ISBN: 978-81-946587-3-3

Adoption of e-Governance in India

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KRIPA DRISHTI PUBLICATIONS, PUNE.

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Kripa-Drishti Publications

Book Title: **Adoption of e-Governance in India**

Written by: **Dr. Rohini Jha and Dr. Shradha Shivani**

1st Edition

ISBN: **978-81-946587-3-3**

Published: **July 2020**

Publisher:

KRIPA DRISHTI PUBLICATIONS

Kripa-Drishti Publications

A/ 503, Poorva Height, SNO 148/1A/1/1A, Sus Road,

Near Padmalayas, Pashan- 411021,Pune, Maharashtra, India.

Mob: +91-8007068686

Email: editor@kdpublications.in

Web:https://www.kdpublications.in

A STUDY OF ADOPTION OF E-GOVERNANCE IN INDIA

PREFACE

Purpose

Adoption of e-governance in India started in mid 90s, but early adoption initiatives by the states and union territories had been characterized by initiatives in form of separate projects. These initiatives were piecemeal approaches thus could not address the issue of provisioning all citizen centric services through kiosks located in rural and urban India called Citizen Service Centres (CSCs). Our effort in this research work has been to analyze the e-governance adoption initiatives post NeGP (NeGP was formulated in 2006 and implementation began in 2007) by each state and union territories as regards provisioning of integrated e-governance services through CSCs at the lowest level i.e., district centers. Our analysis of e-governance offerings through CSCs of each state and union territories have been based on scaled inputs of the lowest level strategy implementer's at District Centers viz., village level entrepreneurs (VLEs), State designated agency (SDAs) representative, National Informatics Centre (NIC) representatives, users and analysis of associated web sites offerings by each state and union territories. There are total of 641 districts in India and only 581 districts have District Centres. A few District Centres have been entrusted with additional responsibility of provisioning CSCs in neighboring districts. EAF version 2.0 frame work designed for analysis of pilot projects has been modified for integrative benefit assessment of each state and UT post NeGP using its subjective assessment methodology. Based on the thirty three KPIs derived from EAF framework, and its combinatorial mapping to the relevant CSFs in Indian context a questionnaire was designed to get scaled inputs of all stakeholder's involved in NeGP implementation at the lowest level i.e., District Centres. The survey was conducted on line in the months of June 2009 to Dec 2009 and e-Government assessment index (eGAI)

was compiled for each state and UT. The states and UTs based on inputs on their CSFs and eGAI were clustered into four categories using K-means and fuzzy c-means techniques. The states and union territories were classified into four categories as Average Achievers, Expectants, Aspiring Leaders and Leaders. According to previous studies carried out by Ministry of Information Technology, Government of India in 2006-07, the states and union territories were clubbed into six user levels based on e-readiness assessment. The aim of my research work thus is to create a baseline data post NeGP with effect Jan 2010 and predict future course corrections in strategy for each state and union territory based on Fuzzy inference system-CSF based model.

National e-goverance Plan (NeGP) was formulated in 2006 and identified its mission as "Make all Government Services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency and reliability of such services at affordable costs to realize the basic needs of the common man". The government has taken a *three pronged approach* for effective implementation of NeGP to enable anytime anywhere delivery of government services (i) CSC's are ICT-enabled Kiosks having a PC along with basic support equipment (ii) State Wide Area Network (SWAN) provides the necessary support for Connectivity (iii) State Data Centre (SDC) is useful for secure hosting of data and applications. CSC shall have 3-tier implementation viz., first tier one CSC in a cluster of 5 to 6 villages owned by Village level entrepreneur (VLE), second tier as Service Centre Agency (SCA) to control CSCs in one or two districts and third tier as State Designated Agency (SDA) responsible for implementation of this scheme within the state. CSC scheme thus is a front-end delivery point for government, private and social sector services to the citizens. Three important lessons emerge from the experience of e-governance in the states. First, states are not learning from each other's experience though discharging similar functions. Secondly, many of

these projects are narrow in scope (generally covering one or two services like land records resulting in fragmentation of service delivery). A project has greater chance of success if it provides a number of citizen-centric useful services at one place. Thirdly, the Chief Information Officer (CIO) concept in e-government is required to be driven in the states by policy and institutional support (Mishra et al., 2007).

Method

The methodology adopted is based on the concept of critical success factors (CSFs) which are "Key result areas if achieved" shall guarantee the success of the project (Rockart, 1979). A weighted combination of CSFs gives the implementation strategy, but it is difficult to quantify these CSFs and thus need to be broken down to measurable indicators. These measurable indicators in literature have been termed as Key performance indicators' (KPIs) which have been drawn from EAF version 2.0 framework designed for pilot project analysis by Centre of e-governance, IIMA and NISG, Hyderabad. These thirty three KPIs drawn from EAF version 2.0 framework have been suitably modified for integrative assessment of states and UTs post NeGP. Subjective assessment methodology gave us the weightages of all five dimensions viz., service orientation, technology, sustainability, cost effectiveness and replication. The weightages of each sub-dimension i.e., KPIs were obtained from inputs of experts, academicians and implementer's using AHP technique (Gupta et al., 2003). These KPIs then were mapped to all the relevant CSFs influencing the e-governance implementation in India post NeGP: *Clear cut vision and goals, E-content, Info Infrastructure, Human Capacity Building, Awareness and Communication strategy, Technology Architecture, Privacy and Security, Change Management, Formulation of e-Gov roadmap, e-Gov program management, Integrated e-governance, re-engineering process, Universal accessibility, Continuous feedback, Service Delivery Paradigm, Understanding*

e-Gov prospects, Cost benefit analysis, Evaluation and performance assessment, sustainable business model (Sachdeva, 2006). Based on CSF-KPI combinatorial mappings questionnaire was designed to get scaled inputs from various stakeholders' involved in e-governance implementation at lowest level i.e., District Centres. Various stakeholders whose inputs were taken to evaluate the e-Governance Assessment Index (eGAI) are: (i) Village level entrepreneur (VLE) (ii) representative of State designated agency (SDA) (iii) representative of National Informatics centre (NIC) (iv) users who are well versed with use of the CSC offerings and (v) researcher's analysis of the website offerings of each state and UTs. A total of 1638 completed responses were received details of which are attached in Appendix 'A'. The responses so received for each state/UT was then compiled comprehensively and used for analysis.

Implications

The interlinkages between CSFs were worked out based on the commonality of KPIs and thus five systemic links contributing to e-governance success was obtained. Based on these five systemic links four Fuzzy Inference systems were developed (fifth systemic link was neglected as it was a combination of only two CSFs i.e., Clear Cut vision and Goal and Technical Architecture) and each cluster/category was analyzed to suggest the most appropriate strategy for course correction. The following was thus concluded:

(a) Average Achievers- Re look at the strategy using FIS based on Interlinkage III
(b) Expectants- Realign their strategy using Interlinkage IV
(c) Aspiring Leaders-Invest more resources and replicate successful projects based on Interlinkage II
(d) Leaders- No change in strategy

Chapterisation

In this dissertation, Chapter 1 introduces the e-governance implementation in other countries of world, India's status as regards other countries, the problems faced by India states and UTs and the need for assessment. Chapter 2 examines the relevant literature on critical success factors, key performance indicators, types of assessment frameworks in context of e-governance, cluster analysis techniques and the methodology of formulating strategy using fuzzy inference systems. Chapter 3 applies this literature to calculate the relative weightings of KPIs using expert inputs. Chapter 4 describes the mapping of CSFs and KPIs, and calculation of e-government assessment index (eGAI) based on multi-stakeholder inputs'. Chapter 5 presents survey and clustering analysis. The states/UTs are clustered using clustering techniques and data repository for each cluster is created. Chapter 6 is based on design of FIS using interlinkages of CSFs, and finalization of strategy for each cluster using FIS based simulation technique. The final chapter (Chapter 7) draws conclusion for theory and practice.

Limitations

The major limitation of the study is the limited inputs of the citizens that too in rural areas, the same has been offset by taking inputs of VLEs, SDA and NIC representatives who assist the illiterate/semi-literate users to use these applications through CSCs. The second limitation of the study has been the implementation of the proposed strategy by the states and UTs. The proposed strategy for cluster of states/UTs could not be implemented due to constraints of time; however FIS simulation was done to ascertain the improvement in the e-governance assessment index (eGAI). The proposed strategy could now be forwarded to the cluster of states and UTs to implement and report the results of such implementation.

DEDICATION

I warmheartedly dedicate this book "Adoption of e-Governance in India" to my husband, Lt Col (Dr) L M Jha.

Acknowledgement

I express my gratitude to almighty God for enabling me to complete this book. I take this opportunity to express a great sense of gratitude to all employees and colleagues of BIT MESRA who helped me with constant care and support in my endeavour. My heartfelt gratitude and deepest regard goes to my guide, Dr. Shradha Shivani for her impeccable support. I express my profound gratitude to my parents for their guidance and sacrifice, son, all my family members and friends who helped in devoting time to complete this book and supporting me.

Words will, never express my deep sense of gratitude to my beloved husband, Lt Col (Dr) L M Jha, for his constant encouragement.

I am indebted to all the representatives of e-governance centres in several districts of India who shared information regarding how e-governance can be citizen oriented. Sincerely thanks to all ranks of the Indian Army for extending their unwavering support.

Appreciation is extended to Mrs. Rajani Adam, editor of Kripa Drishti Publishing House for publishing this book which is going to give insight to the citizens, policy makers and implementers to analyse how capacity building is important in a democratic country since there is a paradigm shift in the way services are being offered to the public.

Finally, I would like to express that I have put my heart and soul in completing this book and expect kind consideration for any mistake in this book by esteemed readers.

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ISBN: 978-81-946587-3-3

Chapter 1

Introduction to e-Governance in India

Overview

E-Governance initiatives in India started in mid 90s in form of separate projects initiated in a few states and union territories (UTs). These project initiatives were objective based and thus could not address the issue of provisioning integrated e-Governance services through kiosks called Citizen Service Centres (CSCs). National e-Governance Plan (NeGP) was formulated in 2006 and its implementation began in 2007 by each state and union territories. It aimed at provisioning of integrated e-Governance services through CSCs controlled by District Centers located at District Headquarters. Our aim is to analyze e-Governance offerings of each state and union territories through CSCs and predict future strategy for each state and UT. The integrated e-Governance offerings of each state and UT through CSCs have been based on scaled inputs of the lowest level strategy implementer's at District Centers (village level entrepreneurs (VLEs), State designated agency (SDAs) representative, National Informatics Centre (NIC) representatives), citizens and analysis of associated web sites offerings of each state and union territories. A total of 581 District Centres are functional and are responsible for provisioning of CSCs in 641 districts in India. A few District Centres have been entrusted with additional responsibility of provisioning CSCs in neighbouring districts. Subjective assessment of each state and UT was carried out using e-Governance Assessment Framework (EAF) version 2.0 subjective assessment frame work. The KPIs derived from EAF framework were mapped to the relevant CSFs in Indian context. Based on these mappings a questionnaire was designed to get

scaled inputs of lowest level strategy implementer's. The survey of lowest level strategy implementer's located at 581 District Centres was conducted on line in the months of June 2009 to Dec 2009. An aggregate assessment index, e-Government assessment index (eGAI) based on weightages of CSFs was derived and compiled for each state and UT based on perception inputs of lowest level strategy implementer's (village level entrepreneur (VLEs), state designated agency (SDA) representatives and NIC representatives), citizens and web site offerings of each state and UT. The inputs so received from lowest level strategy implementer's are perception based and have inherent imprecision, non-exactness and uncertainty. Using Fuzzy methodology, proven tools has been developed for handling such ambiguities in data. We have used fuzzy c-means clustering and rule based approximate reasoning as part of the problem solving technique. The states and UTs based on CSF inputs and aggregate eGAI values were clustered into four categories as Average Achievers, Expectants, Aspiring Leaders and Leaders. Previous such study carried out by Ministry of Information Technology, Government of India in 2006-07, clubbed the states and union territories into six user levels based on e-readiness assessment. The aim of my research work is to create a baseline data for states and UTs of India post NeGP (with effect Jan 2010) and predict future course corrections in strategy for each state and UT based on lessons learnt from the strategies adopted by other states and UTs using approximate reasoning tool i.e., CSF based Fuzzy inference systems

1.1 Background of Study

National e-Goverance Plan (NeGP) was formulated in 2006 and identified its mission as "Make all Government services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency and reliability of such services at affordable costs to realize the basic needs of the common man". The government has taken a *three pronged*

approach for effective implementation of NeGP to enable anytime anywhere delivery of government services (i) CSC's are ICT-enabled Kiosks having a PC along with basic support equipment (ii) State Wide Area Network (SWAN) provides the necessary support for Connectivity (iii) State Data Centre (SDC) is useful for secure hosting of data and applications. CSC shall have 3-tier implementation viz., first tier one CSC in a cluster of 5 to 6 villages owned by Village level entrepreneur (VLE), second tier as Service Centre Agency (SCA) to control CSCs in one or two districts and third tier as State Designated Agency (SDA) responsible for implementation of this scheme within the state. CSC scheme thus is a front-end delivery point for government, private and social sector services to the citizens. Three important lessons emerge from the experience of e-Governance in the states. First, states are not learning from each other's experience though discharging similar functions. Secondly, many of these projects are narrow in scope (generally covering one or two services like land records resulting in fragmentation of service delivery). A project has greater chance of success if it provides a number of citizen-centric useful services at one place. Thirdly, the Chief Information Officer (CIO) concept in e-Government is required to be driven in the states by policy and institutional support (Mishra et al., 2007). Thus, we need to classify states and UTs and draw lessons from the strategy of leaders so as to be emulated by states and UTs who are lagging in e-Governance implementation post NeGP.

1.2 E-Governance: World View and India's Status.

The United Nations e-Government Survey 2010 finds that citizens are benefiting from more advanced e-service delivery, better access to information, more efficient government management and improved interactions with governments, primarily as a result of increasing use by the public sector of information and communications technology. Most countries have published a tremendous amount of information online, many going beyond basic websites to

provide national portals that serve as a major starting point for users to connect to government services in different ministries. At the same time, many developing countries need to devote additional energy to transactional services as well as the electronic means of engaging citizens in public consultation and decision-making. Some of the countries registered a drop in their country ranking vis-à-vis the UN e-Government survey conducted in the year 2008. A drop in a country's ranking may serve as a reminder of the need to devote greater resources to improving online services and expanding access to telecommunication infrastructure.

High-income countries enjoy the top rankings in the e-Government development index in 2010 as in previous years. Among the top five countries in the 2010 United Nations e-Government Survey, the Republic of Korea received the highest score, followed by the United States, Canada, the United Kingdom and the Netherlands. The majority of positions in the top 20 rankings belong to high-income countries, which is not surprising since they have the financial resources to develop and rollout advanced e-Government initiatives, as well as to create a favourable environment for citizen engagement and empowerment. Developed countries have a distinct advantage in achieving higher rankings in the survey (comprising of 95 multiple choice questions), as nearly two-thirds of the weight of e-Government development index (an index arrived at from the survey questionnaire) is allocated to the telecommunication infrastructure and human capital components both require long-term investment. For emerging and developing countries, the challenge is to invest in all three dimensions – online services, telecommunication infrastructure and education - to narrow the current digital gap. In other words, having a great website does little in e-service provision if the majority of people in the country cannot read or write, nor if they have no access to the Internet.

Some developing countries have begun to catch up with higher-income countries despite these challenges. Bahrain for example, has made significant strides in the two years since the previous survey, moving up in the rankings to 13th place in 2010 from 42nd place in 2008. Bahrain's recent emphasis on citizen engagement and the electronic provision of government services has propelled the country into the top 15 in e-Government development, somewhat closer to Singapore which is among the global leaders in provision of electronic and mobile public services. Mobile technology will become an affordable tool to fill in the digital gap between developed and developing countries, given the rapid price decline of mobile products. Emerging and least developed countries have already demonstrated that they are capable of narrowing the digital gap by investing in websites and Web portals and by applying tools such as telecentres, kiosks, community centres and other similar outlets to increase access to the Internet. They are adopting the use of mobile technology at a fast rate, which will trigger the need to develop more mobile e-Government services. The private sector in these countries has an opportunity to work with government to create and distribute mobile services. The 2010 survey recorded an increase in the use of mobile technology for communication from Governments to Citizens (G2C), whether it is simple SMS, alert notification or a full-fledged mobile service.

The 2010 survey found that some countries are increasingly active in seeking customer satisfaction through online polls, blogs, surveys and other means. This indicates that a growing number of countries have recognized the importance of citizen feedback via Internet and are taking advantage of social networking tools to create better websites and Web portals. Emerging and developing countries have yet to fill the digital gap. The developing countries that have channelled more investment to telecommunications infrastructure, education and online services could compete with developed countries and in some cases, even score

higher. Mexico experienced the most significant drop in global rankings. It fell by 19 positions from the 2008 Survey to the 2010 Survey and is currently ranked 56th globally. The degeneration of Mexico's e-Government is mainly attributed to the much lower score for online services. Among all the national portals of the developing countries, India has the highest ranking portal with the highest online services score. It has the most e-services and tools for citizen engagement. Some of the developing countries who improved their rankings are Iraq, Oman, Saudi Arabia and Turkey while a few of them who dropped significantly in their rankings are Azerbaijan, Jordan, Kuwait, Lebanon and Syria. India has improved by five positions from its ranking of 60th in 2008 survey to 55th in the present survey. It has vastly improved its online services however the transactional services offered as part of NeGP still needs to be further implemented and improved.

Notable climbers in the online services provision to citizens are Bahrain, Chile, Colombia, Singapore and the United Kingdom, which have joined the world's top performers in online service development. Only a few countries are able to offer many transactional services online at this time. However, countries with the highest scores offer a wide range of integrated transactional e-services that cater to many segments of society. They have comprehensive back office integration systems and secure networks on which these e-services operate, giving citizens security and confidence. The United States, the Republic of Korea and Canada are the top three countries in terms of transactional opportunities. The developing countries are well-represented in the top 10 with four countries: Bahrain, Chile, Colombia and Israel. Least developed countries have no real e-services, nor are they providing citizens with transactional opportunities. The vast majority of the sites surveyed primarily contain e-information and the beginning stages of citizen engagement with polls and

feedback forms. The top two positions among least developed countries in the online service assessment went to Bangladesh and Angola.

1.3 Problems Faced by Indian States and Union territories as regards e-Governance Implementation.

It is generally believed that e-Government dawned in India in mid 1990s when the Internet was made available to public. This narrow view is correct only if the Web-based e-Government is taken into account. If, however, a broader view of e-Government is taken, namely, application of information and communication technology (ICT) to governance, as it should be, and then the roots of e-Government in India can be traced to early 1950s (Mishra et al., 2007). The historical development of e-Government in India can be conceived to consist of three distinguishable phases:

1. ***Phase I(1947-1984): Informatics-based e-Government***, 2. ***Phase II(1984-1995): Personal Computer (PC)-based e-Government***, and 3. ***Phase III (1995-2007): Web-based e-Government.*** Each phasehas a dominant characteristic, namely, *Informatics*, *PersonalComputer* (PC) and the *World Wide Web* respectively.

The Government of India approved NeGP comprising of 27 Mission Mode Projects (MMPs) and 10 components on May 18, 2006. The Mission Mode Projects include:

(a) Central Government: 1. Income Tax, 2. Passport Visa and Immigration Project, 3. DCA 21, 4. Insurance, 5. National Citizen Database, 6. Central Excise, 7. Pensions, 8. Banking.

(b) *State Government:* 1. Agriculture, 2. Commercial Taxes, 3. e-District, 4. Employment Exchange, 5. Land Records, 6. Municipalities, 7. *Panchayats*

(local self-government), 8.Police, 9. Property Registration, 10. Road Transport, and 11.Treasuries.

(c) *Integrated Services*: 1. Community Service Centre (CSC), 2. e-biz, 3. e-courts, 4. e-Procurement, 5. Electronic Data Interchange (EDI) for trade (e-Trade), 6. National e-Governance service delivery gateway and 7. India Portal (www.india.gov.in).

NeGP is a well conceived, well started, and ambitious strategic plan attempting to take e-Governance to the door steps of the people, where e- Governance matters most (Mishra et al., 2007). The common problems faced by states and UTs in implementation of NeGP are as enumerated in succeeding paragraphs:-

1.3.1Low PC Penetration.

PC penetration in India has been below 10% (Dwivedi et al., 2010). The government has taken initiatives of developing low cost PCs but even the introduction of sub 10K PCs has not solved the problem. Recently Government of India has launched an ambitious project for distribution of sub 10 K PCs to students and citizens below poverty line (BPL) as part of Project "AKASH". These initiatives taken of late in 2010-11 shall have bearing on PC penetration in next five years. Realizing that the increasing PC penetration needed a long term solution Government of India embarked on the spread and use of e-Governance by its citizens through development of applications which were either (i) mobile based (as the penetration of mobiles of late have increased to about 40%) or (ii) could be extended through kiosks as defined in NeGP as Community Service centres (CSCs). Presently, the focus is on extending already developed e-Governance services through CSCs in urban as well as rural areas of all states and UTs.

1.3.2 Use of e-Governance Offerings by Citizens

Low penetration of PCs, low literacy rate and common language interfaces are the reasons for no-use of developed e-Governance applications by citizens in rural and urban areas. PC penetration of late has been hovering around 10 %, with figures of as low as 1 to 2 % in rural areas of a few states and UTs i.e., Andaman & Nicobar, Jharkhand, and Madhya Pradesh. There is general lack of technical literacy as well as literacy in countries like India, the correlation between education level and use of electronic means or Internet and other ICT means are quite significant (Dwivedi et al., 2010). States and UTs with high literacy rates have higher e-Governance applications use percentage. Such states like Kerala, Tamil Nadu, Delhi, Chandigarh have also developed local language applications for semi-literate populace. Thus NeGP for its effective implementation and anytime anywhere delivery of government services adopted a kiosk based approach called CSCs. These CSC's are ICT-enabled Kiosks having a PC along with basic support equipment connected through State Wide Area Network (SWAN) with all its data and applications residing at State Data Centres (SDC). CSC shall have 3-tier implementation viz., first tier one CSC in a cluster of 5 to 6 villages owned by Village level entrepreneur (VLE), second tier as Service Centre Agency (SCA) to control CSCs in one or two districts and third tier as State Designated Agency (SDA) responsible for hosting of data and applications within the state. CSC scheme thus is a front-end delivery point for government, private and social sector services to the citizens. VLE shall aid in use of these e-Governance offerings to semi-literate and illiterate citizens.

1.3.3 Integrated e-Governance Offerings through CSCs

The e-Governance scenario in India has come a long way since computers were first introduced. The focus now is on extending the reach of governance to have a major impact on the people at large. As stated earlier, e-Governance is an

important tool to enhance the quality of government services to citizens, to bring in more transparency, to reduce corruption and subjectivity, to reduce costs for citizens and to make government more accessible. Adoption of e-Governance in India started in mid 90s, but early adoption initiatives by the states and union territories had been characterized by initiatives in form of separate projects. These initiatives were piecemeal approaches thus could not address the issue of provisioning all citizen centric services through kiosks located in rural and urban India called Citizen Service Centres (CSCs). CSCs are maintained by VLEs, SCA and SDA. 2 to 3 CSCs are controlled by each District Center, located in each district or one in two/three districts (in case of smaller and new districts). District Centers also have representatives of National Informatics Centre (NIC), an agency created by Government of India responsible for NeGP implementation.

1.3.4Difficulties in Maintenance of CSCs.

CSCs being the front delivery point in rural and urban areas of all states and UTs need to be located in remote areas which are either not connected to the mainland or poorly connected to mainland. Lack of necessary infrastructure like electricity, internet, technology and ways of communications will affect the speed which delays maintenance (Dwivedi et al., 2010).Thus, maintaining them at such remote locations is itself a yeoman task. The maintenance problem has however been solved to a limited extent by incorporating the VLEs, but these VLEs too face the above stated problems and thus are not able to cater to the following (i) updated application software (ii) no facilities of software development available locally (iii) no power back ups in case of long hours of power break down (iv) no equipment back up and repair facilities. These coupled with many more problems increase the outage time of the kiosks or CSCs and thus cannot be used by local populace during the outage period.

1.3.5 Lack of Local Software Development Capabilities.

No Local software development support is available in remote CSCs and thus for each software updates or removal of bugs on use the VLE has to seek help and support of District Centres which too are not well equipped to solve such problems and thus need to fall back to State/UT Head Quarters for seeking solution to such problems. This process involves too much of time and effort due to poor connectivity from the mainland, thus increasing the outage period of the kiosks and adding to the no use of the applications till such problems are resolved. NeGP has aimed at putting a three tier agency i.e., NIC representative, SDA representative and SCA representative in place at District Centres but their expertise is limited and in most cases are unable to solve the problems faced at the CSCs.

1.3.6 Low Literacy Levels

Low literacy levels have been a hindrance in use of the developed e-Governance applications in states and UTs (Dwivedi et al., 20006). Even the VLEs are not able to aid the illiterate in use of these applications. States and UTs with high literacy levels viz., Kerala, Karnataka, Tamil Nadu have high use percentage. Even semi-literate realize the need to use these applications for transparency. Literacy and awareness to use these applications in day-to-day life shall enhance the use percentage.

1.3.7 Languages in Which Interfaces Available

India is a land of diversified languages and no one language is popular through out India. There is a need to modify the front end interface for the e-Governance applications in the local languages so as to enhance the use of such applications by semi-literate and illiterate masses (Dwivedi et al., 2010). Interfaces in local languages and dialects shall aid in use percentage of the applications.

1.3.8 Preparedness and Commitment of Political, Administrative and Technical Leaders

Leadership at different levels need to focus on providing the e-Governance applications access at the grass-root level. Political leadership should aim at developing infrastructure support to CSCs by providing them with uninterrupted power supply, better road connectivity, spreading awareness of the e-Governance applications and human capacity building. Administrative leaders should lend support to CSCs by providing them adequate assistance for process re-engineering (Dwivedi et al., 2010), back up equipment, necessary transport in cases of emergency for transfer of faulty equipment and spreading awareness among masses for use of such applications (Dwivedi et al., 2006). Technical leaders should help in running by providing the necessary technical expertise as forward as possible. The SCA, SDA and NIC representative should be available at each CSC to aid in keeping the outage time of CSCs to minimum.

