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Six Sigma Approach for e-Governance: Indian Perspectives

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Summary: *This article emphasizes the importance of Six Sigma approach in e-Governance for quality improvement in service and delivery. Various e-Governance methods and the associated Six Sigma philosophies are discussed in detail. The necessity of e-Governance in general administration is stressed. Some performance parameters and improvement techniques are highlighted for the better implementation and practice of e-governance project executions.*

Key words: *Big data; Six Sigma; DMAIC; quality; process approach; design-redesign approach; information technology.*

1. INTRODUCTION

In the current dynamic, challenging, data and information explosion environment and of digital technology, e-Governance and adoption of statistical methods and Six Sigma implementation have become vital for higher productivity, quality, cost and waste control in manufacturing, services sectors and administrative systems. Skills in statistical methods have to be developed at all levels to achieve efficiency and effectiveness. These analytical tools and techniques are widely adopted in the west but unfortunately in India, the system is not geared up. Knowledge of statistical methods and Six Sigma, have still largely remained at academic levels and not yet percolated to the application level. Executives and professionals acquire certificates through short term crash courses but do not translate their knowledge into operational areas for critical improvements.

The need and urgency of data based e-Governance for efficient and effective administration is being increasingly felt. Large scale delay in delivery of products and services have been hurting the common man in several ways. The backlog/pending court cases for decades is a classic case of delay. The large amount of paper work and their abnormally slow processing/movement and physical filing system have been a matter of concern in government offices. The information and computing technology have not been fully adopted through e-governance. The paper work and the current method have been choking the systems. The impact and efficiency of e-governance has been partially demonstrated in railways, banking and insurance systems but to a large extent the traditional system of decision making and the processes continue. While e-Commerce, e-Marketing, e-Teaching, e-Banking-post etc. are on the way, these initiatives have touched only the surface. There is vast scope in other areas of public concerns as well. The advent of Big Data concepts have further added the necessity of fast processing and analysis of information's with the help of Information Technology.

It is expected that the current drive for e-Governance will boost the importance of data management for obtaining right data for right decisions besides for planning, implementation, monitoring, control and evaluations of ongoing short term and long term operations and projects. This will further improve the quality of the information's passed onto the stakeholders, leading to stakeholder confidence and morale. Hans et al. [5] reports a number of similarities and differences between e-Commerce and e-Government. According to them, the sheer volume of information, old and new, as well as accuracy and timeliness of information it was said required new presentation formats, exchange strategies, and operations in public and private sectors. In process management, although the transaction volumes in e-Commerce were found far higher than in e-Government, in e-Government online transactions play an increasingly important role. Differences were found in the extent and sophistication of process redesign between the sectors. E-Commerce redesigns were found far more advanced than those in e-Government. Further, while speed of transaction was found an essential element of e-Commerce, less emphasis was put on this aspect in e-Government (see also Ngai et. al., [8] and Wang, et al. [12] for more details).

This article aims to focus on the role and importance of statistical methods and Six Sigma approach and applications in e-Governance in general. In order to understand the concept well, the readers should be familiar with the customer linked activities in an organization, as Six Sigma philosophy involves a good understanding of statistical tools and techniques along with the management of infrastructure, technical know-how and stakeholder participation. According to Madhavan [6], companies that have adopted a Six Sigma model for continuous improvement of their key business and management processes will find that they already have in place important components for a compliance regime such as the Sarbanes Oxley Act of 2002 (an Act to reign in corporate management and their unhealthy and borderline incestuous relationship with their audit firms). They will have the culture and systems for identifying and defining compliance risks, the methods and systems for maturing them through a rigorous review process, and the ability to analyze and put the processes under control.

The article is addressed to a general audience who may be a business personal, inventory and logistic managers, Statisticians, Operations managers, Supply chain managers, government facilitators and Six Sigma consultants. In different sections below, we present the necessity of Six Sigma quality in e-Governance and its relevance in managerial decision making. In section 2, various e-Governance process techniques are discussed from Indian perspectives. The Six Sigma methodology is briefly discussed in section 3. We also discuss the phase-wise tasks and deliverables of Six Sigma concepts of e-Governance in Section 4. Some e-governance recommendations are presented in Section 5, and followed by a conclusion at the end of the article.

