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An Architectural Model of the Government Process Reengineering Inspired by Zachman Framework for Enterprise Architecture Implementation

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Abstract:- It is the Government's duty to make policies for the benefit of the citizens. It evolves ideas and approaches against the hindrances in the way of development and transformation of the society. In the current e-Governance Project evolution, Government agencies focus on the current e-Governance development and implementation activities. Government Process Reengineering is needed for redesigning and redefining the Government Processes related to the e-Governance projects. In this regards, a common model can be adopted in the challenging environment of the Government process so that predefined concepts can be followed with required changes to avoid the failure of the e-Governance implementation. Process Reengineering alone is not sufficient to handle the complexity of the process so the architectural implementation is need of the time.

The Zachman framework is the implementation of Enterprise Architecture which provides a structured way to view and define an enterprise process. Government considers the importance of e-Governance projects and invites new implementations to stable the challenging transformation. In this paper, we proposed an architectural model of Government Process Reengineering with the use of Zachman Enterprise Architecture Framework. We also highlight the benefits and importance of the proposed model in government sector.

Keywords:- *E-Governance, Enterprise Architecture, Government Process Reengineering (GPR), Zachman Framework (ZF).*

I. LITERATURE SURVEY

Initially various services were used to provide manually which involved various issues like human intervention, lack of trust, questionable and time consumption processes. To avoid these many more issues, Electronic-Governance initiatives were taken up to automate the process as much as possible. [1] E- Governance is the application of Information Technology to the processes of Government functioning in order to bring about Simple, Moral, Accountable, Responsive and Transparent (SMART) Governance. Electronic governance also involves transformation from being a passive information and service provider to active citizen involvement.

Government is the authority that provides the citizen centric services by focusing on automation through e-Governance initiatives. E-Governance provides the effective and efficient trustworthy services in speedy and transparent way.

Developing countries are experimenting between automation and adjustments of government processes, and delivery of citizen adoptable initiatives. It [2] helps in achieving greater efficiency in government performance by raising service performance, and service delivery, by eliminating inefficient processes and reducing bottlenecks and red tape in the service delivery process as much as possible.

E-Governance with the process reengineering of the government processes resolves the adoptability issues. For the sustainable growth and affirmative transformation and advancement of the society, the process reengineering of the government processes is need of the hour.

[3] Reengineering implementation involves all activities pertaining to planning, organizing, and conducting the reengineering project. This could involve developing a vision, analyzing the organization, identifying reengineering opportunities, evaluating information technology enablers, establishing commitment, allocating resources, managing the project, and evaluating results.

Process Reengineering [4] involves changes in structures and in processes within the relative environment. It allows an efficient and effective change in the manner in which work is performed with all the stakeholders by reviewing, redefining and redesigning the existing system. Structure is the arrangement and relationship between the parts of something complex while Architecture is the complex thing where these structures can be implemented. [5] Processes Reengineering concept as a mean of enterprise performance improvement was proposed for first time by Massachusetts Institute of technology during 1990's.

[6] More than 80% of organizations do not successfully execute their business strategies. He estimates that in over 70% of these cases, the reason was not the strategy itself, but ineffective execution.

[7] As per Fortune Magazine, nine out of ten organizations fail to implement their strategic plan because

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of they fail to link strategy to budgeting, employee incentives to strategy, stakeholders spend less time to discuss the strategy and typical workforce does not understand the strategy of the organization. Such things also happen in government.

[8] Describes the various causes of government project failure like dissimilarities between various projects, Lack of effective communication among involved agencies, Project Planning, Socio-Cultural, Scope Changes, and Lack of Resources are the common cause of project failure. The government processes are the critical and complex, process reengineering can't face such challenges without adopting architectural standardization.

To minimize such failures, Enterprise Architecture comes into the picture. Architecture plays a vital role in the strategic, competitive, decision making and challenging fields.

[9] Enterprise Architecture is a well-defined practice for conducting enterprise analysis, design, planning, and implementation, using a holistic approach at all times, for the successful development and execution of strategy. It applies architecture principles and practices to guide organizations through the business, information, process, and technology changes necessary to execute their strategies. These practices utilize the various aspects of an enterprise to identify, motivate, and achieve these changes.