1.4 NeGP: It's Timing of Introduction

NeGP prior to its implementation requires three main core components to be established viz., State Wide Area Network, State Data Center, and Common Services Centres (Chauhan et al., 2009). An e-readiness survey was initiated by Government of India, Ministry of Information technology (MIT) to evaluate the preparedness of States and UTs of India regarding implementation of NeGP program in 2005 and then in 2006. The states and UTs were clubbed into six categories viz., Leaders, Aspiring leaders, Expectants, Average Achievers, Below Average Achievers and Least Achievers as shown in Figure 1.1. The Leaders were prepared to implement the NeGP program as their basic infrastructure for implementation of NeGP projects was in place. Aspiring leaders and Expectants would have been able to implement the NeGP program after about a year or so when basic infrastructure would have been in place.

Average achievers and Below Average achievers had only devised strategy and policies for implementation of basic infrastructure for NeGP implementation. Least achievers had not even devised strategies and policies for infrastructure development for NeGP implementation.

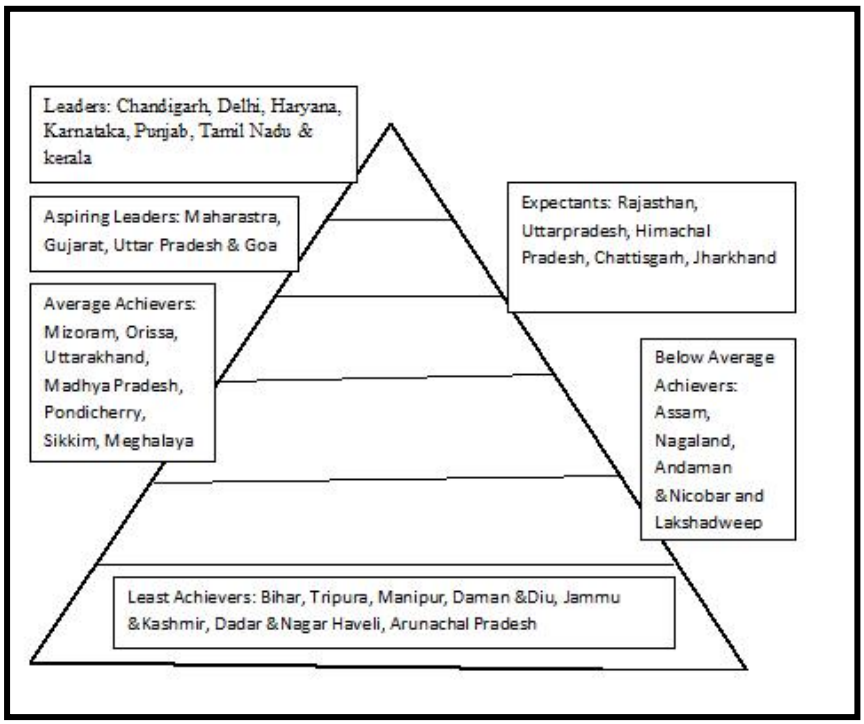

Figure 1.1: Status of e-readiness Assessment Prior to NeGP Implementation 2006 (adapted from MIT e-readiness assessment survey 2006)

It was therefore outlined all states and UTs to develop the basic core components required for NeGP implementation by about a year and the e-readiness assessment survey was to be conducted again by MIT, Government of India by 2008. The basic core components to be developed were outlined in detail as given in succeeding paragraphs:-

1.4.1 State Wide Area Network (SWAN)

SWAN entails establishing State Wide Area Networks (SWANs) across the country in all 28 States and 7 Union Territories. The objective of SWAN

Scheme is to establish converged network consisting of data, voice and video circuits with minimum 2 Mbps capacity, linking the State with the Union Territories Headquarters, right up to the Block and Tehsil headquarters, through the district and the Sub-division headquarters (Chauhan et al., 2009). The aim is to create a secure government closed user group (CUG) network, for the purpose of delivering Government-to-Citizen (G2C) and Government-to-Government (G2G) services. It was outlined that connectivity to each tehsil, block shall be established before introduction of NeGP

1.4.2 State Data Centre (SDC)

SDC is a central repository of the state, secure data storage, online delivery of services, Citizen Information/Services portal, State Intranet portal, disaster recovery, remote management and service integration, among others. It was outlined that the State Data Centre shall be set-up and operated by 2009 across different states in the country.

1.4.3 Common Services Centre (CSC)

CSC involves a scheme for providing a common access point both in urban and rural areas. The Scheme would be funded by state and central government in partnership with private entrepreneurs' called VLEs.

Other than these three basic core components various broad areas also needed to be developed, like technical standards and e-governance architecture, network and information security, e-governance information security standard, localization and language technology standards, metadata and standards for application domains, conformity assessment framework which is extremely relevant for any e-governance project, policies on identity and access management, and e-forms (Chauhan et al., 2009). Each of these areas had not been developed till end of 2006 when NeGP was conceived. The introduction of

NeGP was thus ill timed for all the states except the Leaders and Aspiring leaders. NeGP was mostly thrust upon majority of states and thus could not produce the desired results. Thus there was a need to assess the status of all 28 states and 7 UTs and devise future strategy for effective implementation of NeGP program.

1.5. Need for assessment framework

The NeGP vision aims to "Make all Government Services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency and reliability of such services at affordable costs to realize the basic needs of the common man". The e-Governance initiatives since early 90s were in all three categories i.e., Government to Citizen (G2C), Government to Business (G2B) and Government to Government (G2G). The G2C initiatives were in the form of projects viz., Computerization of Land records was launched by Union Ministry of Rural development in eight states and union territories, Bhoomi project was launched in Karnataka for automation of land records, Gyandoot citizen service delivery was launched in Dhar district, Madhya Pradesh, Lokvani handling of citizen grievances and provision of single window citizen services was launched in Sitapur district of Uttar Pradesh, FRIENDS single window citizen services was launched in Thiruvananthapuram, Kerala, e-Mitra project extending single window citizen services was launched in Rajasthan, e-Seva was launched for extending basic services to urban citizens in Hyderabad, Andhra Pradesh, RACE project was launched for electricity tariff billing of urban citizens in Patna, Bihar and CET project for joint entrance examination was launched in Karnataka. G2B initiatives were in the form of e-procurement project in Andhra Pradesh, e-procurement project in Gujarat, and MCA 21 launched by Ministry of Corporate Affairs to provide online services related to company registration to all stakeholders' of society. G2G initiatives were in the form of Khajane project for

automation of all treasury related activities in Karnataka, and SmartGov project launched in Andhra Pradesh automating the work flow of government. These initiatives were piecemeal approaches and their individual offerings could not extend benefits to end-users as advocated in the National e-Governance Plan (NeGP). This plan seeks to create the right e-Governance and institutional mechanism, set up the core infrastructure and policies and implement a number of mission mode projects at the center, state levels to create a citizen centric and business centric environment for e-Governance [Tripathi et al., 2007]. Some states/UTs have surged ahead of others as they gained by the experience of the implementation of such projects and even developed state wide infrastructure as part of these pilot projects. Thus they have a clear edge of implementation over other states and UTs who did not participate in such initiatives. NeGP lays the same vision for all the states and UTs and thus the states and UTs which 'lagged behind" need to assess and study the strategic initiatives of these 'early adopters' to emulate their strategy.

The lack of formal methods for monitoring and assessing e-Government initiatives has led to a significant slowdown of country-level e-government development [Kunstelj et al., 2004]. From the experience of United States and Canada which have higher level of e-Government and earlier assessment of development of e-Government, the future direction of e-Government evaluation aims towards simplifying indicators and stressing the assessment of outcome as a whole [Shan et al., 2009]. Furthermore, the current approaches to monitoring, evaluating, and benchmarking e-Government development do not support comprehensive e-Government assessment and need to be further improved in order to give policymakers better evaluation criteria for their decisions [Kunstelj et al., 2004]. There are three kinds of situations that require evaluation in e-government. One is the environment; second is evaluating the performance of an e-government program or project; and third is the overall impact of e-govern-

ment on general government functioning, economic development and citizen servicing. Accordingly, we need three kinds of approaches of evaluation such as (i) E-readiness assessment of states or region (ii) Hierarchy of measures taken by the e-government program or project (iii) Overall impact of e-government.

Various stake holders are involved in provision and use of e-Governance offerings by states and UTs in India as part of NeGP viz., government agencies, public-private partners and end user's or citizens. Challenges in assessment of e-Governance intiatives by states and UTs have been (i) appointment of a self-assessment agency to study impact of the project (ii) Lack of comprehensive framework (iii) non-availability of base line data (iv) lack of visibility of assessment reports and (v) lack of funds for holistic assessment (Gupta et al., 2007). Keeping all these limitations and challenges we aim to design an easily implementable overall impact assessment framework for states and union territories and create a baseline of data. For design of an overall impact assessment framework we analyzed the following available frameworks (i) E-Governance assessment framework (EAF), India (ii) Skoch e-Governance report card (iii) e governance Economics Project (eGEP), EU (iv) Impact Assessment framework, IIM Ahmedabad, India (v) VAN-DAM model, Australia and (vi) A Public value Framework, UK

EAF framework is a multi-criteria framework, designed by joint team efforts of IIM Ahmedabad and NISG, Hyderabad with primary focus to access the overall impact on the citizens by the e-Governance service offerings of Indian states and UTs. All key stake holders' were incorporated to get valuable inputs to guide the lifecycle management of the e-Governance service offerings to the citizens. The framework was designed prior to launch of NeGP to be used to assess the overall impact of e-Governance service offerings. EAF assessment is in five dimensions: (i) Service Oientation (user convenience and citizen centricity) (ii) Technology (architecture, standards, security, scalability,

reliability) (iii) Sustainability (internal/organizational, legal and commercial) (iv) Cost effectiveness (cost effectiveness attribute) (v) Replicability (functional and technical). The basic framework was used to extract key performance indicators (KPIs) for evaluation as depicted in Figure 1.2.

1.6 Global Measurements: Shortcomings, Opportunities and Learning's

E-Government strategies could be formulated after an integrated assessment is undertaken with inputs from all stakeholders' involved in the implementation process. An integrated continuous e-Governance assessment system provides important knowledge for policy and decision-makers. In the context of developing countries, it is imperative to analyze the conditions, opportunities and obstacles of an existing environment, to obtain a realistic and workable e-Government strategy that supports public administration reforms and sustainable national development (Dzhusupova et al., 2010). Due to rapidly changing environments, the lifecycle of e-Government Readiness Assessment in developing countries is very short and thus a continuous e- Government assessment framework incorporating all stakeholders' needs to be developed.

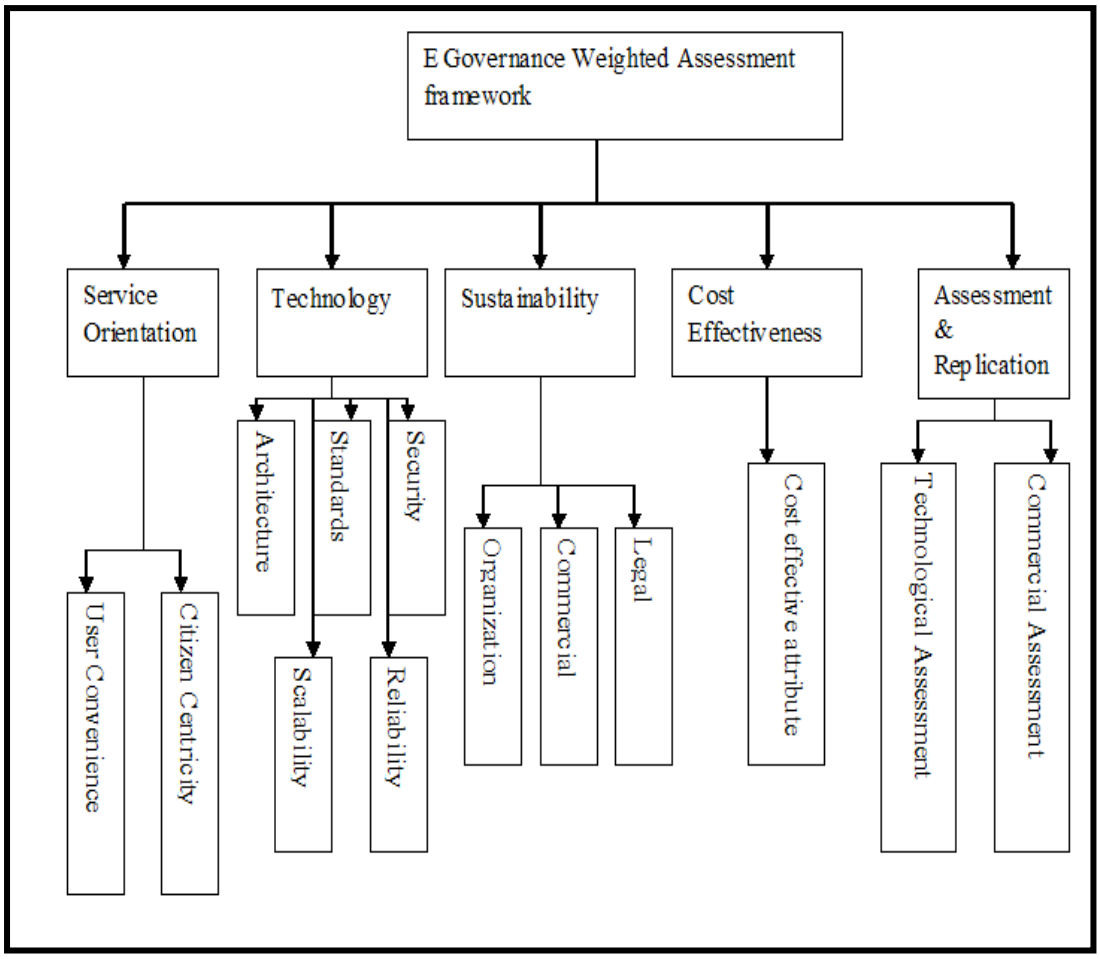

Figure 1.2: EAF version 2.0 framework for assessment of pilot projects

A continuous assessment framework shall provide us a baseline data and strategy formulation/validation tools. While there are different approaches to e-Government Readiness Assessment, each providing inputs to e-Government development, a review of the literature on the topic revealed lack of work on methodologies for e-Government Readiness Assessment applicable for different levels of government and focused on the needs of developing countries (Dzhusupova et al., 2010).

Internationally, a number of e-Governance readiness assessments have been conducted over the last decade. These include the United Nations e-Government Survey reports by UNDESA , Global e-Government reports by the Centre for Public Policy, Brown University (CPP-BU) (Darell et al., 2007), the e-

Government Leadership reports by Accenture, and e-Government Rankings by Waseda University. These e-Government Readiness Assessment focus on ranking countries based on a composite index but none of them stress on development of a continuous assessment methodology. The UNDESA series on e-Government and the Brown University rankings cover over 190 countries each. The UNDESA surveys use a composite index based on ICT infrastructure development, human development and maturity of online presence of governments, whilst CPP-BU focuses primarily on the development and maturity of online presence of governments in the ranked countries (Dzhusupova et al., 2010). On the other hand, Accenture and Waseda University assess a relatively few countries as compared to UNDESA or CPP-BU based on customer services, and e-Government promotion and management respectively. In contrast to UNDESA, CPP-BU, Accenture or Waseda University, the eMacao e-Government Readiness Assessment (Elsa et al., 2005) was designed to provide detailed information for strategic planning at the agency levels. The survey, conducted by the UNU-IIST Center for Electronic Governance, provided information about different individual agencies involved in implementation efforts, the relationships between the agencies and the services they produce or receive to/from the environment or other agencies (Dzhusupova et al., 2010). A comparative analysis of all five well known e-Government readiness assessment approaches revealed that existing frameworks do not take multi-stakeholders' input during assessment. Furthermore, they are not sensitive to the overall country context. This however is crucial particularly for developing countries with weak public administrations, lack of resources and low human and institutional capacities (Dzhusupova et al., 2010).

A through survey of literature revealed that none of the e-Governance readiness assessment could be adapted to the Indian conditions, thus efforts started since 2004, in developing e-Governance readiness assessment framework. The first

effort in this direction was made by Centre of e-Governance, IIM, Ahmedabad outlining a multi-criteria assessment framework for pilot projects called e-Governance Assessment Framework (EAF) (Rao et al., 2005). These efforts were funded by Department of Information Technology, Government of India. In 2005 a SKOCH consultancy group also devised an impact assessment framework based on inputs of users of pilot projects and named it as Skoch e-Governance report card (Kochhar et al., 2005). Based on this impact assessment framework developed by Skoch an Impact assessment framework was developed by Centre of e-Governance, IIM, Ahmedabad in 2007 (Bhatnagar et al., 2007). The EAF framework was later modified in 2006 and EAF version 2.0 was formulated for assessment of pilot projects. In India implementation of NeGP, advocated integrating all pilot projects on a common platform and providing services to users through a common interface. Thus the EAF framework needed to be modified to deal with integrated assessment and incorporate multi stakeholders' input. Therefore, an integrated e-Governance assessment framework (IGAF) based on EAF version 2.0 was developed for integrated assessment of states and UTs of India incorporating input of multi stakeholders' involved in the implementation process. Table 1.1 gives the salient features of the different assessment frameworks used in Indian context.

Table 1.1: Salient Features of e-Governance Assessment Frameworks in Indian Context

S.No.	Assessment Framework	Salient Features	Inputs From	Remarks
1.	e-Governance Assessment Framework (EAF) ver 1.0	Assessment of pilot projects	Users and Implementers	Developed with key indicators
2.	Skoch e-governance Report Card	Assessment of pilot projects	Users	Developed on questionnaire instrument
3.	e-Governance Assessment Framework (EAF) ver 2..0	Assessment of pilot projects	Multi-stakeholders' input	Developed with key indicators
4.	Impact Assessment Framework	Integrated assessment of pilot projects	User input	Developed with key indicators

ISBN: 978-81-946587-3-3

Chapter 2

Literature Survey and Theory

2.1 Introduction

This chapter reviews the literature pertinent to the e-Governance CSFs in global context and Indian context. It also reviews e-Governance assessment literature for extracting factors for assessment and finalizes the type of framework suitable for e-Government assessment in Indian context post NeGP. A thorough review of literature on assessment indicators and schemes to be adopted for evaluation leads us to the conclusion that a mix of soft and hard indicators/sub-indicators may be chosen and clubbed using a multi-criteria framework (Gupta et al., 2007). The methodology for evaluation should be basically scoring method based with an overall assessment index. Such a method with indicators and sub-indicators' have been outlined in e-Governance assessment framework (EAF) version 2.0 for analysis of G2C-U and G2C-R initiatives by Indian states and UTs post NeGP.

This chapter also reviews literature on cluster analysis techniques and the techniques to be used for clustering of states and UTs of India post assessment. Such clusters shall help us identify strategies adopted by states and UTs in same cluster and help us evolve strategy for states and UTs in lower clusters to graduate to next higher cluster. The clustering techniques which are found to be most suitable for clustering of states and UTs based on assessment post NeGP are K-means clustering and Fuzzy c-Means clustering techniques. These two techniques help us identify four clear clusters based on assessment dimensions outlined in EAF version 2.0 frame work. Fuzzy Inference systems were

reviewed for offline process analysis and simulation to check the outcome of the strategies predicted for states and UTs. Fuzzy Inference systems were developed and fine tuned using input data from the multiple stake holders' involved in e-Governance (G2C-U and G2C-R) implementation in states and UTs at the lowest level (CSCs and District centres) in India post NeGP.

2.2 Critical Success Factors: Global List and Identification in Indian Context

Critical Success Factors (CSFs) are "key result areas" if achieved shall guarantee the success of any e-Governance initiatives. The inputs on these key result areas are easy to obtain and can be easily monitored. The concept of CSFs was coined by Rockart. CSFs can be arrayed hierarchically and used as an important vehicle of communication for management, either as an informal planning aid or as a part of the formal planning process (Rockart, 1979). Detail lists of important CSFs for e-Governance implementation have been compiled by many researchers in the global context and Indian context. The scope and definition of each CSF has been elaborated to identify the relevance in Indian context post NeGP. Twenty five important CSFs in global context have been elaborated in succeeding paragraphs and its relevance in Indian context post NeGP has been analyzed. The relevant CSFs shall be used for formulation of strategy for states and UTs of India.

2.2.1 Understanding e-Governance Prospects

The process of Governance needs a transform to migrate to e-Governance scenario by introducing Change Management, Resource Management, Process Reforms, Administrative Reforms, Organization Re-structuring, Information Management, Knowledge Management, Legal Reforms, Technology Management and many more components. All this can be done by domain experts however the IT experts can help them streamline processes with the

supported architecture (Sachdeva et. al., 2006). The first step in transition to e-Governance scenario can be done by understanding the prospects of e-Governance and thus this particular CSF has relevance in Indian context for implementing NeGP plan by states and UTs of India.

2.2.2 Clear cut Vision and Goals

E-Governance vision of the country must be driven from the development vision and objectives of the country (Sachdeva et. al., 2006). e-Governance mission must be clearly spelt out and not vague as found in case of various developing countries, it was observed that many counties made statements like Complete Government Services Online by Year 2010, etc. Such statements in the vision statement lead to just making information online to a small community of netizens. e-Governance is a tool applied to meet various challenges of government; it should start at a smaller stage in form of projects and then be replicated for several applications/components. Vision should aim to incorporate the following:-

- Citizen should be centre of the e-Governance vision of the country.
- The vision should be close to reality and not rhetoric.
- Even though the citizen is at the centre the other stakeholders should not be forgotten.
- Citizen should have access to various delivery channels and should not be limited to being online.
- Service improvement and process efficiency are key objectives of e-Governance.
- The objective should be of collaboration of various organs of the Government.

- The outcomes must be clearly defined and the performance should be measured against those outcomes.
- Partnerships with the private sector may also be highlighted in the objectives.
- One of the objectives must also recognize citizens as customers of the Government and the customer relationship programs may be evolved further.

This particular CSF has lot of relevance in Indian context post NeGP as Clear Cut Vision and Goals need to be formulated by each state and UT based on vision statement of NeGP.

2.2.3 Formulation of e-Governance Roadmap

The e-Governance Roadmap for a country should answer the questions of Why, What, How, Who, When and Where of e-Governance (Sachdeva et. al., 2006)

Table 2.1: Formulation of e-Governance roadmap questions and answers (adapted from Sachdeva et al., (2006))

Ser. No.	Questions	Answers will be found in
1.	Why e-Governance?	Policy
2.	What to e-Govern?	Strategy
3.	How to e-Govern?	Plan
4.	If not e-Governance – what could have been done?	Opportunity Cost
5.	Where	Area

The first step in e-Governance implementation is identifying the areas for e-Governance intervention and prioritizes those areas. The various points that can be of help in prioritizing the initiatives include the following:

- Strengthen the pressure points (which will have maximum impact)
- Choose projects which can be easily replicated.
- Identify projects which have a scope for Public Private Partnerships (PPP).
- Choose projects which will get citizen and leadership support.
- The chosen projects must evolve from the development agenda of the country.
- The projects not having sustainable business model could be evolved.
- The identified projects should be and based on technical standards.
- The selected projects should have low cost of development and less opportunity cost.

This particular CSF has lot of relevance in Indian context post NeGP as roadmaps need to be formulated by each state and UT based on the vision of NeGP.

2.2.4 Leadership for e-Governance

The commitment of top leadership is important for e-Governance. Leadership commitment is not only important at political and bureaucratic level but at the project implementation level as well. The leadership provides the role of reformers who will help the e-Governance initiatives sail through (Sachdeva et. al., 2006). Despite the importance of technological and skill infrastructures, it is the politics of e-Governance initiatives that probably holds the key. The Pacific

Council on International Policy identifies a few questions for the e-Government leadership

- Why are we pursuing e-Government?
- Do we have clear vision and priorities for e-Government?
- What kind of e-Government are we ready for?
- Is there enough political will to lead e-Government effort?
- Are we selecting e-Government projects in best ways?
- How should we plan and manage e-Government projects?
- How will we overcome resistance from with in the Government?
- How will we measure and communicate progress?
- What should be our relationship with the Private Sector?
- How can e-Government improve citizen participation in public affairs?

All these above questions have already been answered while formulating NeGP for states and UTs of India. This particular CSF does have relevance till formulation of NeGP but its relevance diminishes post NeGP, since plan and policies are in place and it is the states and UTs need to implement the programs based on the policies outlined.

2.2.5 Institutional Framework for e-Governance

The various Organization structures that will be required for the successful implementation of e-Governance have been created as part of National Informatics Commission (NIC) and it includes the following:

- E-cooperation Commission (to ensure cooperation amongst different Departments and different levels of Government)
- Interoperability Commission
- Information Security Commission
- Data Protection and Privacy Commission
- e-Governance Audit Commission
- Legal and Administrative reform Commission
- Internet Consumer Rights Commission
- National e-Governance Planning Commission
- Local Language Commission
- Telecom Commission
- e-Governance Implementation Commission
- National Infrastructure Commission
- National Commission for Internet Content
- Online Quality Assurance Commission
- National Commission for International Cooperation

This particular CSF does have relevance till creation of NIC and it looses relevance post NeGP after NIC has been created and made responsible for such tasks as part of NeGP.

2.2.6 Government Process Re-engineering

Reengineering is radical redesign of business processes to achieve dramatic improvements in performance, cost, quality, service, and speed. E-Governance is distinct from computerization as automation by itself will not eliminate all sources of errors, avoidable costs delays. It may even add its share of errors and costs. Therefore process re-engineering must precede the computerization. The various steps in the Process Re-engineering may include the following:

- Identify candidate Processes
- Understand the processes
- Document the process
- Decompose the process in smaller processes
- Analyze the processes
- Eliminate the processes which are of low criticality but difficult to implement
- Reform the process which are of high criticality but difficult to implement
- Continue the processes which are of high criticality but easy to implement
- Integrate the processes
- Automate the Process Steps
- Ensure Change management

GPR study includes examining the health of each Department and analyzing its ability to accept change, constructing an inventory of the processes involved and determining the critically important core processes, assessing the effectiveness and efficiency of the existing processes in order to determine

improvement priorities. The decisions on priorities in a GPR should be on based on three factors - importance, opportunity and feasibility. The e-Government Handbook for developing Countries published by highlights the following recommendations for Process Reforms

- Plan carefully - streamline and consolidate offline processes before converting them to online.
- Don't automate inefficiencies - eliminate them.
- Respond to local needs - draw on the ideas of those who will support the system and enlist the support.
- Try to focus projects from the user perspective.
- Dispel resistance of civil servants by training and granting incentives to reform.
- Ensure commitment of resources for the long term.

This CSF has a lot of relevance in Indian context post NeGP as process reforms for each department in each state and UT needs to be done in order to align the government processes with the newly developed/replicated applications.

2.2.7 Legal Reforms

A successful implementation of e-Governance requires the following to be achieved (most of them have already been put in practice prior to implementation of NeGP):

- *E-Governance legislation:* A comprehensive legislation which may facilitate for closer cooperation between all authorities providing e-Governance services.