2. e-GOVERNANCE IN INDIA

E-Governance in India has reached at the "transactional" stage and providing various services to citizens, business and government organization, offered by Central Government agencies and different State Government departments. National e-Governance Plan (NeGP), initiated in 2006, attempts to make all Government services accessible to the common man in his locality, through Common Service Centers (CSC) being set up across India. As on August 31, 2013, about 1, 27, 002 CSCs was operational with different brand names and started delivering services to people. As the rural landscape in India is set to take the advantage of the flourishing Information and Communication Technology (ICT) initiatives, by various institutions, more specifically the CSCs, India Development Gateway (InDG) initiative offers much required content and services in local languages that makes the difference in the lives of the rural people.

The major focus of e-Governance portal is to support the ongoing e-Governance movement in India by providing one stop information access to online citizen services, state specific e-Governance initiatives and awareness about online legal services, mobile governance, Right to Information (RTI) etc. Keeping in mind the importance of empowering the Virtual Learning Environment (VLE), InDG has included a new section to enrich them with resource materials and providing a platform to share their experiences in their own language. A governance framework enables an organization to more rapidly implement positive changes by establishing team structure, focusing on knowledge transfer and enabling people.

Several dimensions and factors influence the definition of e-Governance or electronic governance. The word “electronic” in the term e-governance implies technology driven governance. E-governance is the application of information and communication technology (ICT) for delivering government services, exchange of information communication transactions, integration of various stand-alone systems and services between government-to-customer (G2C), government-to-business (G2B), government-to-government (G2G) as well as back office processes and interactions within the entire government framework. Through e-governance, government services will be made available to citizens in a convenient, efficient and transparent manner. The three main target groups that can be distinguished in governance concepts are government, citizens and businesses/interest groups. In e-governance there are no distinct boundaries.

Publicly traded companies that are reviewing their current business practices in the context of compliance to governance standards and laws find little comfort in knowing that achieving and retaining excellence in governance is not a onetime event but a continuous monitoring and improvement regimen. Retooling the core values, culture, and operations to ensure the level of internal trust, and the trust of investors supported by auditable reporting processes will be expensive [6]. These changes and increased scrutiny of management comes at a time when companies are all trying to increase their global presence. Their markets are dispersed, research, development, and production operations are also globally dispersed, and there is little correlation geographically. Successful CEOs are finding out that geography is history, distance is defined by time, and business events and decisions are the bridge between history and future. Success is now dependant on managing global events in real-time, by running a fine tuned business network through which knowledge, decisions, and processes flow naturally and without additional management overhead. This environment has motivated companies to increasingly look at continuous process improvement models such as Six Sigma to unify their company.

Gupta [3] proposes framework for Six Sigma quality in e-Governance by listing various e-governance projects and their successes in various Indian states. According to him, the six Sigma philosophy, if applied in the service delivery (government) departments, can help facilitate in

unleashing the immense potential and create synergy between government systems on the one hand and IT on the other. With improved process efficiency and organizational effectiveness, and information networking, a new dimension would be added to the concept of e-governance. Below we discuss three important areas of e-Governance, which needs special attention in terms of quality improvement and data transparency. In Table 2 of Section 4, we compile the other service areas of e-Governance where the improvement can be achieved by the use of Six Sigma philosophy.

2.1 e-Governance in Indian Agriculture

E-Governance in India has steadily evolved from computerization of government departments to initiatives that encapsulate the finer points of governance, such as citizen centricity, service orientation and transparency. The national e-governance plan (NeGP), takes a holistic view of e-governance initiatives across the country, integrating them into a collective vision and a shared cause. In this section we are highlighting the initiatives of the central and state governments to bring public services closer to the citizens.

E-Governance in agriculture, aims to disseminate useful information about improved technology to the farming community and service providers in the rural areas. InDG will create a platform for different levels in the rural agricultural landscape - farmers, cooperatives and professional bodies, farm machinery vendors, fertilizer and chemical companies, insurance regulators and agronomists, consultants, and farm advisors. The major focus of Agriculture sector presently in the InDG portal, is pertaining to Agricultural Credit, Policies and Schemes, MGNREGA, Market Information, Agricultural Best Practices, On & off Farm Enterprises and various Products and Services.

