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Precise Design Optimization of the e-Governance Architecture with Object Oriented Constraints

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***Abstract*— Adoption of design optimization of e-governance architecture is one of the smartest optimization techniques for any software projects development organization. However, it is quite vague to understand the real time constraints of small scale development teams about the adoption of design optimization of e-governance architecture and its relation with its optimization in process management. Therefore, the proposed paper has identified 3 near real time constraints e.g. quantity, working schedule, and cost of new development and has proposed a mathematical model that could evaluate the impact of design-optimization of e-governance architecture using software metrics towards evaluation of such constraints. The paper has considered the most challenging scenario of minimum number of developers and maximum possible e-government projects and mathematical model is applied using feature attribute to visualize the statistical and analytical accomplishment of the results. Empirical experiment towards the proposed mathematical model is conducted and the results shows higher degree of mitigating the uncertainty in usage of design optimization of e-governance architecture for small scale development teams while maintain superior projects delivery.**

Keywords-; Design Optimization of e-governance architecture, software metrics, Mathematical Model, Software Metrics, Software Optimize.

I. INTRODUCTION

For software development organization to effectively manage and control software development projects they require to incorporate a measurement process into their decision making and reporting process [1]. Software measurement process is a methodical technique of measuring assessing and adjusting the software development process using objective data. Software optimization of e-governance architecture is on one of the research issue in the software industry and optimization of e-governance architecture is a prominent subject in the software engineering [2]. In the last 10 years, various researchers have presented many novel concepts and frameworks but only few had a direct influence on the software industry as well as in research domain. The current study incorporates a mathematical modeling effort for quantifying the perception of software optimization of e-governance architecture. It was also seen that optimization of e-governance architecture plays very crucial role in the large-scale software development environments. Various attempts were made to establishing a realistic return on investment on a optimize program [3]. It is indispensable to include optimize into a corporate software development process, and that clearly declaring the prospective advantages of optimize. A optimize metrics and return on investment (ROI) model that distinguish the savings and profit from those already gained through accepted software engineering techniques are discussed [4][5]. The current paper scrutinizes various approaches and methods to visualize the existing system on optimization of e-governance architecture. Knowing what makes design reusability can help us learn how to build new reusable components and help us to identify potential useful modules in existing programs. The study begins by establishing various techniques being established in optimization of e-governance architecture metrics that is designed on their empirical qualitative orientation. Then the paper evaluates numerous scales of various aspects of the design optimization of e-governance architecture and proved it with the help of mathematical modeling.

Software Optimization of e-governance architecture metrics, models and analysis carried out suggests quite strongly that Optimize Software in the circumstances where there are economic and financial benefits to be gained and this we can save the e-government projects money and can have better customer. Benefits of software Optimization of e-governance architecture and mathematical modeling i) Mathematical modeling is proved to be very useful for validation and verification of the software optimization of e-governance architecture metrics. ii) The other benefits of the software metrics are:-Development Benefits, Maintenance, Quantification of the benefits and costing validation. The proposed research paper presents a mathematical model considering a case study of small scale development team to check the impact of design optimization of e-governance architecture on the performance and effectiveness of the delivery given the developers in the firm. Section 2 discusses about the prior research work done towards the same field. Section 3 discuses about problem for designing the mathematical model of design optimization of e-governance architecture followed by discussion of proposed model in section 4. Research methodology is discussed in Section 5 followed by result interpretation in Section 6 and finally some concluding remarks are done in Section 7.

II. RELATED WORK

Priti Adeshara et al. [6] have proposed an insight into the readiness of Small and Medium Sized Enterprises (SMEs) for

accepting e-government services in the UK. They conducted a survey of 128 SMEs, which revealed that there is a moderate demand for e-government services, but they were not rated as efficient and essential for SMEs' businesses as conventional services.

Chethan Venkatesh et al. [7] have conducted to track the usage of OSS, it was found that OSS is extensively promoted in countries like India, China and Taiwan followed by South Korea, Malaysia, Singapore and Thailand in Asia. In South America, Mexico, Brazil and Argentina are encouraging the use of OSS in all sectors of the government whereas in Africa, South Africa is extensively reaping the benefits of OSS followed by Kenya, Ghana and Nigeria (Noronha, 2003).Many developing countries have a large pool of easily available skilled personnel who can modify the source codes of an OSS to meet the specific needs of the government organizations.