- *Right to Information:* A legislation that may that contains provisions on access to public information for the Government Agencies.

- *Data Protection:* Data Protection Legislation may regulate the pre-conditions for the lawful use sharing and transfer of data.

- *Privacy legislation:* This legislation may provide a right to privacy with respect to the processing of personal data which entails the right to information, rectification of incorrect data and erasure of unlawfully processed data.

- *E-identity legislation:* The legislation may legally recognize electronic signatures satisfying certain security requirements.

- *E-procurement legislation:* The e-Procurement-Regulation may govern the electronically based creation and delivery of offers in the area of public procurement. It may specify the rules applicable to communication, storage of data and use of specific procedures, e.g. e-auctions and dynamic purchasing systems.

- *Databases legislation:* The legislation may regulate the creation and maintenance of electronic databases by public sector bodies and creates a state register of databases.

This CSF has little relevance post NeGP, as all required legislations are already in place as far India is concerned and states and UTs shall also implement such legislations.

2.2.8 Human Capacity Building

The Human Capacity building involves not only IT skill building but also skill sets in management, change management and communications. There should be clear plans for human capacity development. In general terms, priority human

capacities for e-Governance are 'hybrids': those who understand the technology, the business of governance *and* the role of information in governance (Sachdeva et. al., 2006). It is they as individuals or small teams can most successfully champion e-Governance in the target organizations. Key implementation capacities to be developed for pilot projects would include:

- Capacity to develop information systems.
- Capacity to manage projects and to manage change.
- Capacity to be an 'intelligent customer': able to raise project finance, specify needs, manage procurement, and manage vendors.
- Capacity to operate and maintain information systems.

Training should also aim at bringing about attitudinal change since a key stumbling block to e-Governance is the lack of motivation amongst those involved. School of e-Governance or its equivalent, may be established which may likely play a lead role in the training to develop human capacities. This CSF has a lot of relevance in Indian context post NeGP to exploit the potential of newly developed/replicated applications.

2.2.9 Cost Benefit Analysis

Any e-Governance initiative must start with a clear understanding of the various costs involved in the project. A Cost-Benefit-Analysis of each project needs to be done with respect to citizens, government agency involved and various stake holders viz., public private partners. Each project must focus on the returns on the investments. Short term and long term plans with expected expenditures, income streams and deadlines may be chartered in detail. The benefits of e-Governance range from improvement in service delivery and social welfare of

citizens (Sachdeva et. al., 2006). The various net benefits arising out of e-Governance are as listed below:

- *Net Financial Benefit to the Government Agency* = Operation Cost Reductions + Revenue Increase – Costs of development of the application.
- *Net Financial Benefit to the Citizen* = Cost reduction (Less Delivery Charges) + Increased Citizen revenue (due to efficiency) – Cost of deployment of new system.
- *Social Benefit* = Increased Health, Education, Employment, Social Upliftment benefits
- *Governance Benefit* = Increased transparency, accountability, efficiency and participation in Government

The newly developed/replicated applications may be evaluated for all above benefits and corresponding costs. This CSF has relevance in Indian context post NeGP to study the benefits of the newly developed/replicated applications in overall perspective.

2.2.10 Sustainable Business Model

The various business models as operating in the e-Governance area are described below. For the success of the project it is necessary that a sustainable business model is chosen from amongst the following referred below (Sachdeva et. al., 2006).

- *Government Owned:* In a Government Owned business model the Government, or it's Agency or a PSU is involved in designing, building, funding, owning and operating the project. The project is built on public money and Government may charge a transaction fee from Citizens or subsidize it from public funding.

- *Private Partners:* In a private partner model the Government funds and owns the project but the designing, building and operation of the project is vested with a private partner. At any time the Government may take the operations to itself after initially getting the project developed by private party.

- *BOO (Built-own-operate):* With the build-own-operate model, a private company is granted the right to develop, finance, design, build, own, operate, and maintain the project. The private sector partner owns the project outright and retains the operating revenue risk and all of the surplus operating revenue in perpetuity.

- *BOOT (Built-own-operate-transfer):*A BOOT funding model involves a single organization, or consortium (BOOT provider) designing, building, funding, owning and operating the scheme for a defined period of time and then transferring this ownership across to an agreed party.

- *SPV Model: I*n a Special Purpose Vehicle model the Government in collaboration with a private agency or Government Agency or International Agency or itself forms a special purpose vehicle to fund the project.

- *Externally Funded Projects:* In externally funded projects the international donor agencies fund the various projects by giving grants to the Government or its agencies and the project is executed as a mutually agreed methodology.

This CSF has a lot of relevance in Indian context post NeGP as all future and replicated projects/plans/schemes need to follow a sustainable business model to be able to survive for the intended time period.

2.2.11 Service Delivery Paradigm

The Government Service Delivery paradigm is facing tough challenges due to constraints of regulatory compliance and cost cutting. There is a need to

improve the service delivered to the citizen on dimensions such as speed, quality, reliability, convenience and cost. The IT infrastructure with multi-channel connectivity, inter-connectivity between various wings and department of government and common delivery points are being worked out. Table 2.2 compares the past and present service delivery paradigms.

Table 2.2 Change of Service Delivery Paradigm

Past	**Present**
Departmental Centric Approach	Citizen Centric Approach
Process Orientation	Service Orientation
Output based Assessment	Outcome based Assessment
Departmental View	Integrated View

Integrated Service Delivery through common service delivery points or kiosks has been advocated by UN study of e-Governance for countries with low PC penetration and low computer literacy. It is advocated to have Common Service Centers (CSC) providing e-Government services at Village Panchayats and owned by village level entrepreneurs to assist the citizens to access these services at nominal cost. The changing service delivery paradigm has lot of relevance in Indian context post NeGP to extend the reach of newly developed/replicated applications to rural and urban areas of each state and UT.

2.2.12 Collaboration for e-Governance

Collaboration is must for extending the reach and access of e-Governance newly developed/replicated applications. The collaboration may include the collaboration with following stakeholders:

- Centre, State and Local Government Collaboration

- Collaboration with NGO's
- Collaboration with Businesses / private sector
- Inter-Government Agency Collaboration
- Citizen- Government Collaboration
- Government – Employee Collaboration
- Government – Academics Collaboration (for capacity building)

First step in any e-Governance project is to establish a consultative process with all stakeholders that may be directly or indirectly affected by the initiative (Sachdeva et. al., 2006). The Project team may have discussions with Government employees, Industry representatives, NGO's and other agencies. Collaboration with private sector will help to get the expertise of private sector as applied to Government sector. Cooperation between various agencies of Government is also necessary. There must be efforts to create business opportunities so that the private sector may be attracted to invest in e-Governance Projects. Create local leadership and ownership wherever the project is implemented. This CSF does not have much relevance in Indian context post NeGP as such collaborations have already been executed and applications have already been developed for extending various services to citizens of states and UTs. Some of the applications which have not been developed by a few states and UTs could be replicated from other states and UTs with help of their private partners and developers'.

2.2.13 E-content

Keeping the citizen informed, providing him with details of Government activities is the function of the government. The Government needs to be transparent in its functioning and for the same it needs to introduce legislation if

required. Such transparency in government functioning shall bring accountability amongst Civil Servants and other government functionaries. The rationale is to increase the pressure on staff to perform well and to improve public understanding of government (Sachdeva et. al., 2006). The Right to Information should become the fundamental right of the citizens and should demarcate information types to be shared among the citizens:-

- *Information Government wishes to disseminate:* press notices, consultation papers, policies, White Papers, news, health and safety advice, benefits and entitlements, applicable regulations.

- *Information Government may make available:* geographical data, demographic data, economic data, information collected, information generated routinely, value added services.

- *Information Government will be required to supply:* performance indicators, environmental indicators, audited accounts, personal data, internal policy documents, correspondence, and management reports.

This CSF has relevance in the Indian context post NeGP as e-content needs to be updated and revised in accordance to the changes in the facts and figures of government departmental functioning.

2.2.14 Building National Information Infrastructure

National Information Infrastructure is more than just the physical facilities used to transmit, store, process, and display voice, data, and images. The various components that make information infrastructure comprise of:

- *Equipment* including cameras, scanners, keyboards, telephones, fax machines, computers, switches, compact disks, video and audio tape, cable, wire, satellites, optical fibre transmission lines, microwave nets, switches,

televisions, monitors, printers, and much more. The NII will integrate and interconnect these physical components in a technologically neutral manner (Sachdeva et. al., 2006).

- *Information:* The information may be in the form of video programming, scientific or business databases, images, sound recordings, library archives, and other media.

- *Applications and software:* This allows users to access, manipulate, organize, and digest the proliferating mass of information that the NII's facilities will put at their fingertips.

- *Network standards and Transmission Codes*: This facilitates interconnection and interoperation between networks, and ensures the privacy of persons and the security of the information carried, as well as the security and reliability of the networks.

- *People:* The people who create the information, develop applications and services, construct the facilities, and train others to tap its potential. Many of these people will be vendors, operators, and service providers working for private industry.

- *Delivery Points:* The delivery points will be the Information Kiosks in most cases.

- *Data Centres:* The data centres will store the various databases etc at National, State and Local Level. The key databases may include databases for citizens, property, vehicles and companies.

This CSF has relevance in the Indian context post NeGP as information infrastructure needs to be upgraded to cater for changing equipment,

information, applications and software, network standards and transmission codes, additional delivery points and data centres.

2.2.15 E-Governance Technology Architecture

E-Governance Architecture is a set of guidelines, concepts, principles, rules, patterns interfaces and standards to follow when building a new IT capability. It is a description of a complex system, its purpose, structure, components, as well as how these interrelate, at one point in time (Sachdeva et. al., 2006). A good e-Governance architecture should contain the following:-

- Allows for a multitude of different technologies
- Is based on open Standards
- Provides adequate security and data protection
- Is Accessible to all stakeholders
- Is interoperable
- Can be Scaled for future

Interoperability, Security, Openness, Flexibility and Scalability are the foundations of an e-Governance architecture. This CSF has relevance in the Indian context post NeGP as developing new applications or replicating the existing ones shall entail sticking to the laid out technology architecture.

2.2.16 Privacy and Security

The e-Governance application needs to build the trust of citizens in the system. It needs to ensure that the data and transactions of the citizens are secure. The information shared by the citizens should also remain safe and the privacy of the citizen needs to be protected (Sachdeva et. al., 2006). Any citizen e-Government

transaction involves sharing a lot of personal information, which can be misused by the private sector and anti-social elements. Thus, the citizen needs to be assured that such information flow would pass through reliable channels and seamless network. The various levels of security that are important are:

- *Physical security:* This extends from a locked computer room to access control systems, to closed circuit cameras, to key lock to power supply.

- *Information security:* This kind of security helps to protect information from unwanted exposure, tampering or destruction. Various mathematical techniques called cryptography are used to protect data.

- *Authentication:* This helps in establishing the validity of an identity and the rights and privileges attached to a transaction. This includes password based identification, biometrics, digital signatures, digital certificates and network based authentication.

- *Server Security:* This entails security of servers which may include mail servers, file servers, web servers, database servers, name servers etc. Any unauthorized access to servers is restricted through the use of intrusion detection systems, and firewalls. Routers may also be added to screen off the unwanted intruders to the network.

This CSF has relevance in the Indian context post NeGP as privacy and security are very critical to any transaction in e-Government environment.

2.2.17 People's Participation / Continuous Feed back

People participation and continuous feed back are essential elements in development and improvement process of all e-Governance initiatives. People's Participation/Continuous feed back can be ensured by the following methods.

- *E-inform:* The government should inform its citizens of its policies and program, budgets, laws and regulations etc with use of e-participation tools like websites. The various tools that may be included for people's participation and soliciting their feedbacks are use of web forums, e-mail lists, newsgroups and chat rooms.

- *E-consult:* Here in the Government takes feedback from the citizens about various legislatures, proposed policies etc. The web tools offer a choice of public policy topics on line for discussion with real-time and archived access to audios and videos of public meetings (Sachdeva et. al., 2006).

- *E-decisions:* The government indicates it will take citizen input into decision-making and provides actual feedback on the outcome of specific issues.

- Local Language Content and Local Language Interface is important for success of e-Governance initiative (Sachdeva et. al., 2006).

This CSF has relevance in the Indian context post NeGP as people participation and their continuous feedback help in developing and making already developed applications user friendly.

2.2.18 Universal Accessibility

All citizens of the country should have the opportunity to access the introduced e-Governance initiative. Amongst the complete population, there is only a fraction of population who have access to internet; there is still a smaller fraction that is skilled to use internet; there is further a smaller fraction which is using are using internet for Government services. Any e-Governance application is not for this small fraction of population and therefore we need to ensure such delivery channels which are universally accessible. There are many causes of the digital divide. This may include the linguistic barriers wherein the

content may be created in language for the majority population but the content for the minority population may not be there. Further the online services which are designed are made so sophisticated that they become inaccessible to the common man. Further a few services are now charged online which are available free offline. The population in villages may be provided with the Internet Kiosks for community access to e-Governance. The access needs to be combined with the training to use the developed e-Government applications effectively. This CSF has relevance in the Indian context post NeGP as universal accessibility shall guarantee the e-Governance application use by the populace.

2.2.19 Awareness and Communication Strategy

Marketing and publicity are integral parts of successful electronic government initiatives (Sachdeva et. al., 2006). Marketing efforts should focus on creating brand awareness of the online presence. Using traditional media methods and outlets to create the right image for this new delivery channel can accomplish this kind of "branding." One branding strategy is to use an advertising agency, such as those employed by many states for lottery advertising. The customer would learn to identify a particular slogan or message with e-Governance activities. Another important strategy is for all agencies involved in e-Governance implementation to present a unified front. All collateral materials sent to "traditional" customers (citizens and end users') should stipulate the source and location of the e-document. For example, on a tax form there should be the location of its source like a website address. Agencies should encourage front-line employees to promote to customers going online next time they wish to transact business. Community outreach programs, including seminars, educational programs and speakers' bureaus, offer other potential channels to reach the public. Other customers segment is the Government employees. Unless they are convinced, they will not communicate the message to the

citizen. Therefore they should be specifically targeted. Business Groups for E-Commerce could be specifically targeted. Develop publicity campaigns and training material that will engage people in e-Government efforts. This CSF has relevance in the Indian context post NeGP as awareness and communication strategy shall guarantee that new e-Governance initiatives are known to citizens and they can use it effectively.

2.2.20 E-Governance Program Management

An effective e-Governance program management would be to control scope, time, quality, scope, human resources, communications and risks of the intended initiatives (new ones or the ones being replicated). Effective program management ensures that the stated goals and objectives are accomplished. The program includes multiple projects and project scoping includes scoping the deliverables of the projects and incorporating, documenting and communicating change requests of stakeholders (Sachdeva et. al., 2006). The time required for a project/plan is total of the time for completion of various components, which may be broken down and estimated on time. A project/plan schedule based on project scoping is worked out in the beginning of project. The cost is calculated based on cost of various resources including cost of services. The effort is to ensure that the project/plan is completed on time and within budget. Multiple projects in an integrated manner will contribute to an effective plan/program. Quality Management ensures that the e-Governance program will satisfy the needs for which it was undertaken. In order to achieve quality a quality plan is necessary and controls over the activities need to be carried out. Quality standards have significant impact on time and cost. Some tasks may become exceptionally good if given more time. As part of HR Management the Program Management ensures that the most effective use of the people involved within the program takes place. Therefore the Human resource planning and development is an essential part of program management. A communication

plan is necessary to ensure effective communication between the team members and key stakeholders. The Program Management Team needs to ensure that project risks are identified, analyzed, and responded to. Most risks or potential failures can be overcome or resolved, given enough time and resources. The risks mitigation plans can be put in place so that the necessary action is taken on time. The various activities of Program Management may include:

- Scope Definition
- Cost Estimation
- Project Planning
- Assessing Risks
- Estimating resources
- Organizing the work
- Acquiring human and material resources
- Assigning tasks
- Directing activities
- Controlling project execution
- Reporting progress
- Analyzing the results based on the facts achieved
- Quality Assurance
- Monitoring and Evaluation
- Feedback and Improvement

This CSF, e-Governance Program Management has relevance in Indian context post NeGP as many initiatives are taking place simultaneously either to develop the new applications or replicate the applications already developed in other

states and UTs. The applications need to be interfaced on a common user interface developed by each state and UT and thus needs to be user friendly incorporating local language interfaces.

2.2.21 E-Governance Application Development

Software Development is an important aspect of Project Management. It is a phase beyond conceptualization and architecture. At the Government end if the project is outsourced then it starts with bid process management which includes call for Expression of Interest, Release of Request for Proposal (RFP), Call for bids, their evaluation and selection of successful bidder. If the project is developed In-house all above steps are curtailed. The various steps in software development lifecycle include the following:

- *Requirement Analysis:* In this phase the development team visits the Client and understands the requirement. The team studies the systems with in the new scenario of Business Process Re-engineering being already implemented. In this face the requirement analysis is focused specially on software.
- *System Analysis and Design:* In this phase the overall structure is designed. This may include preference in terms of say the client/server technology, the package architecture, the database design, the data structure design etc. At this stage a software development model is created which becomes basis of code generation.
- *Code Generation:* Generation of code is the next step in SDLC and uses programming tools like Compilers, Interpreters, Debuggers to generate the code. Various high level programming languages like C, C++, Pascal, Java are used for coding.
- *Testing:* Testing is the next step after code generation. The various testing methodologies are used to locate the bugs in the system.

- *Maintenance:* Any software delivered to customer will undergo changes due to various reasons. The software should be developed to accommodate such changes.

This CSF does not have relevance in Indian context post NeGP as almost all possible applications have been developed in form of pilot initiatives by some state and UT and post analysis and assessment have to be replicated in other states and UTs.

2.2.22 Change Management in Government

The delivery of Government services through the e-Governance will lead to administrative, process and legal changes (Sachdeva et. al., 2006). It may necessitate empowerment of employees, de-layering of decision making levels. These changes need not only be accepted by the Government and citizens but also be accepted by various interests groups like Employees unions. Under such circumstances bringing in a change will involve changing the mindsets of the people, and a complete Reengineering process needs to be carried out for the same. There will also be a loss of vested interests and power amongst the legislature and the executive, which may lead, to resistance to change. Therefore a Change Management Strategy is a beginning point of e-Governance. The various components of Change management are:

- Define and identify the various areas of reforms
- Identify Champion of Change
- Ensure Commitment to Change
- Facilitate the Participation of Stakeholders
- Device a Communication Strategy
- Enable a IT Training

- Set up a Mechanism for Continuous Learning
- Monitor, Evaluate and Analyze the Change Process
- Provide Support whenever required

This CSF has relevance in Indian context post NeGP as change management processes need to be initiated by all states and UTs while adopting such applications already developed in other states and UTs.

2.2.23 Evaluating and Performance Assessment of e-Governance Projects

Clear project objectives need to be set and projects need to be evaluated based on those objectives. The success of the project will depend on how far the stated objectives have been met. Another parameter which may define project success is the sustainability of projects over a long period and return on investments (Sachdeva et. al., 2006). The e-Governance project successes may also be studied on service delivery, technology, reliability and replicability attributes. The projects need to be evaluated as a constant improvement model even while implementation is underway. The interventions may be carried out at each stage of implementation. Bottlenecks and causes of delays should be documented, even though they may be removed later. The successful projects/pilots should be replicated over the nation with members drawn from the implementing team. The projects, which could not achieve the desired outcome, should be documented for possible causes of failure. Various bottlenecks and causes of delay should be identified. This CSF has relevance in Indian context post NeGP as evaluating and assessing the developed projects or replicated projects shall lead to constant improvement process.

2.2.24 Integrated Government (i-Gov)

Integrated Government or i-Gov is evolving concept wherein an integrated approach to Government is achieved. It is integration of services across Federal,

State and Local Government. It is also integration of Government across various Departments (Sachdeva et. al., 2006). It is a single window for Government transactions and in NeGP has been defined as Common Service Centre (CSC). All citizens in all states and UTs can access all e-Governance services through CSCs. The backend integration of various Departments/levels of Governments is necessary for achievement of Integrated Government. In India the constitution provides the distribution of powers with Centre and States, it is a big challenge to achieve such integration of services. Nevertheless almost all states and UTs have replicated the initiatives of few states i.e., E-Seva of Andhara Pradesh and Bangalore One of Karnataka. This integration of services cannot be spearheaded from Ministry of IT for states and UTs. It has to be specifically spearheaded from the Prime Ministers' Office or from the Chief Minister's secretariat so that it has an authority across all Departments at Centre, and states and UTs. This CSF has lot of relevance in Indian context post NeGP.

The CSFs having relevance in Indian context post NeGP are thus summarized as: *Clear cut vision and goals, E-content, Info Infrastructure, Human Capacity Building, Awareness and Communication strategy, Technology Architecture, Privacy and Security, Change Management, Formulation of e-Gov roadmap, e-Gov program management, Integrated e-Governance, re-engineering process, Universal accessibility, Continuous feedback, Service Delivery Paradigm, Understanding e-Gov prospects, Cost benefit analysis, Evaluation and performance assessment, Sustainable business model* (Sachdeva, 2006).These CSFs or a combination of these CSFs shall be the strategy for adoption of e-Governance initiatives by states and UTs of India post NeGP. These CSF variables are not quantifiable and are aids for formal and informal planning and thus need to be mapped to easily measurable performance indicators known in literature as Key Performance Indicators (KPIs). These key performance indicators have been identified for measurement of e- Governance initiatives

under various assessment frameworks. The need thus is to identify the most suitable framework in use, incorporate its measurable indices and formulate cumulative index for assessment based on these measurable indices.

2.3 Types of Assessment for e-Government Evaluation

The lack of formal methods for monitoring and assessing e-Government initiatives has led to a significant slowdown of country-level e-Government development [Kunstelj et al., 2004]. From the experience of United States and Canada which have higher level of e-Government and earlier development of assessment of e-Government, the future direction of e-Government evaluation aims towards simplifying indicators and stressing the assessment of outcome as a whole [Shan et al., 2009]. Furthermore, the current approaches to monitoring, evaluating, and benchmarking e-Government development do not support comprehensive e-Government assessment and need to be further improved in order to give policymakers better evaluation criteria for their decisions [Kunstelj et al., 2004]. There are three kinds of situations that require evaluation in e-Government. One is the environment; second is evaluating the performance of an e-Government program or project; and third is the overall impact of e-Government on general government functioning, economic development and citizen servicing. Accordingly, we need three kinds of approaches of evaluation such as (i) E-readiness assessment of states or region (ii) Hierarchy of measures taken by the e-Government program or project (iii) Overall impact of e-Government.

2.3.1 E-readiness Assessment

This index plays an important role in benchmarking best practices by various Indian state governments and trying to replicate these best practices in other states. The e-readiness index is developed based on six broad parameters viz.,

network access, network learning, network society, network economy, network policy and e-Governance. Each of these parameters is represented by a set of indicators and these indicators are again represented by a number of sub-indicators (Gupta et al., 2007).

2.3.2. Hierarchy of Measures and Impact Analysis

This could be done using hard measure indicators/sub indicators (measures which have strong mathematical and analytical background) and soft measure indicators/sub indicators (measures that require peoples' skills). In fact, a large part of e-Government projects are soft systems, which are often prone to perceptual inconsistencies among designers and users. This often leads to failure of an elegant system. The system also has to match the ongoing changing pattern of relations or interactions within government organizations, businesses and citizens (Gupta et al., 2007). Here a combination of hard and soft system indicators/sub indicators would be suitable in development of hierarchy of measures and impact analysis. In general, any development of hierarchy of measures and impact analysis needs to have a few important characteristics including the ability to incorporate the various goals and vision of the project or plan, the ability to incorporate multiple views of the stakeholders', and the ability to carry out offline process diagnosis. The literature on e-Government offers few approaches, which have been found useful in development of effective evaluation framework. A broad categorization is as follows:-

a. Hard Measures.
    i. Cost–benefit analysis
    ii. Benchmarks in e-Government
b. Soft Measures
    i. Scoring method

ii. Stages of e-Government

iii. Sociological angle

2.3.3Hard Measures

In this methodology information is weighed against a backdrop of cost–benefit analysis. It seeks to find answers to questions like how much money is being spent to acquire the information and how much benefit in monetary terms is being obtained. This issue has been dealt with most thoroughly in information economics, which finds its base in statistical sampling concepts, Bayesian statistics and statistical decision theory based research papers that appear mainly in accounting journals. The main drawback of this approach lies in its implementation. Information and related services in e-Government being an intangible organizational resource, it is sometimes impossible to quantify the cost and value associated with obtaining and using it. Some benefits related to e-Government such as improvement in communication with the users, better appreciation of the role of the information system (IS) within the organization and better integration with business planning are difficult to assess using objective measures (Gupta et al., 2007). Thus the indicator/sub-indicators outlined in this measure i.e., cost benefit analysis and benchmarking methods have been used in this research work for development of evaluation framework to a limited extent.

2.3.4 Soft Measures

Soft approaches employ multi-dimensional attribute measures of information value, which is relevant in the context of e-Government (Gupta et al., 2007). Simultaneous consideration of multiple attributes facilitates the understanding of the extent and depth of the problem. Benefits such as improved decision making, customer or citizen satisfaction and employee productivity can only be

modeled using soft measures. Thus to evaluate the states and UTs of India post NeGP all soft measures were analyzed and indicators/sub-indicators used by such measures were incorporated in our evaluation framework.

2.3.5 Scoring Method

The scoring methodology entails identifying all the key performance indicators (KPIs) and then assigning weights to each of them. Finally the weighted average of all the attributes is calculated. The state and UT with the highest score is judged the best state and UT in comparison to other states and UTs as regards provisioning of e-Government based applications to the citizens both in urban and rural areas through kiosks called CSCs. This approach can incorporate both tangible and intangible benefits. If there is a strong connection between a benefit accrued due to investment in IT infrastructure of e-Government, it will influence the final score even if it does not have a monetary value. Thus the scoring model helps solve the problem of assessing intangible benefits by linking the evaluation of these benefits to the factors that are most important to citizen satisfaction. The approach can also take risk into account, by using negative weights for factors that reduce the citizen satisfaction, user usage, user identity and secrecy of each transaction. This method was used in formulating the aggregated assessment index for e-Governance in Indian contest post NeGP termed as e-Governance assessment index (eGAI).

2.3.6 Stages of e-Government

Based on technical, organizational and the managerial studies of several examples, e-Government is found to be an evolutionary phenomenon and therefore e-Government initiatives should be accordingly derived and implemented. In this regard, the four stages of a growth model for e-Government

are described as: (i) Cataloguing, (ii) Transaction, (iii) Vertical integration, and (iv) Horizontal integration.