Like any other organizations (business, Services and manufacturing) the agricultural organizations also operate in an environment characterized by dynamic market forces and customer demands. Deregulation, consolidation and increased competition are forcing them to re-evaluate their technology and business processes. The changing regulatory demands, tariff issues, environmental concerns, and health and safety issues continues to put pressure on these organizers. The need and urgency of developing statistical and analytical skills among executives for data analysis, Six Sigma and Project Management implementation has been rapidly increasing in agricultural organizations for efficiency and effectiveness.

2.2 e-Governance in Information and Communication Technology

To bring the benefits of Information and Communication Technology (ICT) at the last mile to ensure transparent, timely and hassle free delivery of citizen services, government of India has initiated e-Governance program in country in the late 1990s. After that, union government has approved the NeGP, comprising of 27 Mission Mode Projects (MMPs) and 8 components on May 18, 2006 to give a boost to e-Governance initiatives in India. The Department of Electronics and Information Technology (DEIT) and Department of Administrative Reforms and Public Grievances (DAR&PG) has formulated the National e-Governance Plan (NeGP).

Information governance helps organizations to get a better handle on customers' needs, unearth competitive threats and uncover new business opportunities. The results - measured in profits, market share and customer satisfaction - can be eye-opening, all because organizations have a strategic, dynamic view of information governance that goes beyond compliance and regulations. Since much of the business activities are centered on Analytics and Big Data, the use of IT resources must be done more strategically and cost-effectively. Since, Big Data Analytics is all about tapping into diverse data sets, finding and monetizing unknown relationships, and therefore, a completely data driven process technique like Six Sigma must be integrated into the process of

improving the system. As we all agree that every business process involves large volume of data and are available in many forms (variety). The speed (velocity), at which the data are accessed, recorded, disseminated, and used for further analysis are now becoming a big challenge for all decision makers. The problem is further escalated by the uncertainty and variations involved in every processes. Hence to make a business processes smart; we need analytics and a structured way of problem solving approach, which is guaranteed by Six Sigma principles.

2.3 e-Governance in Primary Education

Primary education is the foundation on which the development of every citizen and the nation as a whole built on. In recent past, India has made a huge progress in terms of increasing primary education enrolment, retention, regular attendance rate and expanding literacy to approximately two thirds of the population. India's improved education system is often cited as one of the main contributors to the economic development of India. At the same time, the quality of elementary education in India has also been a major concern. E-governance in this case requires several elements of good governance, such as transparency, accountability, participation, social integration, cultural transformation and development. It includes a very broad range of services for almost all segments of society. Hence to make the education system transparent in its functioning, it is essential to have a streamlined process in place, which is possible only through six Sigma approach.

3. SIX SIGMA METHODOLOGY

A Six Sigma initiative is a customer focused problem-solving approach with reactive and proactive improvements of a process leading to sustainable business practices. The sustainable business practices include innovation, improvement, competition, environmental compliance, customer satisfaction, and growth of the organization [7]. Technically speaking, Six Sigma is described as a data driven approach to reduce defects in a process or cut costs in a process or product, as measured by, "six standard deviations" between the mean and the nearest specification limits. The Six Sigma philosophy works under a structured problem-solving approach. The problems generally concerned with eliminating variability, defects, and waste in a product or process, all of which undermine customer satisfaction. The working philosophy of Six Sigma is generally, called DMAIC (Define-Measure-Analyze-Improve-Control).

The Six Sigma philosophy is mainly characterized by a Six Sigma process, which is a structured, measured set of activities also called inputs (X's) designed to produce a specified output (Y's) for a particular customer or market. It implies a strong emphasis on how work is done within an organization. A business process is a set of logically related tasks performed to achieve a defined business outcome. The quality of any process depends on the scope of the process and its deliverables. There can be either a single or multiple deliverables and hence dealing with a large process having multiple tasks will be monitored for any kind of uncertainties and failures. The selection of the processes is based on the critical success factors of that organization.