Boryana Deliyska et al. [8] have presented development of ontology-based model of e-Governance, which would be useful for knowledge structuring, standardization and sharing among experts and software engineers who create applications in this area. The main goal is e-Governance semantic harmonization with terminological and technical standards used in society and the public network Internet. For that reason a comparative analysis of e-Governance vs. e-Government is implemented to introduce the reader to the e-Governance ontologies state-of-the-art. The hierarchical ontological model of e-Governance can be considered as extension of existing e-Government model.

Poonam R Gupta, D K Jain [9] has illustrated E-governance offers a large opportunity for serving the citizens in better way. ICT promises lots of advantage in governance process but at the same time requires efforts for changing process, building infrastructures, capacity enhancement etc. This paper presents e-governance activities of CDAC, Noida and its SWOT analysis. The paper also presents technology trends to watch for in future and roadmap of E-Governance group.

Vassilios Peristeras et al. [10] have propose, (a) a high-level representation for the overall governance system and (b) two models for describing the overall policymaking system's function backed up with feedback mechanisms for controlling system's Critical Success Factors. In recent literature and practice the e-government term has been mainly used for describing systems aiming at electronic service provision by public administration agencies. E-Governance, as introduced here, is a much wider concept as it incorporates information flows between society and political system, political and administrative system, and internal political system and civil society flows. Providing high-level models and definitions for the overall governance system is perceived to be the first step towards standardization and the creation of commonly accepted domain vocabularies and ontologies.

Amit S. Pande et al. [11] have described the research, design, and iterative development of India's first ICT enabled Gram Panchayat (GP) in Bellandur, arnataka. Bellandur is a live field demonstration of corporate initiated private-public partnerships that engage other stakeholders, to foster an emergent ecosystem. Through such contextually designed ICTs, they address larger systemic frameworks, methodologies, and practices for social benefits to rural India.

G. Rani and S. Chakraverty[12] have proposed surveys the plethora of existing approaches and models for e-governance and presents a comparative evaluation based on certain qualitative parameters. These parameters have been selected based upon their criticality in e-governance applications. They include security, interoperability, authentication, flexibility, extensibility, privacy, adaptability, transparency, verifiability and robustness. The classification provides a common platform to glean knowledge about the strengths and weaknesses of different models, gain a quality-based comparative evaluation and build upon specific research directions.

Sani Asnain Wani et al. [13] have proposed a working definition of integration modules and makes suggestions for their structure and scope as well as their content and use for E-government applications. This contributes in enabling software engineers to find out shared-understandable and common concepts to describe requirements for different domain models used in developing E-government applications. Several documents related to the integration of modules for E-governance applications are collected, the main concepts and relationships are extracted and refined.

D.Beer et al. [14] have presented architecture for distributed workflow systems for e-Government. Distributed execution of workflows represents an important step towards efficient realization of cross-institutional decision making processes. Many standards still have to be developed until general purpose workflow vendors completely support interoperability in heterogeneous environments.

III. PROBLEM DISCUSSION

E-Government is a fairly complex process of creating and harnessing the right environment that consists of People who are committed to the cause and who have the right knowledge, skill sets, and attitude. One of the most challenging issue is investigating the prior research work on this stream was to identify the problem in code optimization in usage structure related to e-governance. The prime tradeoff is there is no existence of such topic before in history, hence this section discusses few matched studies in association with software optimize. As in the area of software engineering code optimization can also be performed using software optimize. Most of the e-governance initiatives so far have created islands of information, difficulties in data interchange, and inefficient communication among the government, the businesses and the citizens. Technology incompatibility is only a piece of this "Interoperability Issues Puzzle" in e-governance initiatives in India. Incompatibilities in government processes, diverse and distributed working groups, people, teams, multiple interest perspectives, and interest groups, all create much larger issues for interoperability than the technology alone. Specific gaps that are being seen are:

i. Lack of correct understanding of capacity building requirements.

ii. Lack of information on the Human resource requirements to support the central and state e-Governance mission
iii. Lack of personnel with appropriate background and aptitude
iv. Inadequate skill sets of personnel already deployed
v. Lack of appropriate institutional framework to handle the capacity building
vi. Lack of proper policy to fill the gap through sourcing from private sector
vii. In-adequate expertise and skills within the state training institutions to lead training programs at the policy maker level.
viii. Lack of thrust on institutional capacity building in the domain of e-Governance.
ix. Non-availability of specific standards, policy guidelines for e-Governance