Government is like an enterprise which process big data to serve all the stakeholders. Government perseveres to evolve latest technology and best practices to process such voluminous data for successful implementation of strategic planning through e-Governance with the Process Reengineering approach. But without the proper architecture behind the strategy, the initiatives may be fizzled out. To avoid such happenings, Government may adopt an Enterprise Architecture Framework in their redefining and redesigning of processes. Framework is the implementation of Architecture.

[10] Aims to generate awareness and stimulate thinking on how to apply enterprise architecture in business driven activities.

[11] The Zachman enterprise framework is represented and promoted by the ZIFA (Zachman Institute for Framework Advancement) organisation. It is not a standard and there are similar enterprise frameworks that have been derived from it, such as the Federal Enterprise Architecture Framework (FEAF), The Open Group Architecture Framework (TOGAF), and the Department of Defence Architecture Framework (DoDAF).

[12] Describes the basic details and aspects of the Zachman Framework. It contains the definition, purpose, comparison with the existing approaches. [13] discusses to secure the enterprise effectively using Zachman Framework. It presents the understandings of the designer's perspective in detail.

[14] From the perspective of the Zachman framework, the way to learn Baseball is to define the models within the framework, as presented in this paper.

The framework provides a consistent and systematic way to describe an enterprise and has been employed in many large organisations like Bank of America, General Motors and Volkswagen etc.

The idea of such framework may also be implemented in government organizations to structure the proper performance of operations and utilization of resources.

The enterprise architecture can resolve the various government issues related to the successful implementation of the complex projects. We propose a Model for the Government Process Reengineering (GPR) through the inspiration of Zachman Framework for the Enterprise Architecture.

II. PRECISE PROBLEM FORMULATION

The government processes are the complex and scope is not limited. Due to the frequent changing demands, the policies are required to be flexible sometimes they may become the reason of failure. Due to the absence of state of art technology and best practices, government policies and projects are stuck on the way. There is improper structure to implement the project. Projects are full of human intervention, lack of public trust, improper planning, dissimilarities between different projects, lack of communication among the agencies involved, scope changes and interoperability are the causes of failure. Different standards are followed for each project while there should be the change of fundamental principles of the projects. Such starting from zero to the saturation or we can say that the lack of reusability oriented approach of the projects involves unnecessary wasting of time and cost.

The government organizations or agencies may have different opinions on process, targets and metrics. Lack of consensus diverts the strategies and the goals.

The improper planning and lack of forward looking aspects become the reason of not achieving the goal. It is due to not follow proper standards and planning. The government are just rearranging existing processes instead of generating new ideas with the significant benefits so these processes are needed to be redesigned and redefined through the standard reengineering mechanism and framework.

If the government process is easy and well understood with fewer dependencies, then the reengineering of processes may lead to the success without architect's intervention. Generally, government's process scope, complexity, functional/ non-functional dependencies are extensive, and then the architecture is required to handle the ground.

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III. METHODOLOGY AND MOTIVATION

The global and local factors affect the working principle of the government. Planning, Technology, Gap Analysis, Frequently changing demands, Training, Maintenance etc are the main causes which affect the e-Governance projects. It required proper process reengineering of the government processes which hikes the success ratio of the project. Process reengineering as a mean of the enterprise performance improvement was proposed for the first time by Massachusetts Institute of Technology during 1990's. Reengineering is the fundamental and principally rethinking of the processes for achieving incredible success in terms of quality and service rate. These things can be modelled to form structures. Architecture is the more advanced concept of refined structure. Architecture is the high level mechanism which deals mainly with the non functional attributes of the project. The Government needs to implement the enterprise architectural approach by reengineering their existing working mechanism to successfully implement and maintain the project to achieve the desired goals.

- *Government Process Reengineering (GPR)*

GPR is the method to redesign and redefine the working concept of government through the reengineering of the processes. Reengineering of government process is applied to get the advantages of today and tomorrow's technological world. GPR of the project is to study the current scenario and future perspective to get the desired goal. The current scenario involves the project proposal and result study, forecasting on adopted practices and gap analysis etc.

If the desired output is not achieved then other stage should be followed to identify the root cause of obstacles, fruitful information collection, identification of clear wants and desires which eventually the project will reach improvement.

