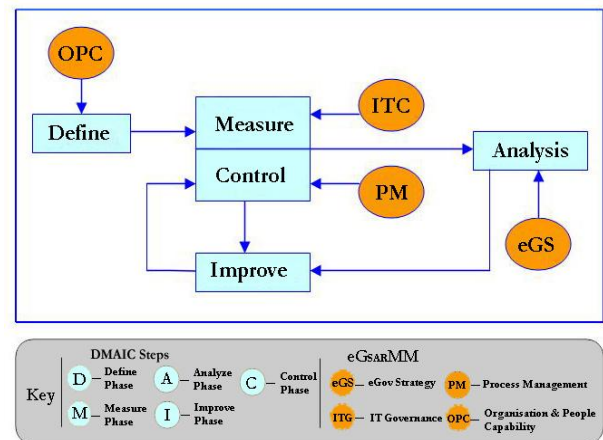


Fig.3. Integration of eGSARMM and Six Sigma

OPC is organisation and people capabilities, ITC is IT Governance component, PM is Process Management, and eGS is eGovernance strategy. The process areas, generic goals and specific goals can be integrated with DMAIC frame of Six Sigma.

6. CONCLUSIONS AND FUTURE WORK

It is essential to develop a robust eGovernance Security, available and Reliable Maturity Model (eGSARMM) to deliver secure and reliable services with high availability to a common man using eGMM and Six Sigma concepts. Future work is planned by proposing these concepts to be applied in eGovernance applications over cloud computing concepts i.e., scalability, availability and reliability.

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