The DMAIC process tracks Six Sigma opportunities through the define phase, where the opportunity is defined (D) and developed. This is followed by the (M) measurement phase, where baseline performance to the KPIs (Key Performance Indicators) is measured. The analysis (A) stage is where the Black Belts, with the help of the Master BB, develop problem analysis, performance models and simulations. In the (I) improve stage process, changes are implemented, and the process under control is matured. The (C) control phase is the long term monitoring and assurance that the original KPIs, and the delivered outputs, are falling within Six Sigma limits of the post improvement environment. The detailed process map according to various phases is given in Table 1 and Figure 1.

Table 1. Six Sigma Improvement Processes

Phase	Process Improvement	Process Design / Redesign
Define	- Identify the problem - Define requirements - Set goals	- Identify specific or broad problems - Define goal/ change vision - Clarify scope and citizen's requirements
Measure	- Validate problem / process - Refine problem / goal - Measure key steps / inputs	- Measure performance to requirements - Gather process efficiency data
Analyze	- Develop causal hypotheses - Identify vital "few root causes" - Validate hypothesis	- Identify "best practices" - Assess process design - value/non-value adding - bottlenecks/disconnects - alternate paths - Identifying CTQs - Prepare cause-effect (CE) matrix
Improve	- Develop ideas to remove root causes - Test solutions - Standardize solution/ measure results	- Design new process - challenges assumptions - apply creativity - workflow principles - Implement new process, structures, systems - Change management
Control	- Establish standard measures to maintain performance - Correct problems as needed	- Quality control – establish measures and reviews to maintain performance - Correct problems as needed

Source: Analysis based on Pande, et. al. [9] and Peppard [11].

4. SIX SIGMA DELIVERABLES

In today's environment, where citizen's requirements are changing, no service system is likely to deliver efficiently for long, unless it thinks to improve/redesign processes on a regular basis.

Six Sigma projects address three different areas of potential improvement: quality, cost and schedule. Critical characteristics in the product, process or service are identified using Critical-to-quality characteristics (CTQ); critical-to-cost (CTC); and critical-to-schedule (CTS). This classification scheme, combined with the total opportunity of cost (TOC), can help focus Six Sigma projects by defining project deliverables in terms of their impact on one or more critical characteristics. To some extent, by combining the Six Sigma methodology with SAP (a high level enterprise application and BPM (Business Process Management), companies can increase speed, quality and sustainability of the Six Sigma projects.

4.1 A Framework for e-Governance System Analysis

In the light of the above discussion together with IT system, we need to look at government systems especially the process and capacity of delivery system as also networking and building social capital. The important features are listed below:

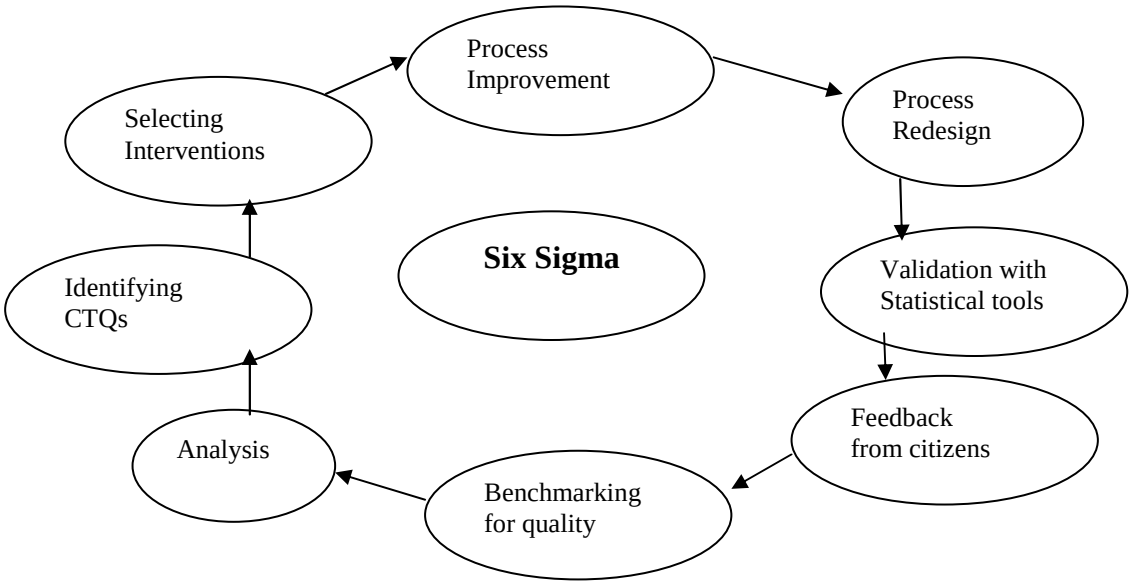

Figure 1. Process approach

- Government Systems:
- government processes,
- delivery system: capacity of system to deliver, capabilities of personnel, work culture and so on.
- IT System:
- hardware,
- software,
- information database (seamless access of data i.e. accessing data from one database to another),
- management information system (MIS).
- Networking:
- with government agencies,
- with private agencies.
- Human Capital:
- facilitating right kind of values,
- information and knowledge generation and sharing.

Six Sigma for improving Delivery System: The process improvement and redesign would use process approach (see Figure 1). It would include the following steps:

- identification of citizen's requirements and regular updating,
- benchmarking the parameters,
- identification of processes,
- measurement of inputs and outputs of each process,
- analysis of processes and identifying Critical to Quality characteristics (CTQs) – preparation of cause-effect matrix,
- identifying interventions for process improvements,
- process improvement and process design/redesign,
- validation of improvements (using statistical tools),
- Feedback and control.

Synchronizing the Processes (IT compatible) and Organizational Capacity with the efficacy of Information Technology to generate Synergy in the System and to realize full Potential of IT will be the success of e-governance.

4.2 Quality in e-Governance

Quality has acquired bigger dimension. It is no longer confined to the narrow view of limiting defects or control of non-conformance. Now it encompasses all aspects that go towards making a business (including service management) more effective or achieving what may be called as business excellence ("excellence in government", in case of public institutions). The quality is standard of something when it is compared to set benchmarks or expectations.

Quality of services, among others, should be the touchstone of judging the success of e-governance. It has to be a key factor. In the context of "quality service", the important consideration has to be how close to the "expectations of citizens" the services can be provided in order to meet their aspirations. It would require evolving quality parameters and ensuring them through improved systems. The important parameters that need to be looked at in the context of "making services available to people". Based on the urgency and the availability of resources (for providing the services), two levels of services have been suggested. Level I of quality standard is that where initially the emphasis is to be laid; and then after achieving it we can move to level II. The parameters in list II may also be observed during level I, if there is a requirement. The Table 2 illustrates the critical quality parameters for select services.

It is often argued that improved quality would be associated with loss of efficiency or high cost. Also there is a trade-off between quality, cost and availability. Such an argument may be true in short run. But, while attempting for improved quality, the attention must go on to the people involved in delivery of services. Since services are usually "labor intensive" – the primary resource input determining quality and productivity are personnel, their capabilities, training and motivation. For a success of service department, it should lay emphasis on selecting right people, and training, motivating and rewarding them. This way the service department may become efficient. Motivated employees if provided opportunities and encouragement are likely to think many ways of improving the processes. The satisfaction that comes from having made contribution for the organization, if properly recognized and rewarded, may reinforce the motivating effects of employee participation and encourage further efforts. Service departments that are able to involve employees in quality and productivity efforts are likely to see complementary effect of quality and productivity, as the process continuously improves.

5. e-GOVERNANCE: SOME RECOMMENDATIONS

E-Governance generally reduces lots of waste generated through papers, materials, products and processes. It mandates faster execution of orders and facilitates material movements with fewer amounts of green wastes. The method is very user friendly and hence project execution is reliable and efficient. Further, use of e-governance in Six Sigma project management facilitates self-assessment of processes for gaps in control and risk analysis, improve business intelligence gathering, knowledge delivery, and enhances decision making and tracking in a rapid way. Above all, it improves compliance to applicable laws, corporate policies and rules, and ethical standards of an organization.