Stage I: Cataloguing (online presence, catalogue presentation, downloadable forms) In this stage, governments create a 'state web site'. They do not have much internet expertise, and prefer to minimize risks by doing a small project. Parts of the government's non-transactional information are put on the site. Usually at first, the index site is organized on the basis of functions or departments as opposed to service access points.

Stage II: Transaction (Services and forms are online, working data base supporting online transactions) This stage empowers citizens to deal with their governments online anytime, saving hours of paperwork, the inconvenience of traveling to a government office and time spent waiting in line. Registering vehicles or filing state taxes online is only the beginning of such transaction-based services.

Stage III: Vertical Integration (local systems linked to higher level systems, within similar functionality) Information is made available through the citizen's local portal. The citizen-user will be able to access the service at the state or centre level from the same entry in the local portal, because the local systems are connected to upper level systems, directly or indirectly.

Stage IV: Horizontal Integration (systems integrated across different functions, real one-stop shopping for citizens) The horizontal integration of government services across different functions of government will be driven by visions of efficiency and effectiveness in using information technology, but pulled by citizens' demands for an 'inside-out' transformation of government functions to more service-oriented ones. Here e-Government offers the best hope for improved efficiencies through administrative reform because of both its vertical and horizontal integration. Such integration will facilitate 'one-stop

solution' for the citizen. The states and UTs based on stages of e-Government could broadly be classified into these four stages, but most of states and UTs of India would either fall in stage I or in stage II. The basic purpose of our assessment of states and UTs post NeGP is to draw important lessons from each others' experience while extending the e-Governance applications to its citizens which would not be achieved using this staged assessment approach..

2.3.7 Hierarchy of Measures

A good method is required to determine the criteria for evaluation, to develop the means to measure the variables for which criteria are established and then test these with the help of the relevant data. We can consider three types of valuation. The *first* would address the value of an state wide infrastructure i.e., SWAN. Factors such as a communication network, a standardized data management approach and an IS architecture impact and benefit to the entire population must be evaluated in this context. This is one of the more difficult things to evaluate because benefits stem not from a network but from the applications it supports. The second would consider the applications implemented to support specific or multiple functions within state or UT. E-Governance applications do not directly produce value. The value is in its impact on the citizens of the state or UT. The third area of concentrated IT support is at the level of the individual user. It can be very diverse in terms of the amount of use and the ability of the user to take advantage of the type and amount of available computer-based support. This diversity makes assessing the value of e-Governance application use very complex. No single measurement tells the complete story. Thus this measure was ignored.

After analyzing all the hard measures, soft measures and the hierarchy of measures, it was concluded that a multi criteria based approach having a mix of hard and soft measures would be most suitable for assessment of states and UTs of India (as regards extending benefits to the citizens post NeGP).

2.3.8. Multi-criteria Approach

A multi-criteria based approach has already been developed by IIM Ahmedabad and NISG, Hyderabad for evaluation post NeGP called e-Governance assessment framework (EAF). The EAF framework had some short comings which have been rectified in version 2.0 of the framework. This framework has a mix of hard and soft measures. The basic five dimensional frame work has been depicted in Figure 2.1.

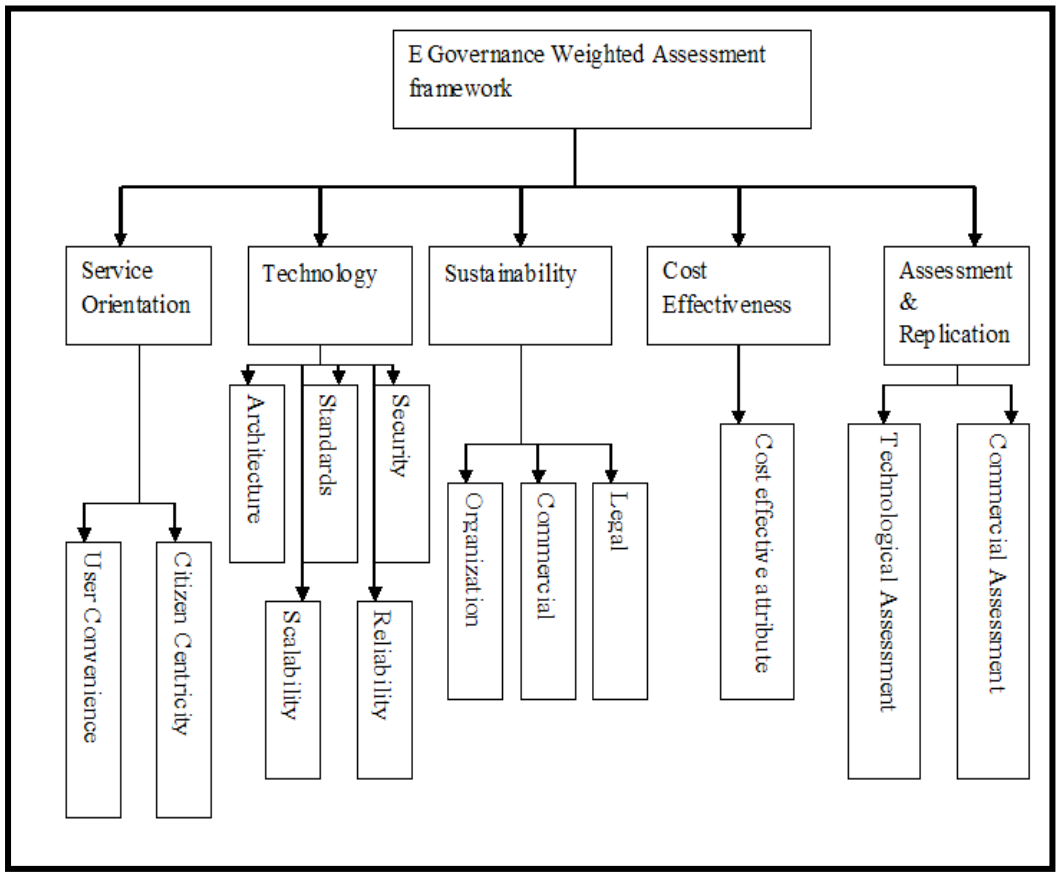

Figure 2.1 Five Dimensional EAF version 2.0

2.4. Key Performance Indicators their Scope and Definition

EAF assessment version 2.0, a multi-criteria hierarchical framework of five dimensions viz., (i) service orientation (user efficiency, user convenience and

citizen centricity) (ii) Technology (architecture, standards, security, scalability, reliability), (iii) Sustainability (internal/organizational, legal and commercial) (iv) Cost effectiveness (cost effectiveness attribute) and (v) Replicability (functional and technical) have been broken down into KPIs as depicted in Figure 2.2.

KPIs are measures that quantify objectives and enable the measurement of strategic performance. E-Government assessment framework (EAF) version 2.0 was designed prior to launch of NeGP and is being used to assess the overall impact of pilot project offerings for G2C-Rural, G2C-Urban, G2G and G2B. This framework was designed by joint efforts of Centre of e-Governance, IIM Ahmedabad and National Institute of Smart Governance (NISG), Hyderabad. The framework supports two kinds of assessment i.e., Summary Assessment and Detailed Assessment. Summary Assessment done through 33 KPIs is meant for strategic assessment whereas Detailed Assessment done through 108 KPIs meant for case study approach (Rao et al., 2006).

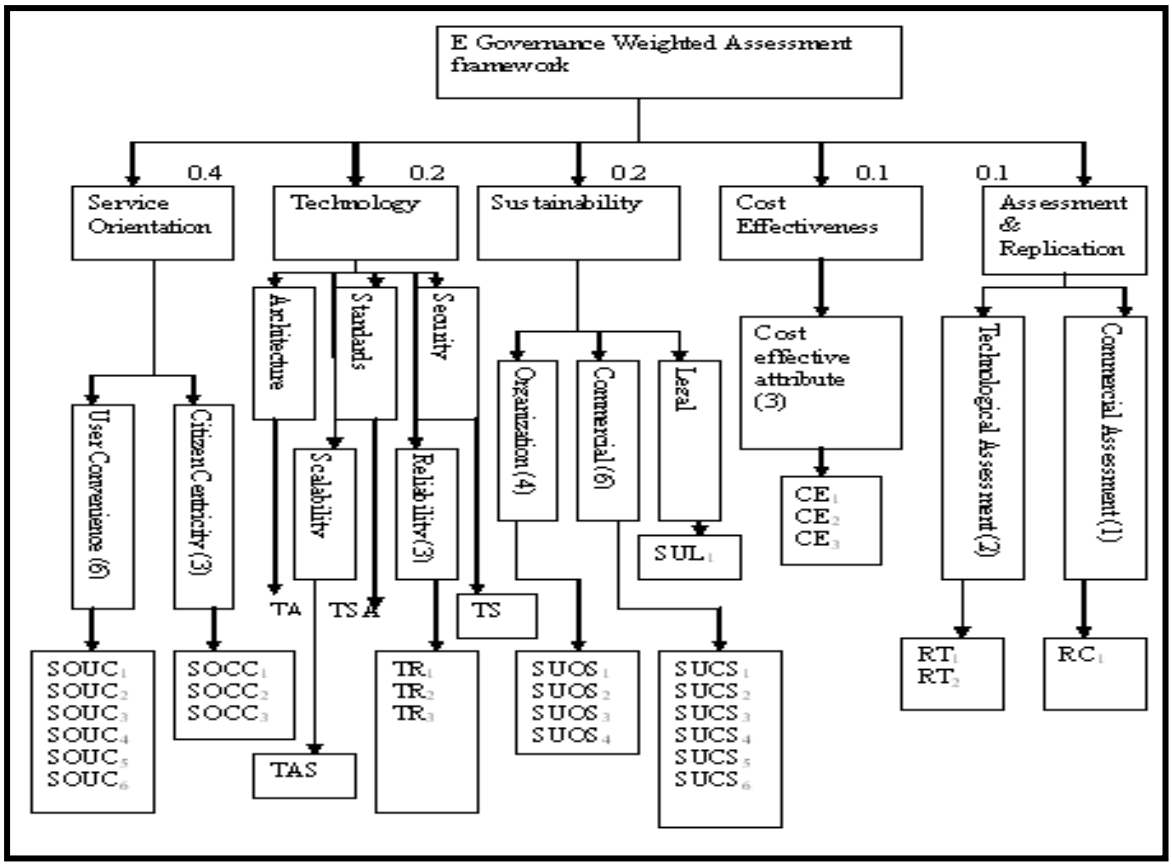

Figure 2.2: KPIs Depicted in all Five Dimensions

The basic five dimensional assessment frame work was used to extract 33 sub-dimensional attributes for summary assessment. Summary assessment has been chosen because it needs a small sample. It could startwith collection of data on the project (and similar projects) from secondary sources to facilitate development of a broad framework for evaluation. The study could includeinterviews and administration of questionnaires on a small sample of respondents (of arepresentative sample of stakeholders). Summary Assessment would offer broad insightsinto the ground realities of the project and provide inputs to sharpen the understanding ofthe project objectives, identification of stakeholders, control groups, affected groups, etc.,. To a large extent, the data collection should be done in a natural environment,preferably without giving prior notice to the concerned parties so that it is not biased. Table 2.3 describes

each dimension attributes and methodology to be adopted to get a measured value.

Table 2.3 Dimension Attributes and Methodology to Measure the Values in EAF Framework

Sr No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
1.	Service Orientation	User Convenience	SOUC 1	Measures speed of delivery of service	Compares before and after execution of project in days/ hrs/minutes
			SOUC 2	Compliance to committed time frame	Measures % compliance & score
			SOUC 3	% users benefited from e-service	1 for 1-20%, 2 for 21-40%, 3 for 41-60%, 4 for 61-80%, & 5 for 81-100%
			SOUC 4	% socially &economically backward users benefited from e-service	1 for 1-20%, 2 for 21-40%, 3 for 41-60%, 4 for 61-80%, & 5 for 81-100%
			SOUC 5	Ease of access to service	How convenient is location of CSC
			SOUC 6	Suitability of CSC w. r. t to access to socially & backward classes?	On 0 to 5 scale; 0 for inconvenient and 5 for most conveniently located
		Citizen Centric	SOCC1	Degree of alignment of service design to user requirement	Extent of user requirements covered in service design (0-5)

Sr No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
			SOCC2	User interfaces in local language	Extent of local language in user interface (0-5)
			SOCC3	Reduction of visits to high level government offices	% reduction of visits to high level government offices (village/ taluka/ block) to complete transaction (0-5 scale)
2.	Technology	Architecture	TA	Comprehensiveness of architecture to meet needs of the project	Is configuration adequate to handle all services? 0 for over design or under design
		Standard	TSA	Mechanism in place for enforcing standards	Measures the efficiency of mechanism for enforcing standards (on 0-5 scale)
		Security	TS	Mechanism in place for enforcing secure transactions	Measures the efficiency of security mechanisms (No - 0 & Yes-5)
		Scalability	TAS	Degree of scalability of project to cover target users completely	Based on provisions to handle large number of users and transactions without sacrificing response (0-5)
		Reliability	TR1	Degree of availability	High degree of availability99.99 % through disaster

Sr No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
					recovery systems & alternative channels, gets a score of 5 (on 0-5 scale)
			TR2	Availability of SLA (Service Level Agreement)	Are the operational contracts based on a system of SLAs? Yes -5; No-0.
			TR3	Availability of alternative service delivery channels in case of system breakdowns	Extent to which the users can depend on the system's response in case of break downs (power, connectivity, hardware, software)
3.	Sustainability	Organizational	SUOS1	Existence and functioning of an organizational structure for managing the project	Whether created by reforming the conventional structure and is functioning effectively (0-5)
			SUOS 2	Role clarity and degree of employee-buy-in (Change management)	If no ambiguity exists on the roles to be played by employees in the changed environment, 5 (0-5)
			SUOS 3	Continuity of top champions	Score 1 for each year of

Sr No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
				of the project for 3-5 years	continuity; Less than one year 0; (0-5)
			SUOS 4	Existence and effectiveness of User Groups and Service Reviews	Based on the existence and effectiveness of a system of reviewing the system operations periodically, incorporating user feedback (0-5)
		Commercial	SUCS1	Amenability of Service Delivery through PPP mode	Based on the degree to which the service is amenable for private participation (0-5)
			SUCS2	Strength of PPP arrangement (if PPP)	Based on effectiveness with which the private partner is executing the project (0-5)
			SUCS3	Collection of user charges	Score 5, if the charges provide good stream of revenue adequate to ensure financial sustainability (0-

Sr No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
					5)
			SUCS4	Arrangements to ensure availability of service during user convenient time slots	Score 5 if power supply & connectivity are available during the prime time slots (0-5)
			SUCS5	Period of continuous functioning of the project after launch without showing symptoms of decline through reduced number of transactions	Score 5 if the project functions for 3 years or more after launch without decline and with growth. Score MINUS 10 if the project has stopped functioning within 3 years of launch and MINUS 5 if the numbers show a decline
			SUCS6	Economic benefit to the users in the rural areas	Extent to which the services provide economic benefit to the citizens in rural areas
		Legal	SUL	Extent of Business Process Re-engineering undertaken	Extent to which processes are simplified taking advantages of ICT (0-5 scale)

Sr No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
4.	Cost Effectiveness	CE attributes	CE1	Extent of reduction of direct cost to user compared to earlier system	Estimate the percentage reduction in direct cost like travel cost and give a score between 0-5
			CE2	Enhanced revenue/ benefit to the government	Based on the increase in revenues and benefits to government (0-5)
			CE3	Degree of reduction in corruption	Based on citizens perception on corruption with new system: 0-5 (5 if high reduction)
5.	Replicability & Assessment	Technical	RT1	Quality of project documentation	Based on availability of system documentation in standard format (0-5)
			RT2	Quality of user manuals	Quality of user manuals on (0-5) scale depending on clarity
		Commercial	RC1	Replication arrangement with Application developer	Whether the commercial arrangement with the developer / PPP partner permits

Sr No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
					replication - Yes / No (5 or 0)

2.5 Cluster Analysis

Cluster analysis is the organization of a collection of patterns (usually represented as a vector of measurements, or a point in a multidimensional space) into clusters based on similarity. Intuitively, patterns within a valid cluster are more similar to each other than they are to a pattern belonging to a different cluster (Jain et al., 1999). Commonly used clustering techniques are viz., hierarchical, k-means and fuzzy c-means clustering. The states and UTs post assessment were clustered using k-means and fuzzy c-means clustering, these techniques have been elaborated in succeeding paragraphs:-

2.5.1. K-means Clustering.

K-means is the simplest and most commonly used algorithm employing a squared error criterion. The squared error for a clustering $\Im$ of pattern set $\Re$ (containing K clusters) is:

$$e^2(\Im, \Re) = \sum_{j=1}^{k} \sum_{i=1}^{n_j} \left\| x_i^{(j)} - c_j \right\|^2$$

where $x_i^{(j)}$ is the i^{th} pattern belonging to j^{th} cluster and c_j is the centroid of the j^{th} cluster. It starts with a random initial partition and keeps reassigning the patterns to clusters based on the similarity between the pattern and the cluster centres until a convergence criterion is met (e.g., there is no reassignment of any pattern from one cluster to another, or the squared error ceases to decrease significantly after some number of iterations). The *k*-means algorithm is popular because it is easy to implement, and its time complexity is $O(n)$, where *n* is the number of patterns (Jain et al., 1999). K-means clustering of data set comprising of 35 states and UTs × 19 CSFs for each state and UT was attempted.

2.5.2 Fuzzy C-means Clustering

Traditional clustering approaches generate partitions within the data set. In a partition, each pattern belongs to one and only one cluster. Hence, the clusters in a hard clustering are disjoint. Fuzzy clustering extends this notion to associate each pattern with every cluster using a membership function [Zadeh 1965].The output of such algorithms is a clustering, but not a partition [Jain et al., 1999]. The fuzzy clustering algorithm is described below:

Fuzzy Clustering Algorithm

(1) Select an initial fuzzy partition of the *N* objects into *K* clusters by selecting the *N*×*K* membership matrix U. An element u_{ij} of this matrix represents the grade of membership of object x_i in cluster c_j. Typically, $u_{ij} \in [0,1]$

(2) Using U, find the value of a fuzzy criterion function, e.g., a weighted squared error criterion function, associated with the corresponding partition. One possible fuzzy criteria is $E^2(\Re, \mathrm{U}) = \sum_{\mathrm{i}=1}^{\mathrm{N}} \sum_{j=1}^{K} u_{ij} \| x_i - \mathrm{c_k} \|^2$,

where $c_k = \sum_{\mathrm{i}=1}^{\mathrm{N}} u_{ik} x_i$ is the k^{th} fuzzy cluster

Reassign patterns to clusters to reduce this criterion function value and re-compute U.

(3) Repeat step 2 until entries in U does not change significantly. The cluster technique was adopted for our data set till U values did not significantly change.

2.6 Fuzzy Inference System

Fuzzy inference systems (FIS) are one of the most famous applications of fuzzy logic and fuzzy sets theory [Zadeh et al., 1965]. They can be helpful to achieve

classification tasks, offline process simulation and diagnosis, online decision support tools and process control. In our research work we have used FIS for offline process simulation and diagnosis. There are two types of FIS: one that handles linguistic concepts and act as universal approximators to perform nonlinear mappings between inputs and outputs, and the other that can be designed from data to predict the outcome by simulation. The first kind of FIS focuses on the ability of fuzzy logic to model natural language. These FIS contain fuzzy rules built from expert knowledge and they are called fuzzy expert systems or fuzzy controllers, depending on their use. Prior to FIS, expert knowledge was used to build expert systems for simulation purposes. These expert systems were based on classical boolean logic and were not well suited. Another class of simulation tools is based on automatic learning from data [Guillaume et al., 2001]. This study is restricted to supervised learning and observed outputs are part of the training data. A numerical performance index is defined which controls the simulation results. Their main advantage is the numerical accuracy while a major drawback is their *black box* behaviour. Sugeno [Sugeno et al., 1985] was one of the first to propose self-learning FIS and to open the way to a second kind of FIS; those designed from data. Even the fuzzy rules, which are automatically generated from data, are expressed in the same form as expert rules; there is generally a loss of semantic. Since Sugeno's early work, a lot of researchers have been involved in designing fuzzy systems from databases. In this research work also an attempt has been made to design fuzzy inference systems from data of each cluster. Rule generation can be decomposed into two main steps: 1) rule induction and 2) rule-base optimization. Originally, automatic induction methods were applied to simple systems with a few variables. In these conditions, there is no need for optimizing the rule base. The situation is different for large systems. The number of induced rules becomes enormous and the rule description is complex because of the number of variables. Obviously, the rules will be easier to

interpret if they are defined by the most influential variables and the system behaviour will be easier to understand as the number of rules is getting smaller. Variable selection and rule reduction are, thus, two important steps of the rule generation process. They are usually referred as structure optimization.

2.7 Conclusion

This research work extends the multi-criteria framework developed for evaluation of e-Governance pilot projects i.e., EAF framework. Our research work has aimed at developing a multi-criteria evaluation framework based on EAF version 2.0 for integrated benefit assessment of G2C-U and G2C-R initiatives in states and UTs of India. The advantages of integrated assessment framework (IGAF) over EAF ver 2.0 is as given in Table 2.4 below.

Table 2.4 Advantages of IGAF over EAF version 2.0

Sr. No	Framework	Salient Features	Inputs from	Remarks
1.	e-Governance Assessment Framework (EAF) version 2.0	Assessment with KPIs	Users and Pilot project implementers	33 KPIs
2.	Integrated Assessment Framework (IGAF)	Integrated Assessment of all pilot projects adopted on a common user interface with KPIs	Users, Public Private partners (VLE, SDA and NIC representatives), experts and academicians in the field of e-Governance.	33 modified KPIs for integrated assessment of states and UTs of India for strategy formulation

The strategies adopted by states and UTs for replication of successful projects by the states and UTs were derived based on cluster analysis of all 35 states and

UTs of India post assessment. The futuristic strategies for enhancing benefits to the citizens were evolved using fuzzy inference systems (FIS) offline process analysis techniques developed from the data inputs of multiple stake holders' involved in NeGP implementation at lowest level i.e., CSCs and District Centres. The FIS simulation systems have been developed using data obtained on the CSFs of each state and UTs and the derived aggregate assessment index, e-Government assessment index (eGAI).

ISBN: 978-81-946587-3-3

Chapter 3

Integrated e-Governance Assessment Framework

3.1 Introduction

This chapter describes the development of integrated assessment framework for continuous assessment of states and UTs post NeGP. Our analysis in this thesis is restricted to G2C-U and G2C-R services in states and UTs of India post NeGP. We aim at developing integrated assessment framework by modifying already existing framework for continuous assessment of states and UTs in India post NeGP (based on inputs of multiple stake holders' involved in implementation of NeGP viz., VLEs, SDA and NIC representatives). e-Governance assessment frameworks in use are either hard measure based or soft measure based but an integrated assessment framework requires a mix of hard measure and soft measure based indicators/sub-indicators. An emphasis thus is on developing/modifying a multi-criteria based framework with a healthy mix of hard measure and soft measure indicators/sub-indicators. An optimal combination of such a mix shall guarantee us an effective continuous self-assessment framework to bring out the shortcomings in G2C-U and G2C-R implementation in Indian states and UTs post NeGP.

A detailed review of literature on e-Governance assessment frameworks in India and its subsequent analysis (in chapter 2 section 2.3 and 2.4) has revealed that e-Governance assessment framework (EAF) version 2.0 is the most suitable framework for use in Indian context post NeGP with slight modifications for integrated assessment. The e-Governance assessment frameworks in use in India are viz., e-Governance assessment framework (EAF), Skoch e-

Governance report card and Impact assessment framework. EAF framework developed in 2004 for assessment of pilot projects was the first effort in development of e-Governance assessment framework in India (Rao et al., 2004). EAF version 1.0 was developed with an aim to analyze the e-governance project initiatives with respect to the objectives laid down in the project documents. There were a few short comings of such a framework viz., re-grouping of indicators/sub-indicators, overlap of indices, difficult to measure indices and new factors to be incorporated to make the framework more holistic (Gupta et al., 2007). These short comings were overcome in the version 2.0 of the framework designed for integrated assessment of pilot projects initiated by Indian states and UTs, prior to launch of NeGP. The Skoch e-Governance report card was designed for seeking user inputs regarding implementation of pilot projects in states and UTs of India (Kochhar et al., 2005). Impact assessment framework was developed in 2007 to study end user impact of adoption of pilot e-governance projects in India (Bhatnagar et al., 2007).

The development of IGAF framework is based on EAF version 2.0 framework. In EAF version 2.0 framework broad weightages of all five dimensions of the framework have been outlined in the framework for all four scenarios i.e., G2G, G2B, G2C-U and G2C-R. The broad EAF version 2.0 framework with the dimension weightages outlined for G2C-U and G2C-R scenarios was adopted for our integrated assessment and analysis, however the sub-weightages of individual indices were not given in the framework (to enhance its versatility of use in different scenarios and plans). We have used AHP methodology to calculate relative weightages of all indices. The inputs for AHP analysis have been received through our questionnaire instrument circulated to implementer's, experts and academicians in the field of e-Governance. The judgmental matrix obtained gives the importance of Key performance Indices (KPIs) in individual dimension and its product with dimensional weights gave us global weights.

The global weights of all indices thus derived were used for formulation of cumulative assessment index, e-Government Assessment Index (eGAI). Two techniques of assessment had been outlined in EAF version 2.0 framework viz., Summary Assessment and Detailed Assessment. Summary Assessment was deliberately chosen because it required lesser sample size (the inputs of multiple stake holders' in G2C-U and G2C-R environments at lowest level of implementation i.e., CSCs and District centers were not forth coming).

3.2 Issue and Challenges in Design of Assessment Framework Post NeGP

Various stake holders are involved in provision and use of e-Governance offerings by states and UTs in India as part of NeGP viz., Government agencies, Public-private partners and End user's or Citizens. Challenges in development of assessment frameworks for e-Governance initiatives by states and UTs have been summarized as below (Gupta et al., 2007). Each of them has been discussed in detail in Indian context.

(a) Development of a self-assessment framework to study integrated impact of the e-Governance offerings in states and UTs of India.

(b) Lack of comprehensive framework for integrated assessment.

(c) Non-availability of base line data post NeGP.

(d) Lack of visibility of previous integrated assessment reports and

(e) Lack of funds for holistic integrated assessment.