- *Zachman Framework (ZF)*

The Zachman Enterprise Framework provides a means of the classifying an organisation's architecture. The rows of Zachman Framework focus on describing the enterprise from six viewpoint perspectives of the stakeholders. These six perspectives are based on English language interrogatives 'what', 'how', 'where', 'who', 'when', 'why'. The columns of the framework consist of a set of artifacts which are description of the enterprise from specific viewpoint of a group of stakeholders.

The columns represent the interrogatives that are asked of the enterprise. These are:
What (data) - what is the related data, information or objects?
How (function) - how does the business organizations work, i.e., what are the business organization's processes?
Where (network) - where are the related locations?
Who (people) - who are the people that involve in the business operations?
When (time) - when are the business processes performed, i.e., what are the business schedules and workflows?
Why (motivation) – Why it is required? List of the outcomes.

IV. PROPOSED MODEL AND SOLUTION

The Government project team's task is to implement the e-Governance projects with reengineered processes which require a clear definition of the deliverables, scope and process dependencies. This helps to develop the project plan and risk management strategies. This clear definition may be derived from architectural approach.

We propose a model of the Government Process Reengineering through using the Zachman Framework for Enterprise Architecture which may curtail the causes of project failure. Table 1 shows the proposed model of the GPR with Zachman Framework which is classified into a 6x6 matrix of unique cells. The columns represent the interrogatives while each row represents the information relevant to the particular perspective. We have identified our six major perspectives which play crucial role to successfully roll out the e-Governance project in government sector. All these six perspective discussed as below-

	What	How	Where	Who	When	Why	
Proposals Perspective	Government Artifacts Identification -Artifact Types	Government Process Identification -Process Types	Network Identification -Network Types	Responsibility Identification - Responsibility Types	Timing Identification -Timing Types	Motivation Identification - Motivation Types	Innovational Strategies
Change Management Perspective	Determine the need of change -Level -Strategies	Determine the Government Process Culture -Process Transform -Process Inputs	Determine the field for the Change -Change Location	Responsibility Representation -Change Role -Change Work	Timing Representation -Analyze Feedback - Gap Analysis -Corrective Measures	Motivation Representation -Change Review - Adoptability	Change Identification & Impact

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Integration Perspective	System Integration -Modules -Modules Relationship -Integration Plan	Government Process Integration -Module Transform -Module Inputs	Integration Places -Server Locations	Roles in Integration -Planner -Integrator - Programmer -Tester	Timelines - Requirement -Analysis -Planning - Implement - Evaluation	Motivation of Integration -detect defects -dataflow -quality	Functionality Context
Implementation Perspective	Module Implementation -Policy - Agreement -Strategies - Infrastructure	Government Process Implementation - Implementation Transform -meet govt needs	Implementation Places- Implementation Location -Client site -Server site	eGovernance Implementation Responsibility - department -technical team -admin. Team - implementer	Timing Configuration - Implementation Cycle -Strategic plan -Review action -status	Motivation of Implementation - Actual Product	Implementers Efforts
Trainer	Training Initiation -Training Module -Training Strategies	Government Process Training Initiation -skill improvement - transformation -facilitate communication	Places of Training need -Training Location -user site -online manuals	Governance Training Initiation -Planner -Trainer -Users -supervisor	Timing Initiation -training - assessment -evaluation	Motivation of Training -skill development -ability address user issues - optimization of manpower	Human Resource
Updation & Upgradation Perspective	-Need Analysis -amc -support documents -reports -issue reported	Government Process -maintain hw/sw -keep system up -avoid failure	Places -user site -server site -human resource level	Governance Analysis -support staff -call center -field engineer -supervisor	Timing Analysis -identify need - collaborative planning -execution -testing	Motivation Analysis -updated system -reliability - availability - acceptability -trust	Requirement Flexibility
	Requirement Sets	Process Transformation	Network Nodes	Governance Groups	Timing Period	Motivation Reasons	

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A. Proposals Perspective

This row expresses the requirements and strategically defines the data artifacts relevant to the scope of the government project processes. It is the foundation of all other rows of proposed model. It contains all the requirement gathering and analysis to form a strategic documentation.

What (Data) - Important government processes which are performed by the project are identified in this cell of ZF. This cell involves the resources which are currently available and required for efficient functioning of the project. All the artifacts like Documentation, Forecast requirement, Resources, Inputs/ Outputs, Workforce etc are involved.