The e-government strategies adopted by municipal, county (district) and state governments worldwide tend to neglect citizen participation. To enable the internet to foster e-democracy, government web portals need to adopt various initiatives to engage the public in online decision-making. Contrary to popular belief, many proponents of wide-scale citizen participation do not automatically shun technology. Moreover, the government web portal is, however, a technological tool that has yet not been utilized up to its potential to empower citizens. For e-government to significantly enhance citizen participation, web portals need to be sufficiently equipped with tools like bulletin boards, feedback forms, policy forums, and performance reporting systems. Many Frameworks and models exist today, for assessing an e-Governance project, after it is implemented. Using these frameworks like EAF 2.0 [15], one can determine the success and impact of the project. However, this amounts to a post mortem exercise. What is needed is a tool or framework which will enable the decision makers to determine what is most required and what is most likely to succeed. Replication of a successful pilot may not always deliver a similar successful outcome, since, either the priorities of the local citizens may be a little different, or the organizational capabilities may be different or both. If a framework or a model can be built which can help the decision maker to assess the success rate of a future project, based on real time parameters, it will serve a better purpose than an assessment framework.

IV. PROPOSED FRAMEWORK

The proposed framework introduces formulation of a framework for the purpose of design optimization for the software architecture considering challenges of administrative domain. However, visualizing the dynamic nature of the need of effective e-governance architecture in Indian Scenario, it should be noted that the design are usually done on java technologies where the architecture is mainly Object Oriented. However, the previous studies [16] [17] [18] have not much focused on design issues of e-governance in Object Oriented perspective. It was also seen that majority of the design optimization can be effectively studied by using software metric suite [19]. Therefore, our proposed study also concentrates in proposing a framework of e-governance by using factors of software metric suites. Multiple issues pertaining to an effective e-governance architecture implementation in a developing country are psychological as well as technical. It is necessary to adapt good enough to the current situation of the e-governance implementing area to avoid bad user reactions. One of the most important quality factors of e-governance software architecture is user acceptance. Interoperability framework for E-Governance that comprises a set of policies and technical standards to facilitate interaction between isolated E-Governance applications. Leveraging the recent technical advancements that allow applications to interoperate, regardless of the underlying technologies, interoperability framework for E-Governance envisages facilitating joined-up service delivery through a single window. As an initial step, the implementation of interoperability framework for E-Governance standards has already begun in certain National Level Projects. The proposed frameworks for e-governance components are as follows:

- Layered Architecture
- Open Standards at all the layers.
- Development based on Open standards.
- Platform Independence.
- Reusable Component based development.

The basic problem formulation considered in the proposed study is to evaluate and frame up the association between each one of the software metrics suite towards optimization at design stage. But establishing relationship among the software metrics is one of the most sophisticated asks in itself, which calls for performing analysis in larger scenario of users in Indian Administrative Services who deals in software projects and are backed up with small and efficient skillful human resources. It is already known that majority of such governmental organization outsource such projects to Private IT sector. Hence, this research will consider an evaluation to understand if the issues of Object Oriented nature of e-governance projects can be handled by self-own team of government organization itself. For better revenue making strategies, such software development consortium frequently adopts the strategy of optimization of human resources to handle exceptionally higher numbers of software projects. Usually, such organization can scale up the profit if they could possibly trade on the similar types of products to maximum number of e-government projects. Hence, it takes the shape of design optimization of e-governance architecture. The more the event of design optimization of e-governance architecture, more can be the profit of such small scale development team handling e-governance applications. Hence, a case study of need of design-optimization on small scale development team can be taken. In small scale development team, the human resources will be less and they are targeted for highest utilization for maximum revenue generation for the government organization. So, the identified constraint assumptions in this case could be as following – i) A single

human resource can handle Q_{max} specific number of e-government project's projects requirement (Q_{max} is maximum number of projects that can be handled efficiently.), ii) Some of the project's new order falls in same domain of work in Indian Administrative Services, and iii) better optimization of human resources can be done, if one developer can optimize the code or design the new design with exponential higher degree of optimization to maximum extent. The formulations of the issues to be addressed in the proposed study of e-governance software architecture on design optimization are as follows:

- **Issue-1:** Unit Human Resource working on multiple E-government architectures is the first issues under consideration. This case can be considered by assuming that let h_m be number of the human resources working on the unit architectures while Q_n be the quantity of the e-government architectures layers, and let N_{layer} be the number of the e-government layers currently worked on. Therefore, according to the assumption, $m<<N_{layer}$. Hence the problem in this real-time assumption is to optimize the design assuming quantity of multiple e-government projects by unit human resources. Also, if number of the e-government projects are fixed than impact of max N_{layer} is on the design optimization of e-governance software framework is another computational problem.

- **Issue-2:** Distinctive Task-provisioning for multiple E-government layers using open standards on all layers currently existing on cloud and availability of unit human resources is the second issue under consideration. Let us consider TS per layer be TS_{layer}. As currently, majority of the application are on cloud or are about to migrate to cloud, the proposed assumption of design optimization is a big question mark because of uncertainty nature of the extent of design optimization in the software architecture of e-governance. Uploading the intellectual property on cloud is expected to solve task provisioning, but unfortunately, task provisioning per layer evaluation will be a highly troublesome factor because of uncertainty nature of the quality of the existing framework. It should be known that if task provisioning is already an NP hard problem. Therefore, optimization of design constraints considering the dynamics of the task provisioning issues over cloud for multiple layers by unit human resources maintaining the architecture of the e-governance is another computational challenge.
- **Issue-3**: Cost or Return of Investment (ROI) should be another parameter to be judged while considering new formulation of the proposed design optimization. In order to understand these issues, it should be already known that Indian Administrative Services already has a well established website that furnishes the privileges of e-governance. However, none of the currently available applications of e-governance work in optimal quality due to technical flaws in software design aspects. Hence, in case, a new development for design optimization takes place with a consideration that it shouldn't involve i) higher expenditure on incorporating new design as well as ii) the new design of e-governance could be reused to potentially higher extent in future in case of any required amendments in software architecture. However, the problem surfaces if the same issues are considered assuming evaluation with unit human resources and constraint of time for working.

Also, it has been seen in the literature that software-Metrics are the most preferred software quality metrics, but due to inherent issue, the software metrics should be subjected to certain scale of amendments based on the considered case study. The proposed system has considered all the 6 software-Metric factors that have drawbacks. But in order to use it in the proposed mathematical model, there requires some serious amendments in the Software metrics or in the design of the model even. As, seeing the need of small scale development team, the proposed model adopts a unique hypothesis that the alterations of the feature attributes used are not very different than from the mean changes during development for classes by the human resources. The same phrase can be also said as the alteration of the feature attributes used are different (but may be preferably inferior) from the mean alterations during development for classes that are likely to be optimized in an informal manner. In the previous statement, feature attribute is an attribute that is defined by the mathematical model for the purpose of problem formulation and it precisely as it relates to the effort of the human resource, optimal work usage from organization, thresholding etc. Therefore, it can be seen that considered issues highlights some of the near real time issues of small scale development team which needs to be considered in the proposed formulation of the problems identified. It should be also noted that if the Number of Allocation of e-Governance Projects (P) to one developed $\leq Q_{max}$ (Q_{max} is maximum number of e-government project's project), then only the human resource can actually be assumed to use design optimization of e-governance architecture with effectiveness in their delivery model. Consider, T_{opt_limit} is threshold of optimization limit permissible that is limited to 550%, that means if the existing development requires less than 55% optimize, the new design is highly cost effective, and if it is more than 55%, it can be considered equivalent to new development.

V. RESEARCH METHODOLOGY

The preliminary thought of the projected model relies on the actual fact that establishing a relationship among the software system metrics itself is one in all the difficult tasks that call of analyzing with reference to a selected case study. Figure 1 highlights the proposed framework of design optimization of software architecture in e-governance.