Table 2. Critical quality parameters for select List of Services

S.N	Sector	Services	Important parameters
1.	Health	Hospital functioning	Access, Cleanliness / tidiness, Responsiveness, Cost
		Immunization	Reliability, Consistency, Cost
		Medicine	Access, Timeliness, Conformance
		Medical check-up for infants	Timeliness, Safety, Availability
2.	Drinking water	Functioning of tube-wells/pipe water system	Reliability, Cost, Transparency
		Drinking water quality	Access, Conformance, Consistency
		Servicing of equipments	Serviceability, Cost, Reliability
3.	Education	School functioning	Access, Cleanliness / tidiness
		Scholarship	Access, Timeliness, Transparency
		Posting of teachers	Reliability, Consistency
		Literacy	Access, Friendliness, Resources
4.	Land	Records of rights	Timeliness, Security, Availability
		Mutation of records	Timeliness, Security
5.	Agriculture	Agriculture inputs	Timeliness, Cost, Reliability, Conformance
		Commodity prices	Consistency, Timeliness
		Technology transfer	Relationship Management (partnership and learning)
6.	Essential Commodities	Availability	Consistency, Conformance, Timeliness, flexibility (volume, variety)
		Taste and smell	Conformance (of quality)
7.	Rural development	Participatory development	Friendliness, Participation, Relationship Management (partnership and learning)
8.	Natural disaster	Warning system	Reliability, Consistency
		Availability of relief	Access, Courtesy, Friendliness, Perceived quality, Responsiveness, Relationship Management (partnership and learning), flexibility (volume, variety, response)

Source: Based on own Analysis

Some of the project specific recommendations of Six Sigma for e-governance are:

- set a defined standard of environmental regulations through economic parameters,
- involve pollution control and waste reduction in every production processes,
- specify emission target, greenhouse gases and carbon budgets for each SS projects,
- implement economically viable waste resource for collection and disposal,
- develop innovative processes and IT savvy technical know-how's,
- practice sustainable business practices to save energy consumption,
- establish a clear environmental management system to collect data and responsibilities,
- assess the achievements of the company in terms cost saving through sustainable business practices,

- assess the performance of the company in terms of the growth and market share on sustainable business practices,
- assess the product reach and geographical area covered due to sustainable business practices.

It is expected that the interventions under Six Sigma approach would add value in terms of:

- improving government processes and organizational effectiveness, leading to improvement in efficiency of delivery of services,
- information networking thereby empowering people and giving them more opportunities to access various services,
- improving governance transparency and thereby making people more representative and participative,
- improving stakeholder confidence and thereby preparing people to accept information challenges.

Such improvements would add considerable value to the present efforts in e-governance and have multiplier effect. Enabling efficient government processes would add considerable efficiency to processing of applications for services. Together with this, improved work culture would add to citizens' satisfaction and information networking would facilitate realizing full potential of information technology. And finally, it would facilitate in reaching to higher stage of "value addition" from "evolutionary stage". With the improvements that would follow, it would generate a great deal of interest in people to access more and more services from government as well as private agencies. Making such interventions has potential to create significant multiplier and network effects. This can trigger a virtuous cycle of socio-economic development – leading to good governance.

6. CONCLUSIONS

Six Sigma projects must be targeted for process and product improvements that have a direct impact on both financial and operation goals. Integrating e-Governance and sustainable business practices into corporate management can lead to increased business, improved business performance, and further enhancement of the company's credibility with stakeholders. The current efforts under e-governance though positive and encouraging are yet mainly in the area of providing scope to people in villages to access some information about the government programs and to represent to departments either for services or grievances. It demands that the focus should come on providing ‘quality’ services and information to citizens. In order to tap full potential of IT, we need to give priority to improving government systems for improving the performance standard of delivery system. In this endeavour, Six Sigma offers good opportunity. With improved process efficiency and organizational effectiveness, and information networking, a new dimension would be added to the concept of e-governance. It would find wider acceptance and usage from large population in rural areas, who are going to be the prospective users. It would bring in scalability and replicability to the project interventions.

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