How (Function) - This cell is crucial because it reduces the fuzziness and expresses the clear cut functions of the process. It identifies the all the classes of project process.

Where (Location)- It derives the list of the locations/ sites from where the project may be accessed and what may be the requirements by various stakeholders. There are specific operations which are assigned to the particular location/ site.

Who (People)- It identifies the list of people or organizations that operate the projects within the government system.

When (Time)- This cell defines all the milestones, timelines, sequences and time phases for processes. The proposals of the project should be completed on time. It describes the time taken on each stages.

Why (Motivation)- List of project objectives and strategies come under this cell. This cell highlights the expected outcomes from the project for each entity/ person in the government system. The innovative strategies and corresponding outcomes are the part of this cell.

B. Change Management Perspective

This row deals with the implementation of strategies for effective transition or transformation of the goals, processes and technologies. It implements the effective change in the system, control the change and to help people to adapt to change. Change Management is the key to successful implementation of project. It is very important phase because the people do not accept the new thing easily. Government officials full of workloads and very few skill development activities take place. They do not want to come out from the comfort zone. So to change their attitude towards positively accepting the new system is crucial.

What (Data)- The data cell defines the plans, strategies or models adopted to change the process. Identify the assumptions, risks, dependencies, costs, return on investment, dis-benefits and cultural issues. Change Management model consists of four states as Determine need for change, Prepare & Plan for Change, Implement the change and sustain the change.

How (Function)- Change management processes are to supply the knowledge to the stakeholders to support, mentor and expertise them. It forms a structure to establish standards, best practices and methodologies. This cell also expresses to provide training and skill development and overall improvement of the stakeholders. It not only reviews the outcomes but also allocate the available resources across all around to analyze, evaluate and plan the change activities for proper governance.

Where (Location)- All the identified places where the change is required may be listed in prior. So the change managers could implement the change management strategies at the location. Government department's various sections or places should be identified to arrange the resources and trainers properly. Change of site is required for seamless implementation of the initiatives.

Who (People)- User who use the project, project manager, official committee, change manager, change planner, government officials are the peoples who interact with the change requirements.

When (Time)- Change cannot be stopped before reaching the target. Analysis and feedback are required to decide whether change cycle should be over or continued. It identifies the gap analysis of prior and post change activity to take the corrective measures for the project roll out.

Why (Motivation)- The objective of change management is to create a positive and healthy environment for project roll out. All the government stakeholders can be prepared for the new change in their governance functioning. They can be trained, expertized and motivated to adopt the new changes.

C. Integration Perspective

On the basis of Proposal and Change Management perspective, the gap analysis, feedback and corrective measures can be implemented to adapt the things as well as the project developers can take the advantages of such process reengineering of the government process. As soon as the project modules are developed, they are integrated to each other. Then the whole integrated project is being tested to check whether it conforms the functional and non functional requirements of the project. This row of ZF describes the integration perspective of the project under the proposed model.

What (Data)- Integration module which is the part of a program to perform the independent activity. It is integrated by following the integration plan, and then its integration is tested through integration testing. So the Integration modules, Integration Plan, Integration methods, Integration Test cases are the related data comes under this cell. Test drivers and test stubs are used to assist in Integration Testing which are also the data covered by this cell.

How (Function)- This cell of the integration perspective row of ZF describes the processes of integration like it is to bring together the component sub systems into a

system. It ensures the subsystem function together as a system. It improves project quality and performance and user retention. It reduces the operational cost.

Where (Location)- Project module integration is performed at server sites. The integration is tested on staging server, it is shifted to the production server after successful integration testing. Big bang and incremental approaches can be adopted for testing.

Who (People)- System integrator, Integration tester, Integration Planner, Programmer are involved the people of concerned under this cell of the integration row.

When (Time)- System integration cycles involve Requirement gathered from the user department. Feasibility Study is required for the complete study of the integration project. Architecture Plan is required regarding to find how the system should be integrated to the other comprehensive system. After that Management Plan come into the picture to calculate the risk factor, project execution plan etc. Integration Planning includes the logical and physical designs created for the system that are to be integrated. Then implementation and evaluation of the system is done thoroughly. It requires proper time to offer a bug free project to the concerned department.