3.2.1 Development of a Self-Assessment Framework to Study Impact of e-Governance Offerings

Presently it is being stressed that an external agency should do the assessment in order to get an unbiased view. This external agency shall be primarily

dependent on the project owners and other agencies involved for all the project/plan related information. Such agencies generally tend to either give distorted information about the project/plan or give information that does not represent the true perspective. In fact, by providing a self-assessment tool the implementer's and various agencies involved shall be in a better position to assess their own e-governance offerings on an on-going basis. Moreover these assessment indicators and attributes shall act as yardstick for assessing the projects/plan right from the project/plan conceptualization phases; thereby developing efficient and holistic e-Gov offerings for the citizens. The future strategy to be adopted to enhance the integrated benefits to the citizens/end users' of these e-governance offerings can also be decided by all these multiple implementing agencies.

3.2.2Lack of comprehensive framework

A comprehensive framework should be a true indicator of the integrated benefits of e-governance offerings to the end users'/citizens of states and UTs of India as part of NeGP. The assessment framework which have been developed or are in use for continuous assessment need to be altered/modified to suit our requirement of on going assessment analysis of G2C-U and G2C-R offerings by states and UTs of India. These assessment indicators need to be modified so as to receive correct inputs of various stake holders' at lowest level of strategy implementation i.e., CSCs and District Centers. An effort has thus been made in this research work to alter and modify the existing EAF version 2.0 framework so as to solicit inputs of lowest level strategy implementers' of NeGP in states and UTs of India.

3.2.3Non-availability of Baseline Data

It is extremely important to have the data on the functioning of the services prior to implementing the new system, in order to see the improvements over

previous systems. The base line data is basically the as-is processes studied at the project conceptualization phase. In most of the plan/projects, it has been seen that the base-line data was not captured; hence it is taken as a perception of the stakeholder, thereby giving an in-correct assessment of the impact made by the plan/project. Moreover there is no authentic baseline data to measure the continuous improvement in NeGP implementation in states and UTs of India after some time has elapsed and its continuous use by its citizens has begun. Any futuristic strategy prediction study cannot be done as previous data for integrated benefits achieved by previous adoption strategy of these e-governance offerings as part of NeGP does not exist. We therefore in our research work have created a baseline data post NeGP implementation with effect Jan 2010 and predicted futuristic strategy for enhancing .integrated benefits to the users/citizens of states and UTs of India post NeGP.

3.2.4Lack of Visibility of Assessment Reports

It has been seen that most of the time the assessments are done as part of some mandatory requirement of the project/plan and once the said task requirement is completed, the report is shelved and forgotten (Gupta et al., 2007). In case there is high transparency and visibility given to the assessment report, it will provide sufficient learning for the project/plan implementer's and help them design futuristic strategy to enhance integrated benefits to the citizens as part of NeGP.

3.2.5Lack of Funds for Holistic Assessment

As we have seen earlier that a holistic and comprehensive assessment should require varied degree of expertise. This would also involve quite a lot of time resources for the surveys, travel, interviewing, study of secondary data, and analysis. Normally, an in-depth and holistic assessment study would require quite a lot of funding, which is normally unavailable (Gupta et al., 2007). Thus it is recommended that management institutions/research organizations/centers

of excellence of e-governance be allocated funds to do a holistic continuous detailed assessment of states and UTs of India post NeGP.

3.2.6Other Challenges

There are some more similar issues and challenges pointed out in a study done by Centre of e-Governance, IIM, Ahmedabad on impact assessment (Bhatnagar et al., 2007) for e-Governance projects:

(a) Often evaluation studies had been done by agencies that may be seen as having an interest in showing a positive outcome.

(b) Different studies of the same project/plan showed very different outcomes, thus indicating a lack of credibility of the results.

(c) Part of the reason for different outcomes was the use of very small samples and lack of rigor in sampling in collecting data from clients of the systems. The results could therefore not be easily generated over the entire population of clients.

(d) The studies evaluated the functioning of the computerized system but were not able to assess the difference made by ICT use, as the need for counterfactuals was ignored.

(e) Finally, since different studies did not use a standard methodology, it was difficult to compare the outcome of a project with other projects.

3.2.7 Salient Features of Integrated Assessment Framework (IGAF)

The salient features of Integrated e-Governance Assessment Framework (IGAF) developed for integrated assessment of e-Governance offerings in states and UTs of India are as under:-

(a) Evaluation done by multiple stakeholders involved in implementation and use of e-Governance systems.

(b) EAF version 2.0 framework developed for analysis of pilot projects prior to launch of NEGP in 2006 has been modified to study effects of adoption of multitude of pilot projects by states and UTs and integrated on a common state/UT developed interface.

(c) A fairly large sample size spread over 581 district centers and 1638 respondents were used in survey.

(d) The study aimed at developing framework for studying the integrated benefits to the users/citizens and methods/strategy to maximize them.

3.3 EAF version 2.0

E-governance initiatives in India started in form of pilot projects in different states and UTs. These pilot projects were then replicated in other states and UTs and integrated with a common interface to extend the facilities to the citizens (as part of G2C-R and G2C-U) through kiosks called CSCs. These project successes were evaluated through a multi-criteria framework developed by centre of e-Governance, IIM, Ahmedabad and NISG Hyderabad under the directions of Department of Information Technology, Government of India in 2004, This framework structure and its KPIs were used to evaluate the adoption of multiple projects with a common interface developed by states and UTs to extend the facilities to the citizens. The modified version of the framework i.e., version 2.0 summary assessment was used to evaluate the adoption of multiple e-governance projects under the umbrella of a common interface developed by each state and UT. The common user interface developed by each state and UT was in accordance to the vision and direction laid out in NeGP in 2006. Such initiatives of adopting all successful projects of other states and UTs and

integrating them with a common interface started in 2007 as part of NeGP implementation.

The then rational for creating such an e-governance assessment framework (EAF) in 2004 under directions of Department of Information Technology, Government of India for assessing e-Governance projects in various dimensions have been enumerated below:

(a) Significant national resources to the tune of about Rs.2, 500 crores were used annually into implementation of e-Governance projects. Most of these projects are propelled by localized perceptions of the need to exploit ICT for better service, better efficiency and transparency. However, there was no evidence of any appraisal being done before the sanction/grounding of a project or during the period of its execution, as to whether the project was proceeding on the right lines to achieve its original objectives.

(b) The rating of some of the e-Governance projects implemented in the country was based on subjective assessment and value judgment of a few individuals and authorizations. There was no authentic mechanism for objective assessment of the projects.

(c) The National Action Plan on e-governance has an ambitious outlay of over Rs.12000 crores involving public and private investments over the next four years. A significant portion of the National Action Plan would involve replication of successful projects across different geographical areas of the country. However, the absence of a framework for knowing what a successful project is can severely handicap such replication efforts and would result in misdirection of the scarce resources.

(d) Many pilot projects are already in different stages of implementation. It was desired that a set of instruments be made available to the administrators of these

projects to appreciate the various attributes of a good e-governance project, apply midcourse corrections, where needed, and steer these projects in the right direction.

(e) The National Action Plan involves significant private investments flowing into the e-governance sector. These funding agencies which could be banks, financial institutions or multilateral funding agencies would like to be assured that the resources that go into projects has been rated highly as per a rational framework or can be appraised in terms of a widely accepted framework.

The following were the specific objectives formulated for EAF version 2.0 frame work:-

(a) To guide in funding of e-governance projects at various stages of their life-cycle (newly starting, roll-out, scaling up, replication).

(b) To provide guidelines for mid-term assessment of ongoing initiatives, so that mid-course corrections, if any, can be applied

(c) To provide guidelines for shaping future e-governance projects

(d) To provide material for e-governance training programs.

(e) To enhance the trust and confidence of stakeholders by enabling creation of a knowledge base of all e-Governance projects rated as per a trusted framework.

3.3.1 Validity of Framework for e-Governance Pilot Projects

The variety, scope and size of e-Governance projects are very large. It was not possible to attempt to create a framework that is applicable to all possible projects. It was therefore proposed to confine the development of EAF version 2.0 frameworks for the projects falling in the following four categories:

(a) Government to Citizen in Urban Environment (G2C- U)

(b) Government to Citizen in Rural Environment (G2C- R)

(c) Government to Business (G2B)

(d) Government to Government (G2G)

3.3.2 Categories of Framework

A very large number of parameters and attributes will have to be considered and assessed in order to decide the overall rating of an e-Governance project. This would involve considerable resources to be invested. However, there are several occasions where it is not possible to invest such time and resource in administering the elaborate instruments. Keeping this in view, it is proposed to develop two tiers of instruments, the first tier for a summary assessment (SA) of the project and the second tier for a detailed assessment (DA).

3.3.3 Assessment Methodology

The evaluations are to be conducted completely under free atmosphere. This process should not be handed over to the project management staff or the service providers. There must be total autonomy to sample design, selection of respondents and locations. Similarly, there must be total freedom to administer the questionnaires. Each project to be assessed must give consent and fully cooperate in conducting the study as per the above terms. As discussed above the assessment would be conducted in two steps: The Summary Assessment and the Detailed Assessment.

3.3.4 Summary Assessment

It is suggested that summary assessment should be conducted on a small sample. It should start with collection of data on the project (and similar

projects) from secondary sources to facilitate development of a broad framework for evaluation. The study should include interviews and administration of questionnaires on a small sample of respondents (of a representative sample of stakeholders). Summary Assessment should offer broad insights into the ground realities of the project and provide inputs to sharpen the understanding of the project objectives, identification of stakeholders, control groups, affected groups, etc., and help us refine the data collection instruments. Authorizations for conducting the interviews and collection of data should be obtained during this stage from the concerned authorities. To a large extent, the data collection should be done in a natural environment, preferably without giving prior notice to the concerned parties so that it is not biased.

3.3.5 Detailed Assessment

The detailed study should be based on a scientific sampling plan, which is refined by the exploratory study. The sampling plan should detail out the location wise and the type wise number of stakeholders to be surveyed. The sampling plan must include all stake holders and representative geographic locations. It should include a reasonable sample size (about 20%) of those who are not users of the e-governance project, i.e., control groups, and those who are affected by the new system. Separate instruments may be developed for each group. The instruments for control group will have only those attributes which are in the service orientation class.

3.3.6 Computing the Assessment Score

A typical instrument for assessment would have a large number of attributes grouped under the classes viz., Service orientation, Technology, Sustainability, Cost-effectiveness, and Replicability. Each attribute in the instrument has to be given a score between zero and five. At present we recommend equal weight to

each attribute in a class. Therefore depending on the number of attributes in the class, the total possible score for that class would vary. The score obtained for each attribute class should be given a specified weightage as per the scheme

3.3.7 Interpreting the Assessment Score

The total score obtained by a project clearly gives an overall assessment of the project. However it is important to assess a project based on the scores obtained in the individual segments. For example, a project may get an overall high assessment score, but it may be weak in sustainability segment. It is important to identify the attributes on which the project has scored poorly (or highly) to draw lessons for the future projects. The following general guidelines are provided for interpreting the assessment scores of individual projects A prima facie assessment of the strength of a project for a further investment decision, for expansion or for replication can be based on the yardstick given in the Table 3.1 below:

Table 3.1: Assessment yardsticks for project assessment as per EAF framework

Sr. No	Score Range	Category	Remarks
1	70 and above	Extremely Good	Qualifies for replication
2	50 to 69	Good	Scope for marginal improvement
3.	40 to 49	Satisfactory	Amenable to improvement through course correction/gap filling
4.	Below 40	Poor	Not worthy of pursuing further

3.3.8 Methodology and Technique Adopted for Integrated e-Governance Assessment Framework (IGAF)

A brief about the technique and methodology incorporated in the EAF version 2.0 framework has been discussed in preceding paragraphs. The same methodology and technique shall be used by us in integrative benefit assessment of adoption of multiple projects in each state and UT and integrating them on a common user interface developed by each state/UT. Summary Assessment technique has been used for assessing and analyzing G2C-U and G2C-R e-governance initiatives of each state/UT. The cumulative assessment index, eGAI has been formulated based on global weights of all the KPIs. The assessment yard sticks have been used to divide the state and UTs on the eGAI values obtained. The aim and scope of all KPIs in EAF version 2.0 frame work has been modified for integrative assessment. The succeeding paragraphs shall deliberate on the revised aim and scope of all KPIs of EAF version 2.0 framework.

3.4 Key Performance indicators (KPIs)

EAF assessment version 2.0 is a multi-criteria hierarchical framework in five dimensions: (i) service orientation (user efficiency, user convenience and citizen centricity). The user efficiency attributes have been merged with user convenience for integrative assessment. (ii) Technology (architecture, standards, security, scalability, reliability) (iii) Sustainability (internal/organizational, legal and commercial) (iv) Cost effectiveness (cost effectiveness attribute) (v) Replicability (functional and technical). The basic EAF framework structure with its sub-dimensional attributes was used to extract 33 KPIs for summary assessment. A detailed list of sub dimensional attributes and their methodology of use for summary assessment has been outlined in EAF framework and has been enumerated in chapter 2 table 2.1. KPIs for integrative benefit assessment

post NeGP have been based on these 33 sub-dimensional attributes, aim and scope has been modified for summary assessment of states and UTs post NeGP have been tabulated in Table 3.2.

Table 3.2: KPIs and its Methodology to Measure the Values in Integrated e-Governance Assessment Framework (IGAF)

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
1.	Service Orientation	User Convenience	SOUC1	Measures speed of delivery of services	Compares before and after execution of projects/plan in days/ hrs/minutes
			SOUC2	Compliance to committed time frame	Measures % compliance & score
			SOUC3	% users benefited from e-service	1 for 1-20%, 2 for 21-40%, 3 for 41-60%, 4 for 61-80%, & 5 for 81-100%
			SOUC4	% socially & economically backward users benefited from e-services	1 for 1-20%, 2 for 21-40%, 3 for 41-60%, 4 for 61-80%, & 5 for 81-100%
			SOUC5	Ease of access to services	How convenient is location of CSCs for % population. 1 for 1-20%,

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
					2 for 21-40%, 3 for 41-60%, 4 for 61-80%, & 5 for 81-100%
			SOUC6	Suitability of CSC w. r. t to access to socially & backward classes?	On 0 to 5 scale; 0 for inconvenient and 5 for most conveniently located
		Citizen Centric	SOCC1	Degree of alignment of service design to user requirement	Extent % of user requirements covered in service design (0-5)
			SOCC2	User interfaces in local language	Extent % of local language in user interface (0-5)
			SOCC3	Reduction of visits to high level government offices	% reduction of visits to high level government offices (vill/ taluka/ block) to complete transaction (0-5 scale)
2.	Technology	Architecture	TA	Comprehensiveness of architecture to meet needs of the	Is configuration adequate to handle all

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
				project	services? 0 for over design or under design
		Standard	TSA	Mechanism in place for enforcing standards	Measures the efficiency of mechanism for enforcing standards (on 0-5 scale)
		Security	TS	Mechanism in place for enforcing secure transactions	Measures the efficiency of security mechanisms (No - 0 & Yes-5)
		Scalability	TAS	Degree of scalability of project to cover target users completely	Based on provisions to handle large number of users and transactions without sacrificing response (0-5)
		Reliability	TR1	Degree of availability	High degree of availability 99.99% through disaster recovery systems & alternative channels, gets a score of 5 (on 0-5 scale)
			TR2	Availability of	Are the

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
				SLA (Service Level Agreement)	operational contracts based on a system of SLAs? Yes - 5; No-0.
			TR3	Availability of alternative service delivery channels in case of system breakdowns	Extent to which the users can depend on the system's response in case of break downs (power, connectivity, hardware, software)
3.	Sustainability	Organizational	SUOS1	Existence and functioning of an organizational structure for managing the project	Whether created by reforming the conventional structure and is functioning effectively (0-5)
			SUOS 2	Role clarity and degree of employee-buy-in (Change management)	If no ambiguity exists on the roles to be played by employees in the changed environment, 5 (0-5)

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
			SUOS 3	Continuity of top champions of the project for 3-5 years	Score 1 for each year of continuity; Less than one year 0; (0-5)
			SUOS 4	Existence and effectiveness of User Groups and Service Reviews	Based on the existence and effectiveness of a system of reviewing the system operations periodically, incorporating user feedback (0-5)
		Commercial	SUCS1	Amenability of Service Delivery through PPP mode	Based on the degree to which the service is amenable for private participation (0-5)
			SUCS2	Strength of PPP arrangement (if PPP)	Based on effectiveness with which the private partner is executing the project (0-5)
			SUCS3	Collection of user charges	Score 5, if the charges provide good stream

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
					of revenue adequate to ensure financial sustainability (0-5)
			SUCS4	Arrangements to ensure availability of service during user convenient time slots	Score 5 if power supply & connectivity are available during the prime time slots (0-5)
			SUCS5	Period of continuous functioning of the project after launch without showing symptoms of decline through reduced number of transactions	Score 5 if the project functions for 3 years or more after launch without decline and with growth. Score MINUS 10 if the projects have stopped functioning within 3 years of launch and MINUS 5 if the numbers show a decline
			SUCS6	Economic benefit to the users in the rural areas	Extent to which the services provide

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
					economic benefit to the citizens in rural areas
		Legal	SUL	Extent of Business Process Re-engineering undertaken	Extent to which processes are simplified taking advantages of ICT (0-5 scale)
4.	Cost Effectiveness	CE attributes	CE1	Extent of reduction of direct cost to user compared to earlier system	Estimate the percentage reduction in direct cost like travel cost and give a score between 0-5
			CE2	Enhanced revenue/ benefit to the government	Based on the increase in revenues and benefits to government (0-5)
			CE3	Degree of reduction in corruption	Based on citizens perception on corruption with new system: 0-5 (5 if high reduction)
5.	Replicability	Technical	RT1	Quality of project	Based on availability of

Sr. No	Criteria	Sub-criteria	KPI	Description	Methodology Adopted
	& Assessment			documentation	system documentation in standard format (0-5)
			RT2	Quality of user manuals	Quality of user manuals
		Commercial	RC1	Replication arrangement with Application developer	Whether the commercial arrangement with the developer / PPP partner permits replication - Yes / No (5 or 0)

3.5 AHP Framework

The broad five dimension weightages for G2C-R and G2C-U assessment have been outlined in the EAF version 2.0 framework. The sub dimensional weightages were extracted with help of questionnaire instrument by seeking inputs of experts, academicians and implementer's of e-governance pilot projects. The inputs of the experts, academicians and implementer's of e-governance pilot projects were evaluated using AHP technique. AHP technique for multi-criteria evaluation was developed by Saaty [Saaty et al., 1980]. It is a powerful and flexible decision-making process to set priorities among different attributes. AHP is a method that uses a hierarchic structure to present a complex decision problem by decomposing it into several smaller sub problems [Jha et al., 2008]. The steps for analysis are as enumerated below:

Step I: Let k be the number of sub-criteria under criteria C_n where $n = \{1,2,3,4,5\}$ for EAF framework, E_n be the weight of each criteria. The relative weight of the sub-criteria is calculated using comparisons between two sub-criteria using the pair wise comparison scale, a_{ij} represents the comparison between sub-criteria i and j where $i = 1, 2.....k$ and $j = 1, 2.....k$ and the comparisons made are $K(k-1)/2$ for $i > j$, For $i < j$, $a_{ij} = 1/a_{ji}$ and $i = j$, $a_{ij} = 1$ and thus the matrix A_k is formed.

$$A_k = \begin{pmatrix} 1 & a_{ij} & . & . & a_{ik} \\ 1/a_{ij} & 1 & & & \\ . & & 1 & & \\ . & & & 1 & \\ 1/a_{ik} & & & & 1 \end{pmatrix} \qquad [3.1]$$

Step II: Build normalized pair-wise comparison matrix:

$$A_{k1} = \begin{pmatrix} 1 & a'_{ij} & . & . & a'_{ik} \\ 1/a'_{ij} & 1 & . & . & . \\ . & . & 1 & , & . \\ . & . & . & 1 & . \\ 1/a'_{ik} & . & . & . & 1 \end{pmatrix} \text{ where } a'_{ij} = \frac{a_{ij}}{\sum_{i=1}^{k} a_{ij}} \qquad [3.2]$$

Step III: Calculate eigen value and eigen vector

$$w = \begin{bmatrix} w_1 \\ w_2 \\ \\ w_k \end{bmatrix} \text{ and } w_i = \frac{\sum_{i=1}^{k} a'_{ij}}{k} \qquad [3.3]$$

$$w' = A_k w = \begin{bmatrix} w_1' \\ w_2' \\ \\ w_k' \end{bmatrix} \text{and } \lambda_{\max} = \frac{1}{k}\left(\frac{w_1'}{w_1} + \frac{w_2'}{w_2} + \ldots\ldots + \frac{w_k'}{w_k}\right) \quad [3.4]$$

Step IV: Calculate CI and CR.

$CI = \frac{\lambda_{\max} - k}{k-1}$ and $CR = \text{CI}/\text{RI}$ CR values should be less than 0.1, depicts consistency and all values were found to be less than 0.1

[3.5]

Step V: Local and Global weights:

$$Local \text{ weight} = \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) \quad [3.6]$$

$$Global weight \text{ of sub} - \text{criteria} = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) \quad [3.7]$$

where $M_i = a_{i1} * a_{i2} * \ldots\ldots a_{ik}$ and $i = 1, 2 \ldots\ldots \text{k}$

The multi-criteria framework has been outlined in Figure 3.2. giving all the five dimensions and sub-dimension attributes. The relative weightings of the attributes have been calculated using Steps 1 to V through inputs received by academicians associated with e-governance study and research, experts in field of e-governance and implementer's who specialize in adoption of pilot projects and integrating them on a common user interface on questionnaire instrument I (Annexure I). The distribution of respondents' percentage wise is (i) academicians approximately 28% (ii) implementer's approximately 50% and

(iii) experts in field of e-governance 21%. The profile of respondents have diagrammatically depicted in pie chart as in Figure 3.1.

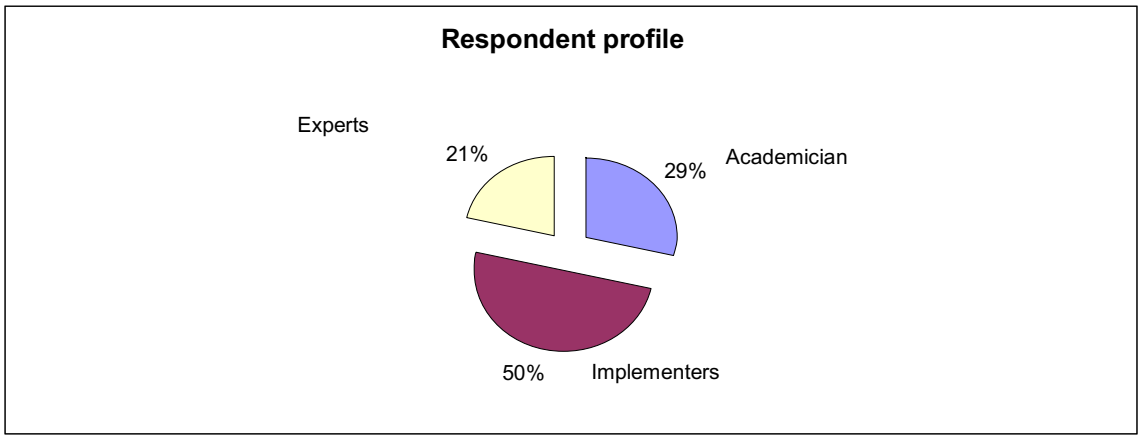

Figure 3.1: Respondent profile for AHP survey pie-chart

The respondent profile as in AHP survey as depicted in form of bar chart in Figure 3.2

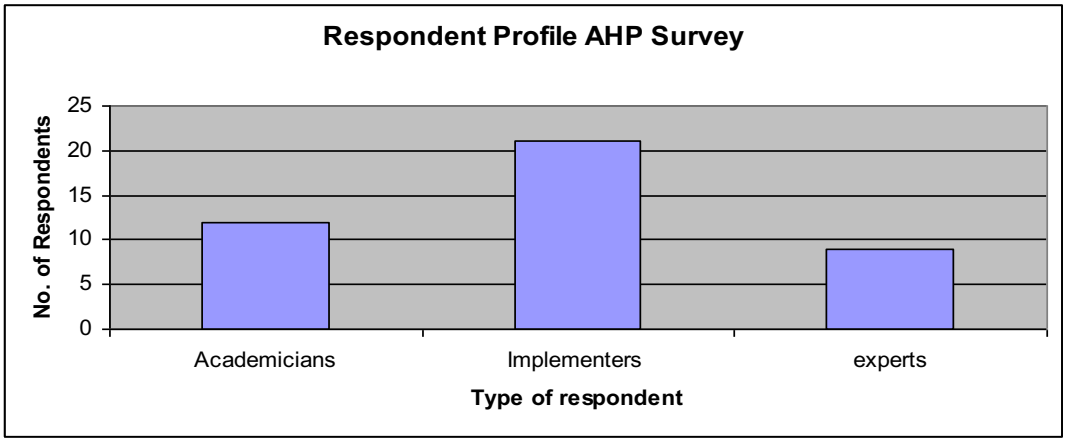

Figure 3.2: Respondent profile for AHP survey bar-chart

The inputs received from by academicians, experts and implementer's for each dimension regarding importance of each attribute/sub-attribute with respect to each other on the Saaty scale of 1 to 9 (1= Equal, 2= Between Equal and Moderate, 3= Moderate, 4= Between Moderate and Strong, 5= Strong, 6= Between Strong and Very Strong, 7= Very Strong, 8= Between Very Strong and

Extreme, 9= Extreme) gave us Judgemental matrix for each dimension/attribute. The judgmental matrix individual values are then multiplied with the dimension weightings to get the global weightings for each KPI. Judgemental weightings for Service orientation dimension with dimension weightings of 0.4 are as given in Table 3.2.

Table 3.3: Judgemental Matrix of Service Orientation Dimension

Sub Dimension	**User Convenience**	**Citizen Centricity**	$(M_i)^{1/k}$	$\sum_{j=i}^{k}(M_i)^{1/k}$	$(M_i)^{1/k} \Big/ \sum_{j=i}^{k}(M_i)^{1/k}$
User Convenience	**1**	**1**	$(1)^{1/2}$	**2**	$1/2 = 0.5$
Citizen Centricity	**1**	**1**	$(1)^{1/2}$	**2**	$1/2 = 0.5$

$$Global weight \text{ of user convenience} = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k}(M_i)^{1/k} \right) = 0.4 \times 0.5 = 0.20$$

$$Global weight \text{ of citizen centricity} = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k}(M_i)^{1/k} \right) = 0.4 \times 0.5 = 0.20$$

IGAF framework for AHP analysis is based on Figures 2.1 and Figure 2.2 of chapter 2. Figures 2.1 and 2.2 have been extracted from EAF version 2.0 framework. The dimensional weightages of EAF framework valid for G2C-R and G2C-U have been used in development of IGAF framework. The sub dimensional weightages have calculated using AHP methodology. The calculations of sub-dimensional weightages for service orientation dimension are being illustrated through Tables 3.3, Table 3.4 and Table 3.5.