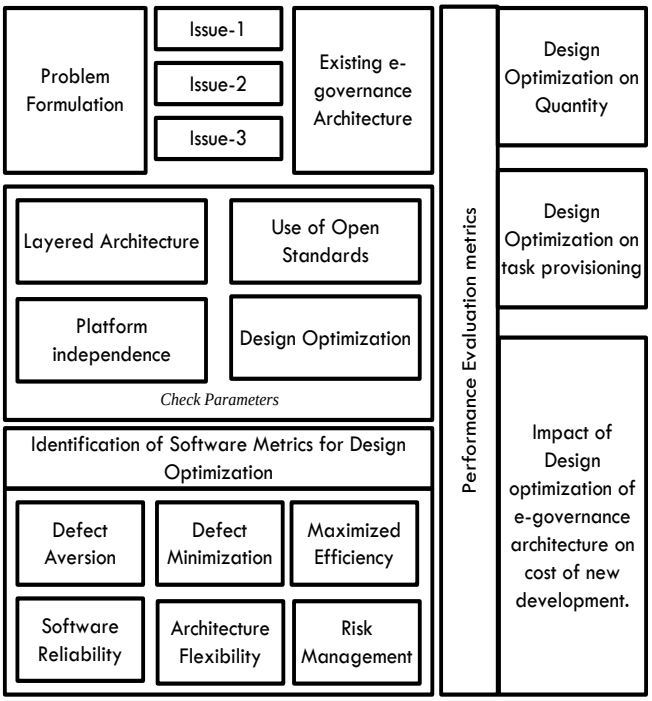

Figure 1 Proposed Schema of Design Optimization Architecture in e-governance.

Hence, the paper can discuss a couple of mathematical model that that may produce a base of relationship of package metrics with the issues mentioned in previous section. The projected mathematical conception is constructed in such the way that the user that's truly perceived for higher usage instantly. It ought to be most unlikely that a really advanced model is designed that is targeted just for some set of users—the projected model discard thought of any such constraint during this design. Hence, for the smoothness within the initial formulation, the system can initial determine a group of candidate categories that are doubtless to be thought-about for optimize. Afterwards, the model will contemplate adoption of planning a watching technique that the daily changes of the standard metrics for every category throughout development be detected. And ultimately, the common of those a day modifications are often thought-about with the change every category gains once it's been optimized. This permits the user to quantify the impact of style optimize on intrinsic quality metrics compared to their accumulative evolution throughout software system project development. It ought to be additionally noted that projected model won't contemplate direct design snippet optimize that's terribly frequent among developers in IT trade, however, the projected model can take into account illustrating about style optimize that specifically a technical architects in IT trade will choose.

Let C_A be one of the characteristic attribute where initially, it can be possible to find mean of their daily changes for each candidate class in object-oriented programs over the whole development period not including days when the class has been optimized. C_A can also be suggested as a set consisting of an element A_n, where n=1-6. Here, A_1 represents Defect Aversion, A_2 represents Defect Minimization, A_3 represents maximized Efficiency, A_4 represents Software Reliability, A_5 represents Architecture Flexibility, and A_6 represents Risk Management

Therefore,

$$D_{opt\_1} = \sum_{k=1}^{n} (C_F.k).\Delta\Psi \tag{1.1}$$

And

$$D_{opt\_2} = \sum_{k=1}^{N_{layer}} [C_F.(k-1)]\Delta\Psi \tag{1.2}$$

$$D_{opt\_3}=N_{layer\_day}-|T_{task\_prov}| \tag{1.3}$$

Where, N_{layer_day} is total number periods permissible to design the complete architecture and $\Delta\psi$ is period required in a unit day effort. It should be noted that T_{task_prov} is the actual provisioning of design optimization task required by the human resources for performing design-optimization of e-governance architecture and $T_{task\_prov} < N_{layer\_day}$. This average value for characteristic attribute be represented as by ΔC_A.

$$\Delta C_A = \frac{D_{opt-1} - D_{opt\_2}}{D_{opt\_3}} \tag{1.4}$$

By $\Delta\psi_i$, it can be showed that the mean of the daily changes of software metric suites only for the days ($k \in \psi$) in which a class has been optimized. To assess whether design optimization of e-governance architecture improves quality of a class that is compute its $\Delta\psi_i$ and ΔC_A values and compare them with each other: If $\Delta\psi_i$ is found negative and significantly lower than ΔC_A, it can be concluded that design optimize concept in highly optimized environment of small scale development team actually enhances quality metric as compared to its standard evolution during development. Hence, formulation of the equation (1.4) expects to find whether applying the proposed design optimization of e-governance architecture model in small scale development teams under constraint elaborated in Section IV can define better delivery of software projects.