Why (Motivation) - This cell describes the motivation/result of the integration perspective row. It helps to detect defects before actual implementation. Feedback on acceptability of the individual module is available. It corrects the data flow, control flow, memory usage. This cell is accountable for time and resources. It improves the quality and reliability of the integration project. It is helpful to apply current industry standards and provides proper documentation for future use which results a successful project which meets the government standards and user department's needs.

D. Implementation Perspective

Implementation consideration is the next row in our proposed model of the ZF implementation of enterprise architecture. This row shows various aspects of the implementation of the government projects. When the majority of the modules written and the project's integration are put into production by migrating all the data and components in a new system, the phase is called as implementation phase. The concerned users of the government department actually interact after implementation of the project. It is the realization of the project. All the six cells of the Implementation Perspective row are discussed in detail as below-

What (data)- Government Infrastructure, Policies, Standards, Agreements, Implementation Strategy, Planning and the idea which is being implemented. All are the data part of this cell because implementing project must adhere to these terms and should not violate anything which may hinder the project in future. Technical and Administrative leadership of the government department is required to adapt and support the new implemented project.

How (function)- Project implementation is the process which defines the information system is built to be operated and used. It also meets the quality and standard policies imposed by government. Project implementation is the process which defines the information system has been built properly to be operated and used. It also meets the quality and standard policies imposed by government. Implementation leads and controls the performance of the processes, it allocates the required resources and establish the foundation of annual objectives.

Where (network)- Implementation phase involves the tasks to be performed at both sides- client and server. The implementing strategic plan is migrated to new system and the requirement of the client side also covered under this step. All the resources and utilities allotted to both end to make the capable sites.

Who (people)- The coordination and cooperation among the Government department user, implementer, technical and administrate heads. They all are responsible stakeholders for the successful implementation of the government process reengineered idea of the project.

When (time)- Implementation cycle involves to define the strategic plan to resolve the doubts or query immediately. It gives the clear direction of moving towards. Review of actions should be required to refine the action plan. The implementing stakeholders in the government system should ensure that the implementation moves forward. They should have regular meetings with the departments and concerned implementing agencies to make sure the activities are on track and the challenges are being addressed. The implementation process should be evaluated regularly to keep track the current status, issues and achieved goals. The two way communication between the implementing agency and the user department should be there to share all the information without hesitation.

Why (motivation)- This cell describes the outcome of the implementation perspective row. It identifies critical differences between the planned and actual implementation. It collects information to support the interpretation of future evaluations of policy impact. It gives the actual product to the department users and others. The successful implementation of project gives thrust to automation and transparency.

E. Trainining Perspective

This row of proposed model through ZF describes the training perspective of the project being implemented by government authorities. Without proper knowledge of the project workflow, the government staff tries to stay away which adversely affects the project timelines. Training is an important phase to achieve the specified goal of the project. It creates a healthy and learning environment which develops the new skills and knowledge to adopt the latest trends and state of art technologies in the government system. Training plays vital role for the successfully implement the government process reengineering. It supports the better change and acceptability. It improves the

capacity, capability, productivity, performance, attitude and knowledge of the trainees.

What (data)- Training strategies and training modules should be developed as per the project needs. The detailed idea of the government policy and standards are necessary as well as the technical training of the project make the trainees more capable and productive. The training schedule should be created for the trainees and the nominated master trainer should provide the training in a resource full lab where they may practice on prototype of the actual project. It may reduce their hesitation and enhance the chances to be part of the government process reengineering.

How (function)- Training of the project which is created after the process reengineering of the government processes is necessary to clear the doubts of the users. They are new to the project so without training the changes can not happen properly. Training ensures that the employees are equipped with better skills, knowledge and ability to perform the assigned tasks. To meet the current and future demands, training play the strategic role. Training is also the part of feedback of the project. They learn and give feedback regarding the project. Training puts the employees on alert and it trains the employees to handle the certain situations on operating the project. It also facilitates a communication between the employees of the department. Training is one of the key functions. It should be the integral part of any project roll out activity.

Where (network)- Training is required at all the sites or places where the user would operate it. Identification of such training areas is a part of training plan. Training may be provided at district, tehsil or block level users as per the requirement. Pamphlets may be distributed and online user manual should be provided so that the user may access it anytime anywhere. District and Sub-District level e-Governance training labs may be properly established and utilized for the training purposes.