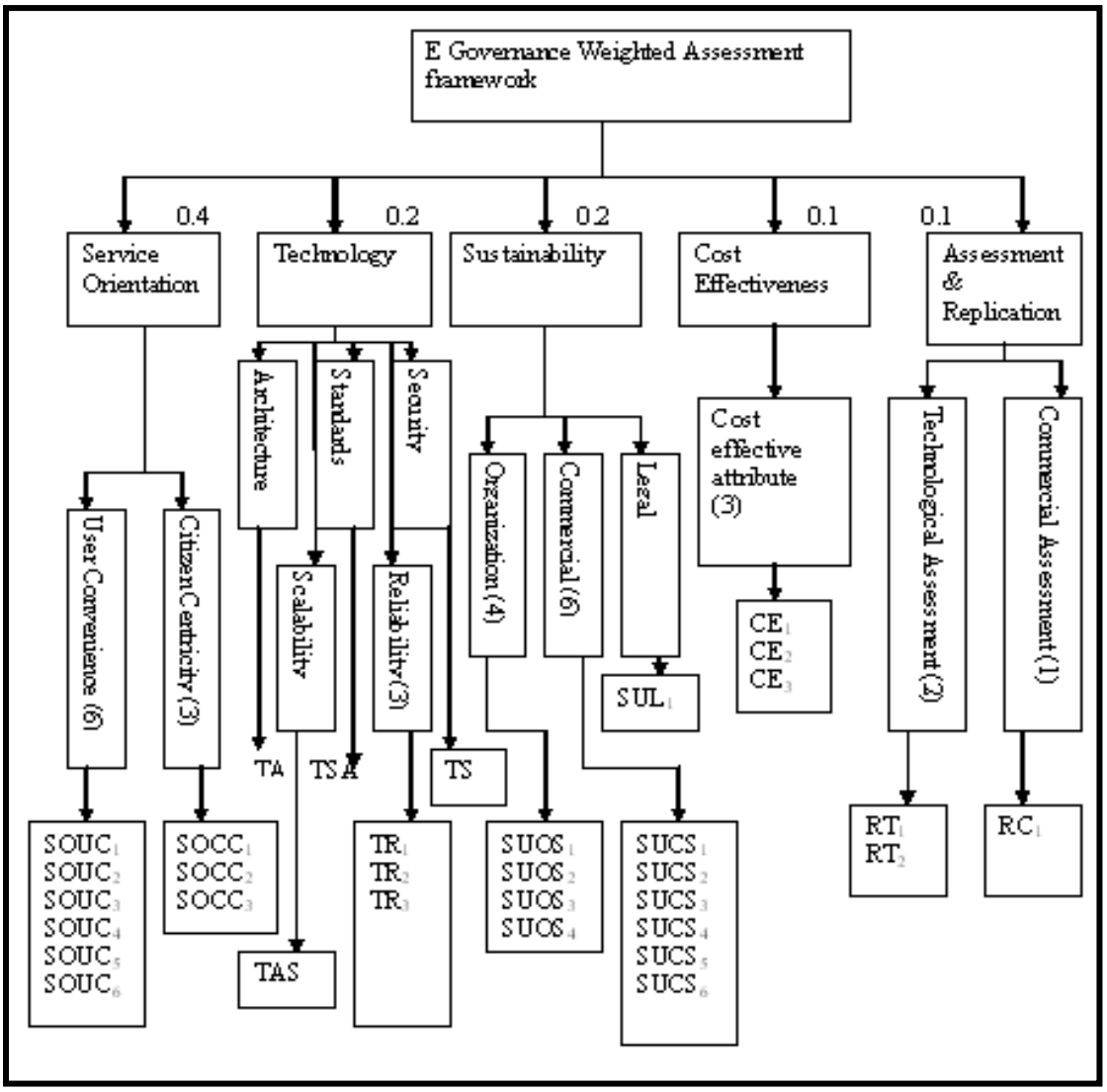

Figure 3.3: IGAF Framework for AHP Evaluation

Table 3.4: Judgemental Matrix of User Convenience Sub-Dimension

Attribute	$SOUC_1$	$SOUC_2$	$SOUC_3$	$SOUC_4$	$SOUC_5$	$SOUC_6$	$(M_i)^1$	$(M_i)^{1/k} \Big/ \sum(M_i)$
$SOUC_1$	1	1	1	1	1	1	$(1)^{1/6}$	$1/6 = 0.16$
$SOUC_2$	1	1	1	1	1	1	$(1)^{1/6}$	$1/6 = 0.16$

$SOUC_3$	1	1	1	1	1	1	$(1)^{1/6}$	$1/6 = 0.16$
$SOUC_4$	1	1	1	1	1	1	$(1)^{1/6}$	$1/6 = 0.16$
$SOUC_5$	1	1	1	1	1	1	$(1)^{1/6}$	$1/6 = 0.16$
$SOUC_6$	1	1	1	1	1	1	$(1)^{1/6}$	$1/6 = 0.16$

$$Globalweight \text{ of } \mathrm{SOUC}_1 = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) = 0.4 \times 0.5 \times 0.16 = 0.033$$

$$Globalweight \text{ of } \mathrm{SOUC}_2 = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) = 0.4 \times 0.5 \times 0.16 = 0.033$$

$$Globalweight \text{ of } \mathrm{SOUC}_3 = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) = 0.4 \times 0.5 \times 0.16 = 0.033$$

$$Globalweight \text{ of } \mathrm{SOUC}_4 = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) = 0.4 \times 0.5 \times 0.16 = 0.033$$

$$Globalweight \text{ of } \mathrm{SOUC}_5 = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) = 0.4 \times 0.5 \times 0.16 = 0.033$$

$$Globalweight \text{ of } \mathrm{SOUC}_6 = E_n * \left((M_i)^{1/k} \Big/ \sum_{k=1}^{k} (M_i)^{1/k} \right) = 0.4 \times 0.5 \times 0.16 = 0.033$$

The above mentioned method has been used to assimilate the inputs of respondents through judgemental matrix and calculate the relative and global weights of each attribute through equations [3.1] to [3.7].

In all judgemental matrices the values of CR was calculated using equation [3.5]

$$CI = \frac{\lambda_{\max} - k}{k - 1} \text{ and}$$

$$CR = \text{CI} \big/ \text{RI}$$

RI values are given in table compiled by Saaty for values of K. In all cases $CR \leq 0.1$ was found or else inputs were rationalized with help of respondents depicting consistency in input values. The relative and global weightings for each of the five dimensions have been calculated for each KPI and tabulated in Table 3.5.

Table 3.5.: Relative and Global Weightings of KPIs with Codes Used

Sr. No	Criteria	Sub-criteria	KPI	Relative weight	Global weights
1.	Service Orientation	User Convenience	SOUC1	0.083	0.033
			SOUC2	0.083	0.033
			SOUC3	0.083	0.033
			SOUC4	0.083	0.033
			SOUC5	0.083	0.033
			SOUC6	0.083	0.033
		Citizen Centric	SOCC1	0.16	0.066

Sr. No	Criteria	Sub-criteria	KPI	Relative weight	Global weights
			SOCC2	0.16	0.066
			SOCC3	0.16	0.066
2.	Technology	Architecture	TA	0.2	0.040
		Standard	TSA	0.2	0.040
		Security	TS	0.2	0.040
		Scalability	TAS	0.2	0.040
		Reliability	TR1	0.066	0.013
			TR2	0.066	0.013
			TR3	0.066	0.013
3.	Sustainability	Organizational	SUOS1	0.0825	0.0165
			SUOS 2	0.0825	0.0165
			SUOS 3	0.0825	0.0165
			SUOS 4	0.0825	0.0165
		Commercial	SUCS1	0.055	0.011
			SUCS2	0.055	0.011
			SUCS3	0.055	0.011
			SUCS4	0.055	0.011
			SUCS5	0.055	0.011

Sr. No	Criteria	Sub-criteria	KPI	Relative weight	Global weights
			SUCS6	0.055	0.011
		Legal	SUL	0.33	0.067
4.	Cost Effectiveness	CE attributes	CE1	0.33	0.033
			CE2	0.33	0.033
			CE3	0.33	0.033
5.	Replicability & Assessment	Technical	RT1	0.25	0.025
			RT2	0.25	0.025
		Commercial	RC1	0.5	0.050
				Total	**0.993**

3.5.1 Error Variance in Relative and Global Weights

The introduction of additive error variance term € in relative and global weights obtained through calculations from equations 3.1 to 3.7 have been done deliberately introduced to cater for instances where the additive values of all sub-dimensional weightages were not found to be 1. The additive weights for service orientation sub-dimension viz., User convenience and citizen centricity as shown in Table 3.3 were found to be 1 (0.5+0.5 = 1). Thus the error variance has been neglected. The additive weights for user convenience sub-dimension viz., $SOUC_1$, $SOUC_2$, $SOUC_3$, $SOUC_4$, $SOUC_5$, and $SOUC_6$ as shown in Table 3.4 were found to be less than 1 i.e., 0.996 (0.166+0.166+0.166+0.166+0.166+0.166+0.166=0.996).

The error variance in this case thus cannot be neglected. The additive weights for all the global weights were found to be 0.993 and thus additive error variance € has been introduced to cater for error variance in relative weights and global weights of all 33 KPIs of the IGAF framework. The error variance term has been introduced in equation 3.8.

3.6 e-Government Assessment Index

e-Government assessment index (eGAI) is a cumulative index of all KPIs with their weightings derived from the multi-criteria framework EAF version 2.0 modified for assessment of states and UTs G2C-R and G2C-U. G2C-R and G2C-U framework comprises of adoption of multiple projects developed in other states and UTs of India. These multiple projects are integrated on a common interface and extended to citizens through CSCs. This assessment index is basically for use by various stakeholders' involved in implementation of G2C-R and G2C-U initiatives in states and UTs of India.The total score obtained after assessment can be calculated with the index called e-Government Assessment Index. It can be formulated using equation [3.8]

$$eGAI = [0.033(\mathrm{SOUC}_1 + SOUC_2 + SOUC_3 + SOUC_4 + SOUC_5 + SOUC_6) + 0.066(\mathrm{SOCC}_1 + \mathrm{SOCC}_2 + \mathrm{SOCC}_3) + 0.04(\mathrm{TA} + \mathrm{TSA} + \mathrm{TS} + \mathrm{TAS}) + 0.013(\mathrm{TR}_1 + TR_2 + \mathrm{TR}_3) + 0.0165(\mathrm{SUOS}_1 + \mathrm{SUOS}_2 + \mathrm{SUOS}_3 + \mathrm{SUOS}_4) + 0.011(\mathrm{SUCS}_1 + \mathrm{SUCS}_1 + \mathrm{SUCS}_2 + \mathrm{SUCS}_3 + \mathrm{SUCS}_4 + \mathrm{SUCS}_5 + \mathrm{SUCS}_6) + 0.067SUL + 0.033(CE_1 + CE_2 + CE_3) + 0.025(RT_1 + RT_2) + 0.050(RC_1) + \varepsilon] \quad [3.8]$$

The eGAI value depicts the overall assessment of the state/UT as regards adoption of e-governance initiatives with respect to G2C-U and G2C-R is concerned. It is important to assess adoption of multiple projects integrated on a common interface and extended to citizens/users for use. This also helps us analyze the grey areas in individual segments. It is important to identify the attributes on which the state/UT has scored poorly (or highly) to draw lessons for the future. The following general guidelines are provided for interpreting the

assessment scores of individual state/UT. A prima facie assessment of the state/UT for further strategic decision making is based on the yardstick given in Table 3.6.

Table 3.6: Assessment Yardsticks for Integrated e-Governance Assessment Framework Based on EAF version 2.0 Framework

Sr. No	Score Range	Category	Remarks
1	70 and above	Extremely Good	Strategy unchanged
2	50 to 69	Good	Qualifies for further improvement by replicating successful projects
3.	40 to 49	Satisfactory	Scope for marginal improvement
4.	Below 40	Poor	Amenable to improvement through course correction/gap filling

3.7 Conclusion

In this chapter we have tried to expand the domain of EAF version 2.0 frameworks for integrated assessment of states and UTs of India post NeGP through IGAF framework. EAF version 2.0 framework has been modified for integrated assessment of all adopted e-Governance pilot projects in states and UTs of India (identified for replication in states and UTs of India as part of NeGP). The modified integrated e-Governance assessment framework (IGAF) shall be used to analyze the adoption of multiple projects in states/UTs of India on a common interface and further extend it to citizens/users through CSCs. IGAF framework is primarily based on EAF version 2.0 with the dimension attributes as given in EAF version 2.0 framework for G2C-U and G2C-R. The importance of 33 sub-attributes or KPIs for integrated assessment are based on inputs of experts, academicians and implementer's of these projects in

states/UTs of India. The inputs received from respondents were analyzed through AHP methodology and the relative weights and global weights were calculated. The global weights of all 33 KPIs were used to formulate the e-Government Assessment index (eGAI). eGAI values would be used to carry out prima facie assessment of states/UTs of India. The inputs on these KPIs are difficult to obtain and thus have been mapped to CSFs based on their definition and scope for obtaining perceptual inputs on these KPIs. The next chapter thus deals with CSFs and their mappings with KPIs based on definition and scope of each of them.

ISBN: 978-81-946587-3-3

Chapter 4

Multi Stakeholder Survey

4.1 Introduction

This chapter outlines the aim and scope of all nineteen CSFs relevant in Indian context post NeGP. It maps the CSFs to the relevant KPIs extracted from EAF version 2.0 frame work as outlined in chapter 3. Based on the weightings of KPIs and their mappings with relevant CSFs, relative weightings of CSFs are calculated and eGAI is formulated. The inputs of multiple stakeholders' involved in G2C-R and GCC-U implementation as part of NeGP in states and UTs of India is extracted through questionnaire instrument (based on the mappings of these CSFs and KPIs). This questionnaire instrument is mailed to all District Centres of states and UTs of India to solicit inputs of various stakeholders' involved in provision of G2C-R and G2C-U services through CSCs. The multi-stakeholders' input for each state and UT is received for each CSF and eGAI values for each state and UT is calculated. A prima facie assessment is done based on eGAI values of states and UTs of India as outlined in EAF version 2.0 and depicted in chapter 3, Table 3.6. The states and UTs were thus divided into four different divisions based on this prima facie assessment.

This chapter also extracts the inter-linkage of CSFs based on commonality of KPIs. A CSF or a few interlinked CSFs generally define strategies of implementation (Rockart et al., 1979). An analysis of multi-stakeholder inputs for CSFs and their inter-linkages shall help us identify strategies adopted by states and UTs in same division. Five inter-linkages of CSFs were found and

analysed with the inputs received for CSFs in each division to extract possible strategies to be adopted by states and UTs of each division. Of the five inter-linkages it was found that only four of them gave us strategies relevant for G2C-U and G2C-R implementation post NeGP. These four inter-linkages have been used in subsequent chapters for defining strategies for states and UTs in India.

4.2 Critical success Factors: Global List and Relevant List in Indian context.

Critical success factors are areas of activity that should receive constant and careful attention from management. The current status of performance in each area should be continually measured, and that information should be made available (Rockart, 1979).

Critical success factors support the attainment of organizational goals. Goals represent the end points that an organization hopes to reach. Critical success factors, however, are the areas in which good performance is necessary to ensure attainment of those goals. The actual CSF interviews are usually conducted in two or three separate sessions. In the first, the executive's goals are initially recorded and the CSFs' that underlie the goals are discussed. The interrelationships of the CSFs and the goals are then talked about for further clarification and for determination of which recorded CSFs should be combined, eliminated, or restated. An initial cut at measures is also taken in this first interview. These concepts of CSFs as outlined by Rockart for arriving at an organizations' strategy has been used in our research work to arrive at the strategy of states and UTs of India post NeGP and draw lessons from each others' experience (Rockart, 1979). Detail lists of important CSFs for e-Governance implementation have been compiled by many researchers in the global context and Indian context. Twenty four important CSFs for e-Governance implementation in the global context have been identified and

listed in chapter 2. Each has been analysed with respect to goals of NeGP implementation in Indian context and nineteen of them have been found to be relevant in Indian context. In succeeding paragraphs CSFs in global context and in Indian context have been listed.

4.2.1 CSFs for e-Governance Implementation in Global Context

The following is the list of twenty four CSFs for e-Governance implementation in global context extracted from literature on e-Governance (Sachdeva et al., 2006):-

(a) Understanding e-Governance Prospects.

(b) Clear cut Vision and Goals

(c) Formulation of e-Governance Roadmap.

(d) Leadership for e-Governance

(e) Institutional Framework for e-Governance

(f) Government Process Re-engineering

(g) Legal Reforms

(h) Human Capacity Building

(i) Cost Benefit Analysis

(j) Sustainable Business Model

(k) Service Delivery Paradigm

(l) Collaboration for e-Governance

(m) E-content

(n) Building National Information Infrastructure

(o) E-Governance Technology Architecture

(p) Privacy and Security

(q) People's Participation / Continuous Feed back

(r) Universal Accessibility

(s) Awareness and Communication Strategy

(t) E-Governance Program Management

(u) E-Governance Application Development

(v) Change Management in Government

(w) Evaluating and Performance Assessment of E-Governance Projects

(x) Integrated Government (iGov)

4.2.2 Relevant CSFs for e-Governance Implementation in India Post NeGP

National e-Goverance Plan (NeGP) was formulated in 2006 and its implementation started in 2007 in all states and UTs of India. The mission as outlined in NeGP for all states and UTs is "Make all Government Services accessible to the common man in his locality, through common service delivery outlets and ensure efficiency, transparency and reliability of such services at affordable costs to realize the basic needs of the common man". Indian government outlined a *three pronged approach* for effective implementation G2C-R and G2C-U services as part of NeGP (i) *Establishment of CSCs*: ICT-enabled Kiosks having a PC along with basic support equipment (ii) *Establishment of State Wide Area Network (SWAN):* To provide necessary Connectivity to all the CSCs (iii) *Establishment of State Data Centre (SDC):*

Created for secure hosting of e-Governance data and applications. CSC shall have 3-tier implementation viz., first tier implementation by Village level entrepreneur (VLE) owning one CSC in a cluster of 5 to 6 villages, second tier implementation by Service Centre Agency (SCA) responsible for control of CSCs in one or two districts and third tier implementation by State Designated Agency (SDA) responsible for implementation of this scheme within the state. National Information Council (NIC) an agency created under the aegis of Indian government shall be responsible for implementation of NeGP at the national level with its presence at District Centers (for carrying out effective co-ordination between various agencies involved in all districts of Indian union). District Centers shall be lowest level at which the strategic control for such implementation would be exercised. The overall co-ordination responsibility at the district level shall rest with NIC representative present at the District Centers. In our research work the aim was to solicit inputs of multiple stakeholders involved in G2C-R and G2C-U implementation as part of NeGP at the lowest level of strategy implementation. Based on these three pronged strategy outlined above it could be deduced that the lowest level of strategy implementation for G2C-R and G2C-U implementation as part of NeGP was done at District Centers and the control was exercised through the NIC representative located at each District centre. The inputs of multiple stakeholders' involved at each District Centre were obtained through the NIC representatives.

The nineteen relevant CSFs in Indian context for NeGP implementation as part of G2C-R and G2C-U e-Governance service delivery are listed in alphabetical order below:-

(a) Awareness and Communication strategy

(b) Clear cut vision and goals

(c) Change Management

(d) Continuous feedback

(e) Cost benefit analysis

(f) E-content,

(g) e-Gov program management

(h) Evaluation and performance assessment

(i) Formulation of e-Gov roadmap

(j) Info Infrastructure

(k) Integrated e-Governance,

(l) Human Capacity Building

(m) Privacy and Security,

(n) Re-engineering process

(o) Service Delivery Paradigm

(p) Sustainable business model

(q) Technology Architecture

(r) Universal accessibility,

(s) Understanding e-Gov prospects

4.3. CSFs and KPI Mapping

All nineteen CSFs found relevant in Indian context post NeGP have been mapped to the thirty three KPIs extracted from EAF version 2.0 and modified

for use in IGAF framework. The mappings have been done based on description and scope of each of them incorporating the concepts of set theory.

4.3.1 Awareness and Communication Strategy

Marketing and publicity are integral parts of successful electronic government initiatives. Traditional media methods and outlets should be used to spread awareness among citizens of newly introduced initiatives. All agencies involved in e-Governance implementation should present a unified front as regards provision of G2C-R and G2C-U services are concerned. All collateral materials sent to "traditional" customers (citizens and end users') should stipulate the source and location of the e-document (Sachdeva et. al., 2006). It should focus on highlighting the following kinds of information with respect to the citizen and government functionaries associated with the initiatives:-

(a) Extent of reduction cost to user-estimate the % reduction in direct cost like travel cost etc.,

(b) Degree of reduction in corruption based on citizen perspective, transparency achieved with the new system

(c) Enhanced revenue benefits to the government from the new system (based on % increase in revenues to the government).

Awareness and Communication strategy should include KPIs associated with cost effective attributes. Thus in equation form Awareness and Communication Strategy with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.1] below:-

$$\mathbf{ACS = CE1 + CE2 + CE3} \qquad \mathbf{[4.1]}$$

The additive weightings of all three KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.2. Clear cut Vision and Goals

Clear cut vision and Goals should clearly outline the following parameters with respect to the citizens of the states and UTs as part of NeGP:-

(a) Existence and functioning of organizational structure for managing the projects

(b) Existence and effectiveness of user groups and service reviews. Based on the existence and effectiveness of the system operators are periodically incorporating the feedbacks

(c) Compliance measure in the % to committed time frame.

(d) Comprehensiveness of the architecture to meet the vision and goals.

(e) A standard technological standard is defined for multiple project integration on common interface.

(f) All transactions are secure and user/citizen privacy is maintained.

(g) Role clarity and degree of employee-buy-in (Change management).

(h) Degree of alignment of service design to user requirement.

Based on the above guidelines clear cut vision and goals can be mapped to six KPIs viz., service orientation user centricity, technological architecture, technological standards, technological standards with respect to security, sustainable organizational structure and incorporation of user reviews and service reviews. Thus in equation form Clear cut vision and Goals with respect to KPIs listed in chapter 3 and tabulated in table 3.2. is represented as in equation [4.2] below:-

CCVG = SOUC2+TA+TSA+TS+SUOS1+*SUOS2*+SUOS4+ SOCC1

[4.2]

The additive weightings of all eight KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.3 Change Management

The delivery of Government services through the e-Governance will lead to administrative, process and legal changes. It may necessitate empowerment of employees and de-layering of decision making levels(Sachdeva et. al., 2006). The various components of Change management are viz., define and identify the various areas of reforms, identify Champion of Change, ensure Commitment to Change, facilitate Participation of Stakeholders, device a Communication Strategy, enable IT Training, set up a Mechanism for Continuous Learning, monitor, evaluate and analyze the Change Process, and provide Support whenever required. It mayinclude the following:-

(a) Existence and functioning of organizational structure for managing the projects.

(b) Role clarity of employees in changed scenario. No ambiguity exists in the roles to be played by employees.

Change Management would include KPIs associated with organizational sustainability in changed environment. Thus in equation form Change Management with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.3] below:-

CM = SUOS1+ SUOS2 **[4.3]**

The additive weightings of both the KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.4 Continuous Feedback

People participation and continuous feedback are essential elements in development and improvement process of all e-Governance initiatives (Sachdeva et. al., 2006). People's Participation/Continuous feedback can be ensured by informing its citizens of its policies and program, budgets, laws and regulations etc. With use of e-participation tools like websites, taking feedback from the citizens through these tools about various legislatures, proposed policies etc., incorporating citizens' input into decision-making, developing local language content and developing local language interface shall effectively enhance use of these applications by the local populace. It should include the following:-

(a) Percentage of user population benefited from e-governance services compared to conventional channels

(b) Reduction in no of visits to the government offices.

(c) Existence and effectiveness of user groups and service reviews. Based on the existence and effectiveness of the system operators periodically in incorporating the feedbacks

Continuous Feedback should include KPIs of service orientation user centricity, service orientation citizen centricity attributes and organizational sustainability attributes. Thus in equation form Continuous Feedback with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.4] below:-

$$\mathbf{CFB = SOUC3+SOCC3+SUOS4} \qquad \mathbf{[4.4]}$$

The additive weightings of all three KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.5 Cost Benefit Analysis

Any e-Governance initiative must start with a clear understanding of the various costs involved in the project. A Cost-Benefit-Analysis of each pilot project adopted needs to be done with respect to citizens, government agency involved and various stake holders viz., public private partners. Each pilot project adopted must focus on the returns on the investments. Short term and long term plans with expected expenditures, income streams and deadlines for each pilot project adopted may be chartered in detail. The benefits of e-Governance range from improvement in service delivery and social welfare of citizens (Sachdeva et. al., 2006). It mayinclude the following:-

(a) Extent of reduction of direct cost to user the % reduction in direct cost like travel cost.

(b) Enhanced revenue benefits to the government-based on increase in revenues to the government.

(c) Degree of reduction in corruption.

Cost Benefit analysis will include all KPIs associated with cost benefit attributes. Thus in equation form Cost Benefit Analysis with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.5] below:-

$$\mathbf{CBA = CE1+CE2+CE3} \qquad \mathbf{[4.5]}$$

The additive weightings of all the three KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.6 E-content

Keeping the citizen informed, providing him with details of Government activities is the function of the government (Sachdeva et. al., 2006).The government should thus align its content as per citizen's requirement, create interfaces in local languages and simplify processes for easy use by its citizens taking advantages of facilities embedded in the software. Based on the above guidelines E-content can be mapped to four KPIs viz., service orientation citizen centricity for creating service design as per user requirement, developing interfaces in local languages, creating legal sustainability for processes by simplifying processes taking advantages of ICT and degree of availability of content of e-government applications. Thus in equation form E-content with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.6] below:-

$$\mathbf{EC = SOCC1 + SOCC2 + SUL1 + TR1} \qquad \mathbf{[4.6]}$$

The additive weightings of all four KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.7 e-Governance Program Management

An effective e-Governance Program Management includes managing multiple project implementations and project scoping includes scoping the deliverables of the projects and incorporating, documenting and communicating change requests of stakeholders (Sachdeva et. al., 2006). The various activities of e-Governance Program Management may include Scope Definition, Cost Estimation, Project Planning, Assessing Risks, Estimating resources, Organizing the work, Acquiring human and material resources, Assigning tasks, Directing activities, Controlling project execution, Reporting progress,

Analyzing the results based on the facts achieved, Quality Assurance, Monitoring and Evaluation, Feedback and Improvement. Thus it may include the KPIs listed in organizational sustainability, commercial sustainability, replication of pilot projects based on technological assessment and commercial assessment. Thus in equation form e-Governance Program Management with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.7] below:-

EGPM=SUOS1+SUOS2+SUOS3+SUOS4+SUCS2+RT1+RT2+RC1 [4.7]

The additive weightings of all eight KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.8. Evaluation and Performance Assessment.