VI. Result Interpretation

For the purpose of analyzing the reliability of the proposed mathematical model, the empirical experiment is conducted in a controlled research environment. The efficiency of the proposed model is analyzed considering the skills and potentials of just 2 Human Resource i.e. Junior Human Resource and Senior Human Resource. Junior developer is assumed to under 2-projects (T_{opt_limit}) with total development duration of 14 months and actual development duration in 10 months considering the constraint as $m<<N_{layer}$. Similarly, the senior Human Resource is assumed to undertake 3-projects (Threshold=3) with total development duration of 24 months and actual development duration in 18 months. The consideration of the threshold factor plays a critical role in this analysis as developer with threshold violation can be considered as inefficient task delivery. The analysis mainly

checks the real viability of design optimization of e-governance architecture with the adopted software metrics and therefore, the analysis performs evaluation of impact of considered software metrics on 3 problems factors i.e. quantity, work schedule as well as cost of new development. T-test with unequal variance has been conducted on the processed data to understand the impact of design-optimization of e-governance architecture and adopted software metrics on quantity, working schedule, and cost of new development.

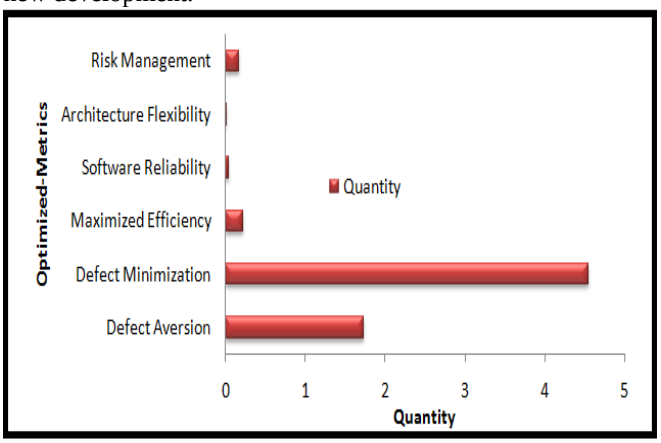

Figure 2 Impact of Design optimization on quantity

Figure 2 shows the impact of design optimization of e-governance architecture on the effective number of the projects that can be handled and well delivered prior delivery schedule. It can be seen that defect aversion and defect minimization are the prime software metric that have significant effect due to design optimization of e-governance architecture under the considered study. It is due to the reason that the critical deployment of defect aversion is actually based on the coupling between object classes for a class that represents the quantity of other classes to which the coupling is performed. Conventional concept of the coupling is associated to the idea that such coupling operation is performed for one object to another. The unidirectional deployment of the method is restricted as well as the instance variables of another object by the object of the class whose optimization of e-governance architecture needs to be estimated.

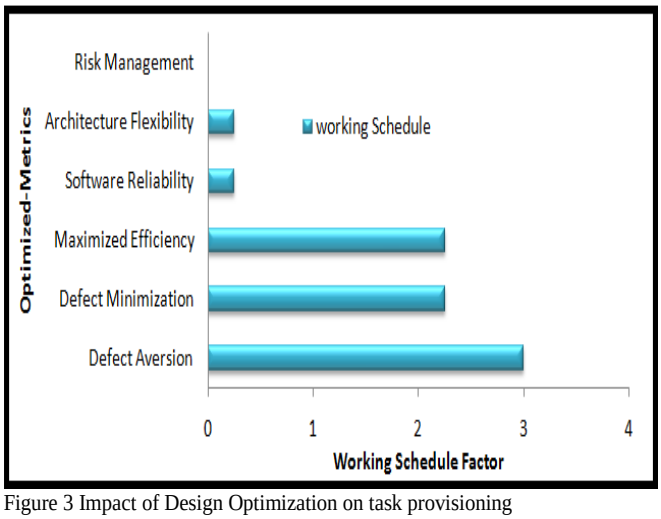

Figure 3 Impact of Design Optimization on task provisioning

The optimization is inversely proportional to the coupling which means that decreasing the coupling between the object classes will increase the optimization of e-governance architecture and it will become quite a simple task to perform amendments with modification and evaluate the software systems using the proposed model. Therefore, certain maximum threshold of coupling level needs to be fixed where it is possible to scale up the optimization of e-governance architecture factor.