Who (people)- Various stakeholders involve in training. Trainer who trains the participants under the supervision of government department's representative. Training Planner who plans the training schedules. Head of the department supports the necessary funding and training resources allocation. Also a formed training committee manages all the necessary requirements.

When (time)- Training timing cycle begins with the assessment of the training need. Afterwards, development of the learning objectives and training program are scheduled. Then, implementation and performance evaluation of the program are to identify the developed skills of the trainees. The proper training schedule and timings are must to receive and resolve the queries. Sometime show should be reserved for the two way communication session.

Why (motivation)- Training ensures that the employees are equipped with better skills, knowledge and ability to perform the assigned tasks. It helps to address the weakness of the employees and which improves the work performance and productivity. It reduces the cost and supervision effort. Training optimizes the utilization of human resources. It creates a better government image and work environment.

F. Maintenance Perspective

Many government projects lag behind due to non-maintenance of the e-Governance projects. The maintenance comes into the picture when the product is in full operation. Maintenance of the project can include software upgrades, updates. It also includes changing of hardware, software, and documentation to support its operational effectiveness. Upgrade is the act of replacing old project with a newer and Update means to fix the issues or to activate specific functionality. The government process reengineering is the continuous process to adapt the new changes in government by adopting the innovative ideas, latest trends, technologies and best practices. Maintenance is of two major types- corrective maintenance and adaptive maintenance. Corrective Maintenance fixes the defects which popped up during the usage of the project while some requirements which were not a part of the requirement analysis but they take the attention of the government authorities then the incorporation of new things comes under the Adaptive Maintenance. They steer the changes in the implemented and operational project towards the right direction which is necessary for the complete success of life cycle of the government project's roll out process.

What (data)- This cell shows the data related to the maintenance perspective like Annual Maintenance Contract (AMC)/ support documents, support levels, Identification of exact issues so that it could be resolve properly. Maintenance supported requirements. AMC is very important documents which includes service support. It provides the exact roles and responsibilities of the vendor regarding the maintenance support. It covers whatever services covered under AMC. Good vendor or agencies are must for the good support. Inspection and support staff performance, deliverable reports play crucial role to identify the support performance.

How (function)- This cell describes the functions of the maintenance perspective. It is very important part of achieving government process reengineering. Maintenance is to maintain the software and hardware, keep the project in running state, preserve, protect and keep away from failure. It makes the government project more reliable.

Where (network)- Maintenance is required all the places where defects or demand arise. It can be user level, server level or human resource level. All the places are covered in the maintenance support documents.

Who (people)- Maintenance Team, Support staff, Call Center Operator, Field Engineer, Maintenance Supervisor all play vital role to resolve the issues.

When (time)- This cell of maintenance perspective describes the timeline or life cycle of the maintenance stage. Identification of the maintenance requirement and Collaborative Planning to get optimal outcomes is required

to design the solution. Then designed solution is implemented and corresponding testing is done to deliver the timely and productive results. Maintenance is required on regular intervals to check up the proper operations of the project and to take preventive actions.

Why (motivation)- Its key deliverables are to keep system live, maintain the code and update/ upgrade the software/ hardware requirements. It avoids the non-functioning of the project. It improves the trust relationship between users and government machinery's implemented projects. Maintenance resolves any bugs/problems that arise. It improves the quality of products and to improve the productivity of the project. It makes the system more reliable, available and trustworthy.

V. CONCLUSION

Government processes are complex and the corresponding designed project also a complex one. Government process reengineering take measures to adapt the process anomalies of the simple, standardized, dedicated and planned projects. But it needs redefining itself when the project's complexity goes severe. Severe projects have different opinion, scope and dependencies. It needs the standard and thorough study of functional and non functional dependencies which may be done through architectural best practices.

The proposed model of the Government Process Reengineering inspired by Zachman Framework for Enterprise Architecture Implementation gives the thrust to provide the common standard and goals to proceed with the different government agencies. It set the positive and improved level of abstraction to allow the doubt clearance. It generates an environment where the good decision making support can be provided on present or future capabilities and process requirements. The proposed model provides the standard, predefined and architectural approach to generate new effective ideas and strategies which promotes the creativity to think out of the box. It reduces the cost and risk to implement the new process. The model improves the success ratio and government project's acceptability rate.

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