The e-Governance implementations may be studied with respect to service delivery, technology, and reliability attributes. The G2C-U and G2C-R services need to be evaluated as a constant improvement model even while implementation is underway. The interventions may be carried out at each stage of implementation. Bottlenecks and causes of delays should be documented, even though they may be removed later. It mayinclude existence and effectiveness of user groups and service reviews. Based on these feed backs, system operators shall periodically work on incorporating the feedbacks. Evaluation and Performance Assessment would comprise of organizational sustainability attribute concerning with establishment of user groups and incorporation of service reviews. Thus in equation form Evaluation and Performance Assessment KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.8] below:-

EPA = SUOS4 [4.8]

The weightings of organizational sustainability attribute concerning with establishment of user groups and incorporation of service reviews calculated in chapter 3 and tabulated in table 3.5. shall determine the weightings of this CSF.

4.3.9 Formulation of e-Gov Roadmap

The e-Governance Roadmap for states and UTs should lay down a detailed plan for implementation, the policy guidelines, strategy to be adopted, costs to be addressed and areas to focus/concentrate while implementation. The various points that can be of help in extending G2C-R and G2C-U initiatives should include strengthening the pressure points (which will have maximum impact), choose projects which can be easily replicated, identifying projects which have a scope for Public Private Partnerships (PPP), choose projects which will get citizen and leadership support. The chosen projects must evolve from the development agenda of the state and UTs. The projects not having sustainable business model could be evolved for sustenance. The identified projects should be based on technical standards. The selected projects should have low cost of development and less opportunity cost. It may include development of Quality project documentation that is based on the lines of G2C-R and G2C-U implementation system documentation in standard format. Formulation of e-Governance road map is based on technological availability and cost effectiveness attribute as in equation [4.9] below

$$\mathbf{FEGR = TR1 \quad +CE3} \qquad \mathbf{[4.9]}$$

The weightings of technological availability and cost effectiveness attributeKPIs calculated in chapter 3 and tabulated in table 3.5. shall determine the weightings of this CSF.

4.3.10. Info Infrastructure

Information Infrastructure is more than just the physical facilities used to transmit, store, process, and display voice, data, and images (Sachdeva et. al., 2006). The various components would include equipment that integrate and interconnect these physical components, information (video, data and voice), applications and software (that allows users to access, manipulate, organize, and digest the information), network standards and transmission codes (that facilitates interconnection and interoperation between networks), privacy and security policies (that ensures privacy of person, people who create the information, use applications and services, use the facilities offered by the applications), delivery points and data centres (that store the various databases etc., at national, state and city/town/district/village level). It may include the following:-

(a) Percentage of user population benefited from e-Governance services

(b) Percentage of user population from socially & backward classes benefited from e-Governance services

(c) User response compliance to committed time frame.

(d) Reduction in no of visits to the office

(e) Availability of alternate channels to handle system break downs and user peak time load access.

Info infrastructure may include KPIs of service orientation user centricity, commercial sustainability and technological reliability attribute. Thus in equation form Info Infrastructure with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.10] below:-

$$\mathbf{II = SOUC3+ SOUC4+SOUC5+ SUCS5+ TR3} \qquad \mathbf{[4.10]}$$

The additive weightings of all five KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.11. Integrated e-Governance.

Integrated Government focuses on an integrated approach to Government with integration of services across National, State and District Government. It is also integration of Government across various Departments (Sachdeva et. al., 2006). All citizens in all states and UTs can access all e-Governance services through single window kiosks called CSCs. The backend integration of various Departments/levels of Governments is necessary for achievement of Integrated Government. In India the constitution provides the distribution of powers between Centre and States, it is a big challenge to achieve such integration of services. It mayinclude the following:-

(a) Amenability of service delivery through PPP mode-based on degree to which service is amenable to private participation.

(b) Strength of PPP arrangement depending on the credibility of private partner executing the project.

(c) Arrangements to ensure availability of service during user convenient time slots if power and connectivity are available during prime time.

(d) Standard technological standards to enforce integration.

(e) Availability of SLA (service level agreement) for operational contracts.

Integrated e-Governance may include KPIs concerned with commercial sustainability, technological standards to allow such integration and technological reliability of such integrations. Thus in equation form Integrated e-Governance with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.11] below:-

IEG = SUCS1 + SUCS2+ SUCS4+TAS+TR2 [4.11]

The additive weightings of all five KPIs calculated in chapter 3 and tabulated in Table 3.5. will determine the weightings of this CSF.

4.3.12 Human Capacity Building

The Human Capacity building involves not only IT skill building but also skill sets in management, change management and communications. There should be clear plans for human capacity development. In general terms, priority human capacities for e-Governance are 'hybrids': those who understand the technology, the business of governance *and* the role of information in governance (Sachdeva et. al., 2006). Trained set of manpower is required for various tasks involved in use and maintenance of e-Governance applications i.e., capacity to develop information systems, capacity to manage projects and to manage change, capacity to be an 'intelligent customer', able to raise project finance, specify needs, manage procurement, and manage vendors and capacity to operate and maintain information systems. It is only possible if the following is done and continuity in developing trained manpower is maintained:-

(a) Existence and functioning of organizational structure for managing the projects

(b) Role clarity of employees employed by various agencies involved. No ambiguity exists in the roles to be played by employees.

(c) Continuity of top champion for the projects for 3 to 5 years.

Human capacity Building would comprise of all organizational sustainability KPIs. Thus in equation form Human Capacity Building with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.12] below:-

HCB = SUOS1+ SUOS2 + SUOS3 [4.12]

The additive weightings of all the three KPIs calculated in chapter 3 and tabulated in Table 3.5. will determine the weightings of this CSF.

4.3.13. Privacy and Security

The e-Governance application needs to build the trust of citizens in the system. It needs to ensure that the data and transactions of the citizens are secure. The information shared by the citizens should also remain safe and the privacy of the citizen needs to be protected (Sachdeva et. al., 2006). Any citizen e-government transaction involves sharing a lot of personal information, which can be misused by the private sector and anti-social elements. It involves physical security, information security, authentication of user and server security to prevent intrusion into the e-Governance applications network. It mayinclude the following:-

(a) All citizen transactions are in secure mode or not.

(b) Comprehensiveness of architecture to meet needs of the project.

(c) E-Governance applications need to build trust of citizens by ensuring that data transactions of the citizens are secure.

Privacy and security shall include two KPIs of technological architecture and technology security attributes. Thus in equation form Privacy and Security with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.13] below:-

$$\mathbf{PSD = TS+TA} \qquad \mathbf{[4.13]}$$

The additive weightings of technological architecture and technological security attribute KPIs calculated in chapter 3 and tabulated in table 3.5. shall determine the weightings of this CSF.

4.3.14 Re-engineering Process

Re-engineering is radical redesign of business processes to achieve dramatic improvements in performance, cost, quality, service, and speed. E-Governance is distinct from computerization as automation by itself will not eliminate all sources of errors, and avoidable costs delays. It may even add its share of errors and costs (Sachdeva et. al., 2006). Therefore process re-engineering must precede the computerization. The various steps involved in Process Re-engineering may include identifying the candidate processes, understanding the processes, documenting the process, decomposing the process in smaller processes, analyzing the processes, eliminating the processes which are of low criticality but difficult to implement, reforming the process which are of high criticality but difficult to implement, continue the processes which are of high criticality but easy to implement, integrating the processes, automating the Process Steps and ensuring change management. It may include the following:-

(a) Extent to which processes are simplified taking advantage of ICT

(b) Degree of scalability to cover target users-based on provisions to handle large no of user's and transactions without sacrificing response.

(c) Degree of availability should be high degree of availability approx 99.99% with disaster recovery.

(d) Availability of alternative service delivery channels in case of system breakdowns

It shall include KPIs such as sustainability legal attribute, technological scalability attribute to support large user base and technological availability attribute. Thus in equation form Technology Architecture with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.14] below:-

REP = SUL1+TSA+TR1+TR3 **[4.14]**

The additive weightings of all four KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.15 Service Delivery Paradigm

The Government Service Delivery paradigm is facing tough challenges due to constraints of regulatory compliance and cost cutting (Sachdeva et. al., 2006). There is a need to improve the service delivered to the citizen through CSCs post NeGP on dimensions such as speed, quality, reliability, convenience and cost. It needs to incorporate the following features:-

(a) Speed of delivery in response to user demand measured in days/hrs/mins.

(b) Percentage of user population from socially & backward classes benefited from e-Governance services.

(c) Suitability of CSC locations (kiosks) w. r. to socially & economically backward classes.

(d) Arrangements to ensure availability of service during user convenient time slots if power and connectivity are available during prime time.

(e) Extent of reduction cost to user-estimate the % reduction in direct cost like travel cost etc.,

(f) Security feature exists to maintain privacy of citizen.

Thus service delivery paradigm can be a combination of six KPIs viz., service orientation user centricity, commercial sustainability, cost effectiveness and technological security. Thus in equation form Service Delivery Paradigm with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.15] below:-

SDP = SOUC1+SOUC5+SOUC6+SUCS4+CE1+TS **[4.15]**

The additive weightings of all six KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.16 Sustainable Business Model

The success of the project is guaranteed through sustainable business model. The sustainable models could be either of the types i.e., Government owned, Private partnership, BOO (build-own-operate), BOOT (build-own-operate and transfer), SPV model and externally funded projects. It mayinclude the following:-

(a) Strength of PPP arrangement depending on the credibility of private partner executing the project.

(b) Collection of user charges if the service created provide good stream of revenue.

(c) Enhanced revenue benefits to the government-based on increase in revenues to the government.

Sustainable Business Model may include KPIs associated with sustainability commercial and cost effectiveness attributes. Thus in equation form Sustainabilty Business Model with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.16] below:-

$$\mathbf{SBM = SUCS2+SUCS3+CE2} \qquad \mathbf{[4.16]}$$

The additive weightings of all three KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.17 Technology Architecture

E-Governance Technology Architecture is a set of guidelines, concepts, principles, rules, patterns interfaces and standards to follow when building a

new IT capability. It is a description of a complex system, its purpose, structure, components, as well as how these interrelate, at one point in time (Sachdeva et. al., 2006). A good e-Governance technological architecture allows for a multitude of different technologies, is based on open standards, provides adequate security and data protection, is accessible to all stakeholders, is interoperable, can be scaled for future. It should have the following guide lines:-

(a) Speed of delivery in response to user demand measured in days/hrs/mins

(b) Compliance measure in the % to committed time frame.

(c) Comprehensiveness of the architecture to meet the vision and goals.

(d) Degree of scalability to cover target users-based on provisions to handle large no of user's and transactions without sacrificing response.

(e) Degree of availability should be high degree of availability approx 99.99% with disaster recovery.

(f) Degree of availability.

It should comprise of KPIs concerning service orientation user centricity, comprehensiveness of technological architecture and technological scalability attribute. Thus in equation form Technology Architecture with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.17] below:-

$$\mathbf{TA = SOUC1+SOUC2+ TA+TSA+TR1} \qquad \mathbf{[4.17]}$$

The additive weightings of all five KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.18 Universal Accessibility

All citizens of the country should have the opportunity to access the introduced e-Governance initiative. There are many causes of the digital divide. This may include the linguistic barriers wherein the content may be created in language for the majority population but the content for the minority population may not be there. Further the online services which are designed are made so sophisticated that they become inaccessible to the common man. Further a few services are now charged online which are available free offline (Sachdeva et. al., 2006). The population in villages of states and UTs of India have been provided with Kiosks (one in a group of 6 to 7 villages) called CSCs for community access to e-Governance. The access needs to be combined with the training to use the developed e-government applications effectively. It should include the following:-

(a) Percentage of user population benefited from e-Governance services

(b) Percentage of user population from socially & backward classes benefited from e-Governance services

(c) User interfaces in local language. Extent of use of local language in user interface.

(d) Availability of e-services during user convenient time slots if power and connectivity are available.

(e) Availability of alternative service delivery channels in case of system breakdowns

Thus universal accessibility should contain KPIs containing service orientation user centricity, service orientation citizen centricity, and commercial sustainability. Thus in equation form Universal Accessibility with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.18] below:-

UA = SOCC2+SOUC3+ SOUC4+SOUC6+ SUCS4+TR3 [4.18]

The additive weightings of all six KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.3.19 Understanding e-Gov Prospects

The process of Governance needs a transform to migrate to e-Governance scenario by introducing change Management, resource Management, process reforms, administrative reforms, organization re-structuring, information management, knowledge management, legal reforms, technology management and many more components. All this can be done by domain experts however the IT experts can help them streamline processes with the supported architecture (Sachdeva et. al., 2006). It shall include the following:-

(a) Degree of alignment of service design to citizen's requirement. It is an indicator to extent of user requirement is covered in service design.

(b) Quality of project documentation based on the availability of system documentation in standard format.

(c) Quality of user manuals. Based on how well user instructions are presented.

(d) User interfaces in local language.

Understanding e-Governance prospects may include KPIs such as service orientation citizen centricity and project technological replication attributes for incorporating pilot projects and extending on common interface. Thus in equation form Understanding e-Government Prospects with respect to KPIs listed in chapter 3 and tabulated in table 3.2. can be expressed as in equation [4.19] below:-

UEGP = SOCC1+RT1+RT2+SOCC2 [4.19]

The additive weightings of all four KPIs calculated in chapter 3 and tabulated in table 3.5. will determine the weightings of this CSF.

4.4. Relative weightings of CSFs

The relative weightings of all 19 CSFs are calculated using equations 4.1. to 4.19 of section 4.3 based on concepts of set theory. The weightages of all KPIs are added to arrive at weightings of individual CSFs. The total weight thus obtained is then normalised to get the relative weight/normalised relative weight of CSFs. The relative importance of CSFs in Indian context post NeGP derived from IGAF framework and subsequent AHP analysis based on KPIs has been calculated as in Table 4.1. The relevance of CSFs had been stated in Indian context (Sachdeva et al., 2006), but such detailed and deliberate analysis has never been attempted. All 19 CSFs in order of relevance are: *Clear cut vision and goals, E-content, Universal accessibility, Understanding e-Gov prospects, Service delivery paradigm, e-Gov program management, Technology Architecture, Re-engineering process, Info infrastructure, Continuous feedback, Awareness and communication strategy, Cost benefit analysis, Integrated e-Governance, Privacy and security, Sustainable business model, Formulation of e-Gov roadmap, Change management, Human capacity building, Evaluation and performance assessment.*

Table 4.1: Relative weightings of CSFs

CSFs	KPI1	KPI2	KPI3	KPI4	KPI5	KPI 6	KPI 7	KPI 8	Total Weight	Relative Weight
	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	$=\sum_{n=1}^{8} W_n$	$=\frac{\sum_{n=1}^{8} W_n}{\sum_{n=1}^{19}\sum_{n=1}^{8} W_n}$
CCVG	0.032	0.066	0.04	0.04	0.04	0.016	0.016	0.016	0.2675	0.1177
EC	0.066	0.066	0.0132	0.066	×	×	×	×	0.2112	0.0929
UA	0.032	0.032	0.032	0.066	0.0132	0.010	×	×	0.1856	0.081
UEGP	0.066	0.066	0.025	0.025	×	×	×	×	0.116	0.080
SDP	0.032	0.032	0.032	0.04	0.010	0.033	×	×	0.1795	0.079
EGPM	0.016	0.016	0.016	0.016	0.010	0.025	0.025	0.05	0.1765	0.077
TA	0.032	0.032	0.04	0.04	0.013	×	×	×	0.1572	0.069
REP	0.04	0.0132	0.0132	0.066×	×	×	×	×	0.1324	0.058
II	0.032	0.032	0.032	0.0132	×	×	×	×	0.1197	0.0527
CFB	0.032	0.066	0.016	×	×	×	×	×	0.1145	0.050
ACS	0.033	0.033	0.033	×	×	×	×	×	0.099	0.043
CBA	0.033	0.033	0.033	×	×	×	×	×	0.099	0.043
IEG	0.04	0.013	0.010	0.01	0.01	×	×	×	0.084	0.037
PSD	0.04	0.04	×	×	×	×	×	×	0.08	0.035
SBM	0.010	0.010	0.033	×	×	×	×	×	0.054	0.0238
FEGR	0.013	0.033	×	×	×	×	×	×	0.0462	0.020
CM	0.016	0.016	×	×	×	×	×	×	0.032	0.0145
HCB	0.016	0.016	×	×	×	×	×	×	0.032	0.0145
EPA	0.016	×	×	×	×	×	×	×	0.016	0.0072

All nineteen CSFs in order of importance has been depicted in form of bar chart as in Figure 4.1.:

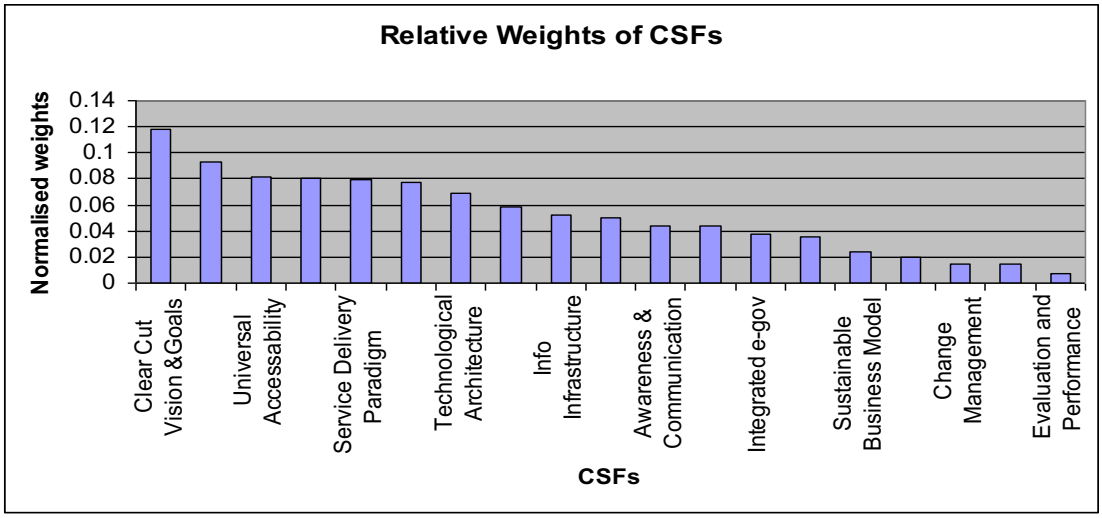

Figure 4.1: Relative weights of CSFs

4.5. eGAI in terms of CSFs

eGAI has been defined as a cumulative index of all KPIs with their weightings derived from the EAF version 2.0 framework modified for assessment of states and UTs for G2C-R and G2C-U services implementation. It had been pointed out in chapter 3 section 3.7 that inputs on these KPIs are difficult to obtain, thus inputs would be obtained on CSFs. The cumulative index eGAI thus needs to be developed with respect to CSFs for prima facie assessment of states and UTs. eGAI values with respect to CSFs and their relative weightings have been developed as given in equation 20 below

eGAI = 0.1077 CCVG + 0.0929 EC +0.081 UA + 0.080 UEGP +0.079 SDP + 0.077 EGPM + 0.069 TA + 0.058 REP +0.0527 II + 0.050 CFB + 0.043 ACS + 0.043 CBA + 0.037 IEG + 0.035 PSD + 0.0238 SBM + 0.020 FEGR + 0.0145 CM+ 0.0145 HCB + 0.0071 EPA

[20]

The prima facie assessment yardsticks as depicted in table 3.6. for states and UTs for G2C-R and G2C-U services implementation would thus be modified as in Table 4.2. below.

Table 4.2: Assessment Yardsticks for States and UTs for G2C-R and G2C-U Services Implementation

Sr. No	Score Range	Category	Remarks
1	70 and above	Extremely Good	Strategy Unchanged
2	50 to 69	Good	Qualifies for further improvement by replicating successful projects
3	40 to 49	Satisfactory	Scope for improvement by replicating strategy of leaders
4	Below 40	Poor	Amenable to improvement through course correction/gap filling

4.6. Design of Questionnaire for Multi-stakeholder survey.

The questionnaire instrument consists of two parts viz., inputs on CSFs and input based on majority of the projects adopted by each district centre and integrated on a common interface. All questions based on 19 CSFs relevant in India post NeGP are closed questions with options based on themes. The respondents have to assess all nineteen KPIs based on given themes or a combination of themes. The second part contains one open question giving details of projects adopted and integrated on a common interface. The design of questions in questionnaire instrument was done based on the six step thematic analysis technique (Greg et al., 2012):-

Step 1: Familiarization with Data

The aim and scope of each CSF is read and re-read and equations are formulated to identify likely patterns in the data.

Step 2: Generating Initial Codes

The aim and scope of each CSF was classified into likely labels in order to create categories for analysis.

Step 3: Searching Themes within Codes

Combine labels/codes into over-arching themes that accurately depict the data.

Step 4: Reviewing Themes

A coherent recognition was drawn of how themes are patterned to tell an accurate story about the data.

Step 5: Defining and Naming Themes

A comprehensive analysis of what the themes contribute to understanding the data.

Step 6: Producing Final report

The final report should give why particular themes are more useful at making contributions and understanding what is going on within the data set. It needs to be describe the process of choosing the way in which the results should be reported

This six step methodology was adopted for developing theme based options for all nineteen CSFs based on equations 4.1 to 4.19. The development of theme based was based on studies carried out at District centre and CSCs located in and around Ranchi and Ramgarh districts.

4.6.1 Pre-testing the Questionnaire

Pretesting of the questionnaire was carried out at Ranchi and Ramgarh district centres, at all CSCs in Ranchi and Ramgarh district and NIC Nodal centre located in the state of Jharkhand. The state of Jharkhand had started adopting e-

Governance projects prior to implementation of NeGP program. A participative pre-test was conducted among the VLEs, SDA representatives, NIC representatives and citizens using e-governance offerings in these two districts of Jharkhand. The respondents were briefed in advance about the nature of the survey conducted. The respondents after having filled the questionnaire also gave their suggestion on the form content, wording and order of the questionnaire. After revising the questionnaire on the basis of the suggestions received, a second round of pre-test was again conducted in the two districts of Jharkhand with a different set of VLEs, SDA representatives, NIC representatives and citizens using e-governance offerings. The respondents, however, were not informed about the pre-test nature of the questionnaire. Necessary amendments were made to the questionnaire based on inputs received after two rounds of pre-test. The details of inputs received from respondents after pre-test and the changes incorporated are depicted in Table 4.3 below:

Table 4.3: Pre-Test Inputs and the Changes Incorporated in the Questionnaire

Sr. No	Changes in Questionnaire	Procedure of incorporating changes in questionnaire	Remarks
1.	Themes made coherent	• Themes arranged in order of facilities and ease of use by users'	• Ease of filling the questionnaire
2.	CSFs listed as per order of preference	• CSFs were listed in order of preference for ease of response.	• Stakeholders could refer to the program documents while filling responses

4.6.2 Re-design of Questionnaire

The questionnaire instrument in two parts was re-designed incorporating the pre-test inputs (See Appendix II). Part I was designed to seek inputs of all stakeholders (users, government representatives, and implementers) in NeGP implementation in states and UTs of India. The respondents were required to indicate applicable themes in all nineteen CSFs. Part II was designed to seek inputs on e-Governance pilot projects already implemented and extended to users on a common interface. This part is essential in compilation of results.

4.6.3 Validity of Questionnaire

The multi-stakeholder questionnaire based on KPIs and their mapping with CSFs did not adopt confidence and multi-co-linearity tests as the methodology of construction of questionnaire incorporated the concepts of thematic analysis i.e., use of themes as labels. The labels were converted to code values as has been discussed. The bias in the responses have been overcome by using fuzzy techniques in analysis

4.7 Multi-stakeholder Questionnaire Survey

The questionnaire survey was conducted online by mailing the questionnaire to each District Centre and telephonically contacting the NIC representative of each District Centre to explain the aim and objectives of the survey. The various stakeholders involved viz., VLEs responsible for provision and maintenance of CSCs, representative of Service Centre Agency (SCA) to control CSCs in one or two districts, representative of SDA (state designated agency) responsible for SWAN and state data centres and users extensively using G2C-R and G2C-U service applications were explained the aim and objective of the survey by the NIC representatives. The inputs so received by various stakeholders' was then verified and cross checked telephonically to ascertain the correctness of the

input. The inputs received for each district centre was then aggregated and results for each district centre were compiled. The inputs for each district centre were then aggregated and averaged to get all the nineteen CSF inputs for each state and UT. The survey being a prolonged process because of the number of stakeholders' involved took approximately 180 days for receiving inputs from all district centres of states and UTs of India. The compilation of results including verification and cross-checking of inputs took another 90 days. The survey was conducted in the month of June to December 2009. The compilation of results was done from January 2010 to Mar 2010.

4.8 Respondent Profile for Multi-stakeholder survey

A total of 640 districts exist in India. Each district has a District Centre; however there are a few District Centres that are responsible for one or more districts. Of the 640 districts only 581 could be contacted. The state wise details of the number of District centres which could be contacted has been given in table 4.3. below. Each district centre has at least one NIC representative who is responsible for at least 6 to 7 CSCs under its jurisdiction. The NIC representative is also responsible for co-ordination between various stakeholders' involved in provision of G2C-R and G2C-U services to the citizens of the district. The details of the NIC representative i.e., their names, their mail-id, their contact numbers and areas of responsibility were collected from the NIC portal. NIC representatives were initially contacted in the month of April 2009 to June 2009. The aim of the survey was explained to them and their co-operation in conduct of such survey was solicited. The questionnaires based on these 19 CSFs were then mailed to each of them in month of Jun 2009. The questionnaire was to be circulated among village level entrepreneurs, representatives of service centre agency, representatives of state designated agencies, user representatives who are using these applications frequently for day to day transactions with the government agencies. A total of 1638

completed responses were received which have been used for further analysis. Completed multi-stakeholder responses for each state/UT which has been used for analysis and giving details of districts, number of district centres, number of NIC representative inputs, number of SDA representative inputs, number of user representative inputs, number of VLE representative inputs and number of SCA representative inputs has been tabulated as in Table 4.4 below.