Figure 3 shows the impact of design optimization of e-governance architecture on the working schedule. As $TS_{layer} \alpha Q_{max}$, therefore increase in number of projects will also increase the work schedule. The analysis has considered $\Delta\psi$=8Hrs with minimum 50% viability of the design optimization of e-governance architecture for all the 5 total e-government projects under consideration. One of the obvious advantages of using the design optimization of e-governance architecture methods highlights that defect aversion, defect minimization, and maximized efficiency are the significant factors responsible as they represent coupling between multiple classes and the sophistication of a class in terms of method designs and calls. It can be said that these software metrics are potential identifiers for understanding the extent of design optimization of e-governance architecture. It can also be seen that maximum values of defect aversion interprets that class is highly dependent on multiple extrinsic class and highly challenging to optimize when class is separated for optimize (interface design). However, with the use of proposed model, the analysis shows that adoption of design optimization of e-governance architecture can enhance the prediction of majority of the software metrics when it comes to work schedule.

Figure 4 shows that most significant part of the analysis where it can be visualized that all the 6 software metrics are almost equally responsible factors of prediction when it comes to identify cost of new development.

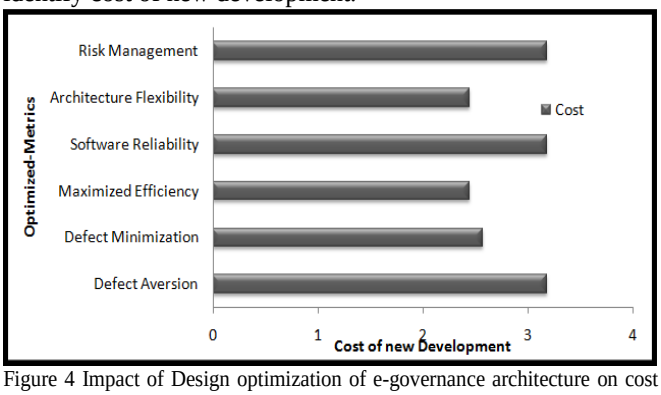

Figure 4 Impact of Design optimization of e-governance architecture on cost of new development.

With Statistical analysis perform with significant level of alpha as 0.05 in SPSS, the cost of new development is determined. The analysis considers that 50% of the existing design can be used for the new e-government project and remaining 50% need to be developed from scratch. Hence, keeping future need in mind, the proposed solution also highlights that new development should also be incorporated

with minimum 50% of the design that can be optimized in future. Hence, it can be seen that adoption of the proposed model is highly feasible in small scale development teams where the adoption of design optimization of e-governance architecture is quite non-trivial with the dynamic requirements of the e-government projects. However, the proposed study built a relationship between the software metrics and design optimization of e-governance architecture.

VII. CONCLUSION

The proposed system introduces a mathematical model that evaluates the challenging scenario of small scale development teams related to design-optimization of e-governance architecture. A model is built on an optimization technique of technical resources undertaking design-optimization of e-governance architecture. One interesting finding of the model is that the statistical prediction performed can actually evaluate the significance of near real time constraints in small scale development teams e.g. quantity, working schedule, and cost of new development. Although software metrics are very standard parameters in software engineering, but it is shrouded by uncertain issues explored in literature survey. Hence the proposed study aimed at making the cumulative amendments in the software metric usage by considering all the 6 parameters in feature attribute. Evaluation of the feature attribute builds a robust base to establish a relationship between the constraints and impact of design optimization of e-governance architecture on them. However, the proposed study is conducted under extreme controlled research environment where the real time parameters in small scale development teams (e.g. number of projects, e-government projects, duration of development, designation and skills etc) are hypothetically assumed to check the accomplished results. Like most other research in this stream, our study has several limitations. Our analyses cover only a subset of the software suite of metrics. It is strongly believed that the proposed system has not considered many critical parameters like requirement volatility, change management, as well as risk management issues in SDLC design process in terms of design optimization of e-governance architecture in order to focus on the effectiveness of mathematical model proposed. It is also believed that the proposed model should be further more enhanced by considering more number of constraints (currently, only 3 constraints are considered) and higher dimension of evaluation parameters.

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