Table 4.4: Respondent Profile of Multi-stakeholder Survey

Sr. No	States/UTs	Dist	Dist Centres	NIC rep	SDA	User	VLE	SCA rep	Total
1	Andaman & Nicobar	03	02	02	02	02	01	01	08
2.	Andhra Pradesh	23	23	18	04	04	16	12	54
3.	Arunachal Pradesh	16	12	08	06	04	02	03	35
4.	Assam	27	27	21	09	14	12	08	64
5.	Bihar	38	24	22	08	08	06	04	72
6.	Chandigarh	01	01	02	02	04	01	01	10
7.	Chattisgarh	18	16	13	07	08	08	03	55
8.	Dadar & Nagar Haveli	01	01	02	02	06	01	01	12
9.	Daman & Diu	02	02	03	02	05	01	01	12
10.	Delhi	09	09	08	06	08	02	02	26
11.	Goa	02	03	03	03	03	03	03	15
12.	Gujarat	26	22	20	08	09	08	06	51
13.	Haryana	21	19	14	08	09	08	04	43
14.	Himachal Pradesh	12	13	12	08	08	06	04	38

Sr. No	States/UTs	Dist	Dist Centres	NIC rep	SDA	User	VLE	SCA rep	Total
15.	Jammu & Kashmir	22	14	12	06	06	08	03	35
16.	Jharkhand	24	21	18	08	12	08	08	54
17.	Karnataka	30	23	21	07	12	06	06	52
18.	Kerala	14	12	12	08	08	06	06	40
19.	Lakshadweep	01	01	02	02	04	02	02	12
20.	Madhya Pradesh	50	43	38	18	28	08	09	101
21.	Maharashtra	35	35	32	21	23	08	08	92
22.	Manipur	09	09	06	06	13	04	04	33
23.	Meghalaya	07	07	05	04	12	02	02	25
24.	Mizoram	08	08	06	04	13	03	03	29
25.	Nagaland	11	08	05	04	12	04	04	29
26.	Orissa	30	30	23	06	18	12	13	72
27.	Pondicherry	04	04	03	03	12	02	02	22
28.	Punjab	20	17	14	08	15	06	08	51
29.	Rajasthan	33	32	23	09	18	19	17	86
30.	Sikkim	04	04	03	04	12	02	02	23
31.	Tamil Nadu	32	30	24	08	22	18	17	89
32.	Tripura	04	04	03	03	12	03	03	24
33.	Uttara Khand	13	13	12	10	14	08	08	52
34.	Uttar Pradesh	72	70	62	14	72	11	11	170
35.	West Bengal	19	18	12	12	13	07	08	52
	Total	640	581	484	240	443	222	197	1638

The respondent details diagrammatically represented in form of barchart are as shown in Figure 4.2.

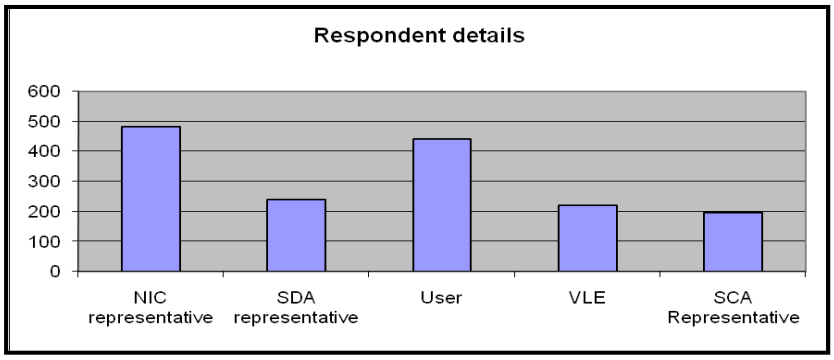

Figure 4.2.: Respondent details

The respondent details diagrammatically represented in form of pie chart are as shown in Figure 4.3.

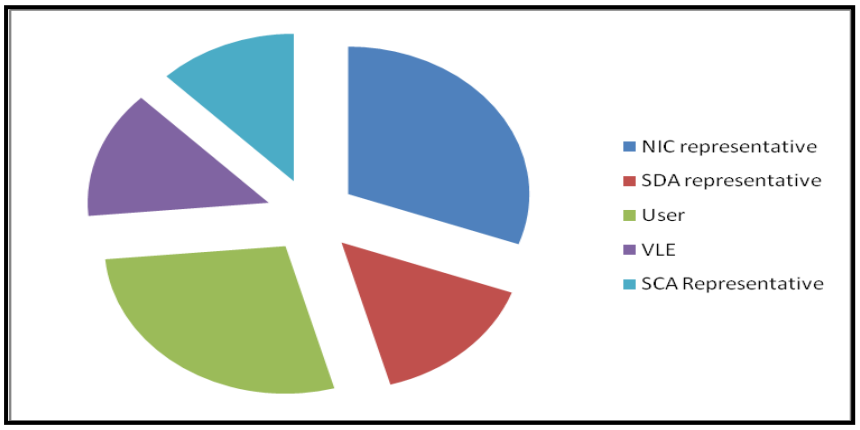

Figure 4.3.: Respondent Details

4.9 Analysis of Multi-stakeholder Questionnaire Survey

The analysis of questionnaire survey being an elaborate method for each of the 35 states and UTs; however the methodology adopted has been elaborated for Andaman and Nicobar Islands. The analysis has been deliberated in two subsections i.e., respondent details and inputs obtained

4.9.1 Respondent Details

Andaman and Nicobar islands have been divided into three district viz., North and Middle Andaman, South Andaman and Nicobar. At the time of survey the three districts were supported by two district centres located at Port Blair and Car Nicobar. North and Middle Andaman district was supported from district centre located at Port Blair. The respondent details for Andaman and Nicobar island multi-stakeholder input is as shown in Table 4.4

Table 4.5: Respondent Details of Andaman & Nicobar Islands for Multi-Stakeholder Survey

Respondents	NIC representative	SDA representative	SCA representative	VLEs	Users
Number of Respondents	2	2	1	1	2
Total Respondents					8

The respondent details for multi-stakeholder survey in Andaman & Nicobar Islands has been shown in form of bar chart as in Figure 4.4 below

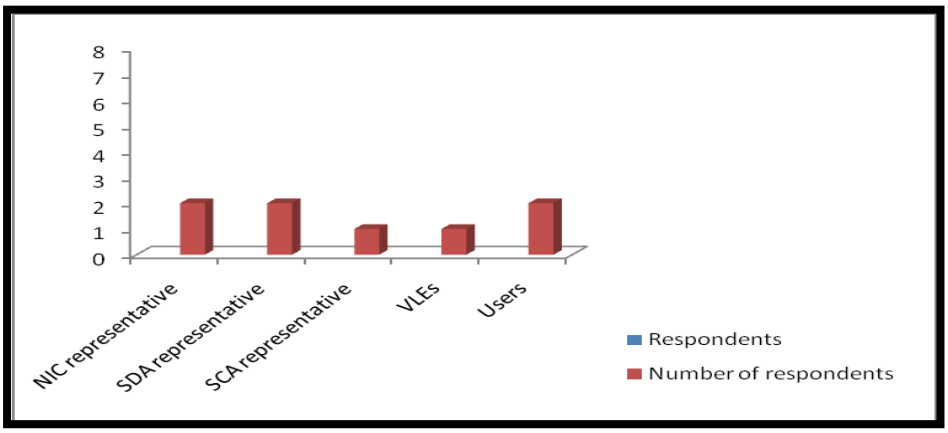

Figure 4.4: Respondent Details in Multi-stakeholder Survey of Andaman & Nicobar Islands

4.9.2 Inputs on CSFs

The inputs received from multi-stakeholders' of Andaman & Nicobar islands viz., NIC representatives, SCA representatives, SDA representatives, VLEs and users have been compiled and converted into pre-formulated relevant codes for analysis. The codes have been formulated for each availiable option of the nineteen CSFs. Similar compilations were done for each state and UT and the same has been consolidated in section below. The inputs obtained from multi-stakeholder respondents on all 19 CSFs have been tabulated for Andaman & Nicobar islands in Table 4.5

Table 4.6: Inputs of Multi-stakeholder respondents of Andaman & Nicobar Islands

Sr. No	CSFs	Input 1	Input 2	Input 3	Input 4	Input 5	Coding score
1	Clear Cut Vision & Goal	-	6	2	-	-	2
2	E-content	-	5	3	-	-	2
3	Info Infrastructure	-	2	6	-	-	3
4	Human capacity Building	-	5	3	-	-	2
5	Awareness & Communication Strategy	-	6	2	-	-	2
6	Technology Architecture	-	3	5	-	-	3
7	Privacy & Security	-	8	×	×	×	5
8	Change		2	6			3

Sr. No	CSFs	Input 1	Input 2	Input 3	Input 4	Input 5	Coding score
	Management						
9	Formulation of e-Governance Roadmap	-	5	3	-	-	2
10	e-Governance Program Management	-	6	2	-	-	2
11	Integrated e-Governance	-	-	3	5	-	4
12	Re-engineering Process	-	6	2	-	-	2
13	Universal Accessibility	-	5	3	-	-	2
14	Service Delivery Paradigm	-	2	6	-	-	3
15	Understanding e-Governance Prospects	-	5	3	-	-	2
16	Continuous Feedback	-	6	2	-	-	2
17	Cost Benefit Analysis	-	3	5	-	-	3
18	Sustainable Business Model	-	3	5	-	-	3
19	Evaluation & Performance Assessment	-	6	2	-	-	2

4.10 Inputs on Questionnaire: State and UTs

The completed inputs were compiled District Centre wise and then aggregated at the state/UT level. The average of responses for each CSF for each state/UT was tabulated. Based on the inputs of CSFs for each state/UT and using equation [20] eGAI values for each state/UT were calculated. The aggregated average inputs received from all District Centres of all states/UTs on all 19 CSFs and the eGAI values on 1 to 100 scale is as given in table 4.4. below:-

Table 4.7: Aggregated CSF and eGAI Values for States and UTs

Sr. No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI values
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Andaman & Nicobar	2	2	3	2	2	3	5	3	2	2	4	2	2	3	2	2	3	3	2	47.99
2	Andhra Pradesh	5	4	5	4	5	4	5	4	5	4	4	4	5	5	4	4	4	4	4	82.66
3	Arunachal Pradesh	1	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	2	2	22.96
4	Assam	3	4	3	3	4	4	5	2	2	3	3	2	2	3	3	3	2	3	3	58.67
5	Bihar	4	2	2	3	1	3	5	3	2	2	2	2	2	3	2	1	2	3	2	49.61
6	Chandigarh	4	4	5	4	4	4	5	4	4	3	4	4	4	5	4	4	4	3	4	76.51
7	Chattisgarh	4	5	3	4	3	4	5	3	4	4	4	3	3	4	4	3	3	3	3	71.26
8	Dadar & Nagar Haveli	1	1	1	2	1	1	1	2	2	1	1	1	1	2	1	1	2	2	2	22.98
9	Daman & Diu	2	3	2	3	2	3	5	3	3	2	2	2	2	3	2	3	3	2	3	50.15
10	Delhi	3	4	5	4	3	5	5	4	3	2	3	3	4	4	2	4	4	4	3	70.83
11	Goa	3	4	4	4	3	4	5	4	4	3	5	5	4	4	2	2	4	3	3	71.44
12	Gujarat	5	4	5	5	4	5	5	4	5	5	5	5	4	5	2	5	4	3	5	85.59

Sr. No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI values
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
13	Haryana	5	4	5	5	4	4	5	4	5	5	5	5	4	4	4	4	4	5	5	83.87
14	Himachal Pradesh	4	4	3	3	3	3	5	3	3	3	3	3	3	4	3	2	3	3	3	63.15
15	Jammu & Kashmir	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20.51
16	Jharkhand	3	3	2	3	1	3	5	3	3	2	2	2	2	3	3	2	3	3	3	50.70
17	Karnataka	5	5	5	5	5	5	5	4	5	5	4	4	5	4	5	5	5	5	4	88.83
18	Kerala	3	4	3	4	5	5	5	4	4	3	3	2	3	3	3	3	3	3	3	70.95
19	Lakshadweep	4	4	4	4	4	4	5	4	4	3	4	3	3	3	2	3	3	3	4	72.80
20	Madhya Pradesh	4	4	3	4	4	4	5	3	3	3	4	4	5	4	3	4	3	3	3	70.50
21	Maharashtra	3	5	3	4	5	4	5	3	3	3	3	4	3	4	3	2	3	3	3	70.51
22	Manipur	3	4	2	3	2	3	5	3	2	3	3	2	2	3	2	2	3	3	3	54.70
23	Meghalaya	3	3	3	3	2	2	5	3	2	2	2	2	2	2	2	2	2	3	2	49.75
24	Mizoram	3	2	2	3	2	2	5	3	2	2	2	2	2	2	2	2	2	2	3	46.98
25	Nagaland	3	3	1	1	2	2	1	2	2	2	1	1	1	2	2	2	2	2	2	32.46
26	Orissa	3	4	4	4	3	4	5	3	3	3	4	3	3	4	3	3	3	4	4	66.79
27	Pondicherry	3	3	3	3	3	3	5	3	3	2	2	2	2	3	3	2	2	3	3	55.59
28	Punjab	3	5	4	4	5	4	5	3	3	3	3	3	4	4	3	3	4	3	4	72.32
29	Rajasthan State/UT	4	4	3	4	4	3	5	3	3	3	3	3	2	3	2	2	3	3	3	65.73
30	Sikkim	3	2	2	2	2	3	5	3	2	2	2	2	2	2	2	2	2	3	3	46.86
31	Tamil Nadu	5	4	4	5	4	5	5	4	5	4	4	5	5	5	3	3	3	3	3	84.99

Sr. No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI values
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
32	Tripura	3	4	3	3	2	4	5	3	3	3	3	2	2	3	3	2	3	3	3	59.39
33	Uttarakhand	3	4	3	3	3	3	5	3	3	3	2	3	2	3	3	2	3	3	3	59.38
34	Uttar Pradesh	3	4	3	4	3	3	5	3	4	4	4	3	3	4	4	3	3	3	3	65.14
35	West Bengal	3	4	3	3	4	4	5	3	3	3	3	3	3	4	3	3	3	3	3	64.27

4.11 Survey Results

The cumulative index eGAI values based on CSFs calculated using equation [20] for all thirty five states/UTs on 1 to 100 scales has been calculated in Table 4.4. The highest eGAI value was found for state of Karnataka with a value of 88.83 and lowest value was found to be 20.51 for Jammu and Kashmir state. The eGAI values for each state and UT has been depicted in form of bar chart as in Figure 4.4.below.

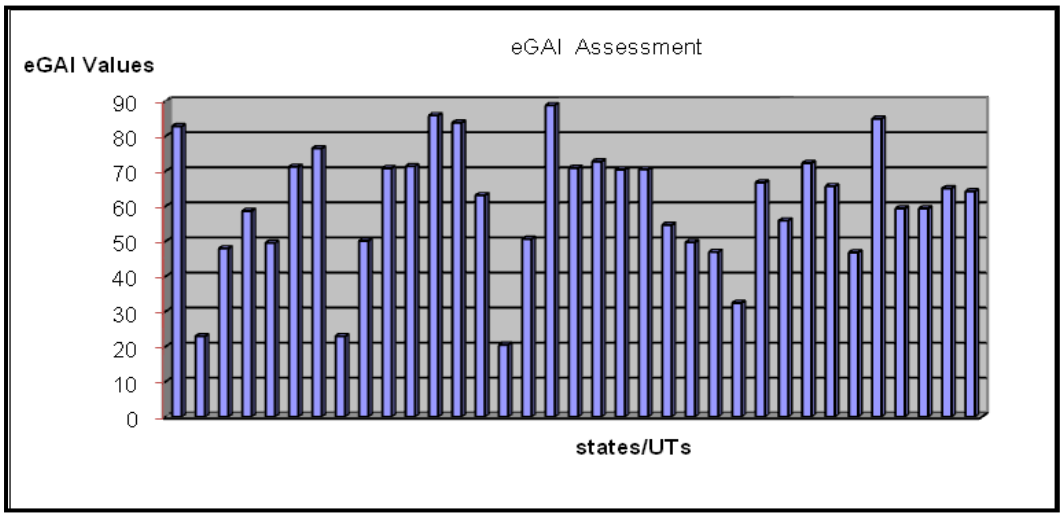

Figure 4.5.: eGAI values for States/UTs

4.12. Division of states and UTs based on eGAI values. Prima facie assessment division of states/UTs using e-Governance Cumulative Index (eGAI) yardsticks expressed in table 4.2. is as shown in table 4.5. below:-

Table 4.8: Division of States and UTs based on eGAI Assessment Yardsticks

(adapted from EAF version 2.0 framework)

Sr. No	Score Range	Category	States/UTs
1	70 and above	Extremely Good	Andhra Pradesh, Chandigarh, Chattisgarh, Delhi, Goa, Gujarat, Haryana, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharastra, Punjab, TamilNadu
2	50 to 69	Good	Assam, Daman & Diu, Himachal Pradesh, Jharkhand, Manipur, Orissa, Pondicherry, Rajasthan, Tripura, Uttarakhand, Uttar Pradesh, West Bengal
3	40 to 49	Satisfactory	Andaman & Nicobar, Bihar, Meghalaya, Mizoram, Sikkim
4	Below 40	Poor	Arunachal Pradesh, Dadar & Nagar Haveli, Jammu & Kashmir, Nagaland

4.13 Interlinkage of CSFs

Critical success factors are the areas in which good performance is necessary to ensure attainment of vision/goals (Rockart et al., 1979). Critical success factors are areas of activity that should receive constant and careful attention from management during the process of NeGP implementation in states and UTs of India. A CSF or a combination of CSFs decides the strategy of an organization/government. The current status of performance in each area should be continually measured, and that information should be made available to all stakeholders' involved in strategic implementation of NeGP in states and UTs

of India. CSF based control system must be tailored to the specific organization/government in which the organization/government operates and to the specific strategies that it has adopted; it must identify the 'critical success factors' that should receive careful and continuous management attention if the organization/government has to be successful; and it must highlight performance with respect to these key variables in reports to all levels of management.

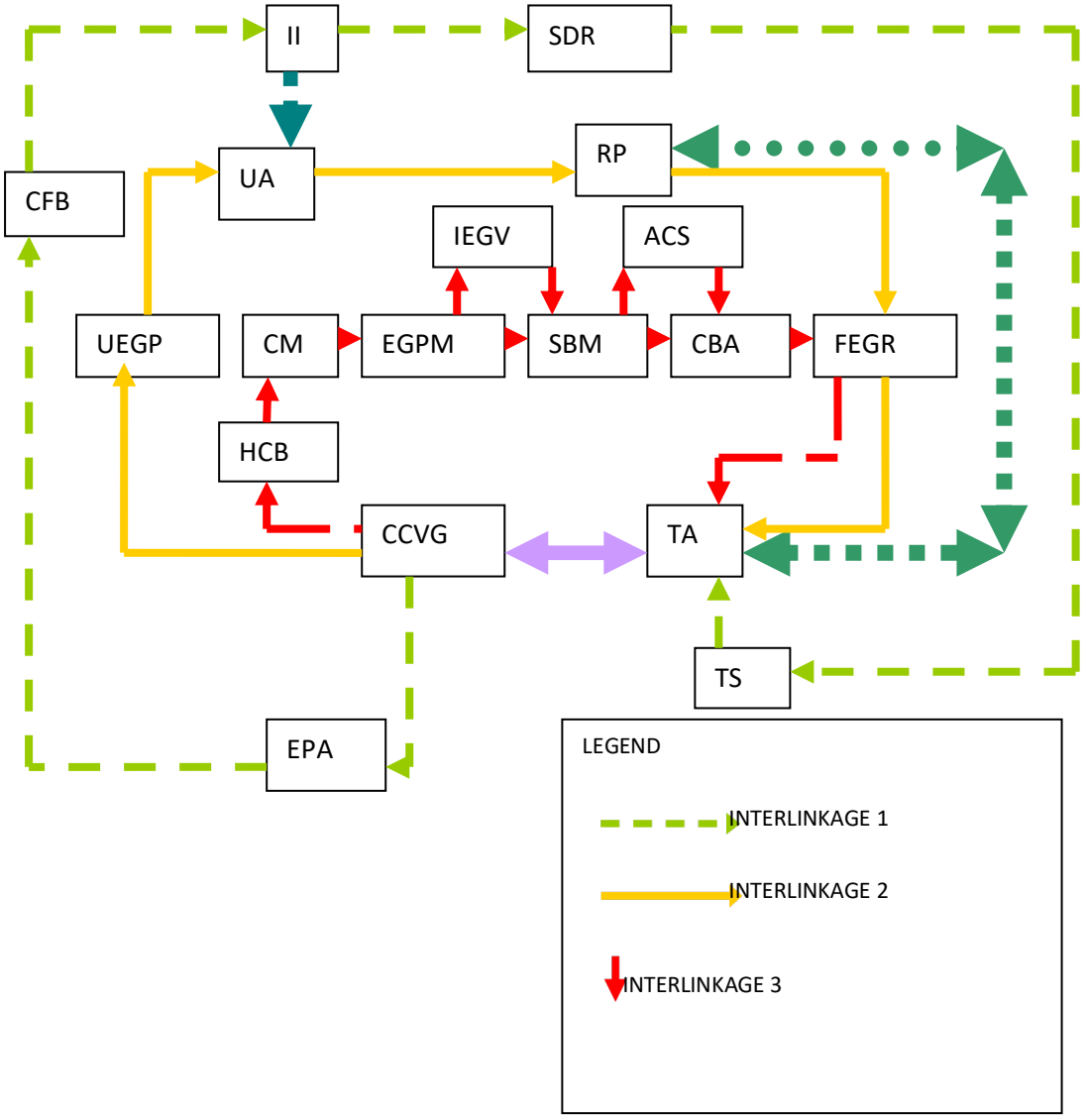

Figure 4.6: Interlinkage of CSFs

A small but significant part of the information concerning the status of CSFs requires subjective assessment on the part of others in the organization, rather

than being neatly quantifiable (Rockart et al., 1979). Therefore in our assessment to decide on the CSFs for each division of states and UTs, the KPIs were adapted from summary assessment scheme of EAF version 2.0 frame work and integrated into our IGAF framework. The 33 KPIs of summary assessment framework adapted for integrated assessment in NeGP scenario were mapped to CSFs to give us the CSFs or a combination of CSFs that decide the strategy of states/UTs for implementation of NeGP.

All possible interlinkages of CSFs based on KPIs adapted from summary assessment scheme of EAF version 2.0 framework and integrated into IGAF have been depicted. Five interlinkages of CSFs have been identified based on commonality of CSFs derived from equations 4.1 to 4.19 have been shown in Figure 4.6. The five interlinkages of CSFs are a combination of all possible strategies that could be followed by states and UTs for implementation of NeGP. These possible strategies could be used by States and UTs as optimal strategies for maximizing benefits to citizens/users while implementing NeGP.

4.12 Conclusion

This chapter in the research work extends the multi-criteria framework developed for evaluation of e-Governance pilot projects i.e., EAF framework. Our research work has aimed at developing a multi-criteria evaluation framework, IGAF framework (based on EAF version 2.0) for integrated benefit assessment of G2C-U and G2C-R initiatives in states and UTs of India post NeGP. The inputs on KPIs for integrated benefit assessment of all adopted projects and extended on a common interface to the citizens' of the states and UTs were difficult to obtain. The KPIs were then mapped to CSFs for obtaining inputs of multiple stakeholders' involved in G2C-U and G2C-R implementation as part of NeGP. These mapping between KPIs and CSFs based on aim and scope of each of them were used to obtain inputs of multiple stakeholders'

involved in G2C-U and G2C-R implementation at the lowest level of strategic implementation of NeGP i.e., District Centres. The inputs obtained from multiple stakeholders' involved in G2C-U and G2C-R implementation were compiled at District Centre and then aggregated at the state/UT level to get the cumulative assessment index value, e-Governance assessment index (eGAI). The cumulative assessment index yardsticks were used to divide the states and UTs in to four divisions. This division based on eGAI values may not be accurate, therefore clustering techniques viz., k-means clustering and fuzzy c-means clustering have been attempted in next chapter to get accurate divisions based on 19 CSFs and eGAI values.

Other aim of our research work was to draw lessons from the adoption experience of G2C-U and G2C-R implementation of 'leader' state and UT as part of NeGP to be emulated by state/UTs lagging behind in G2C-U and G2C-R implementation as part of NeGP. The lessons could be drawn by studying the strategic guidelines adopted by 'leader' state /UT at lowest level of implementation i.e., District Centres. The strategic guidelines could be obtained from the assessment data obtained from multi-stakeholder survey conducted at each district Centre of 'leader' state/UT. The assessment data from multi-stakeholder survey was obtained on all 19 CSFs. These CSFs were interlinked based on common KPIs between them. These interlinkages in conjunction with the assessment data shall give us the strategy adopted by each states/UTs for G2C-U and G2C-R implementation as part of NeGP at lowest level of implementation. The strategic guidelines of the 'leader' states and UTs and those lagging behind in G2C-U and G2C-R implementation as part of NeGP can be deduced in subsequent chapters using Clustering techniques. The minimum and maximum values of 'critical CSFs' (CSFs that change value within cluster limits) for each cluster combined with the interlinkages shall determine the strategy for each cluster. The interlinkages evaluation for identifying the

'critical interlinkage' (the interlinkage whose minimum number of CSF and minimum CSF value perturbations help migrate states and UTs to next higher cluster eGAI values) for each cluster can be done using offline process diagnosis technique i.e., Fuzzy Inference Systems. Offline simulation with the 'critical Interlinkage' and rules developed from the data set of cluster of states/UTs lagging behind in G2C-U and G2C-R implementation as part of NeGP has been done using Fuzzy Inference systems in subsequent chapters.

ISBN: 978-81-946587-3-3

Chapter 5

Survey Analysis and Clustering

5.1 Introduction

Prima facie assessment of states and UTs based on multi-stakeholder inputs and eGAI values was done as outlined in modified EAF version 2.0 frame work in the previous chapter. The states and UTs were divided based on the assessment yardsticks outlined in the EAF version 2.0 frame work and the states and UTs could be clubbed in to four divisions. These divisions were based on the cumulative assessment index, eGAI only and thus deriving strategy from such divisions would be difficult. It is therefore concluded that such divisions should be based on more robust techniques such as clustering techniques to get more accurate results. In this chapter we have used the advanced clustering techniques i.e., hierarchical clustering, k-means clustering and fuzzy c-means clustering. The clustering so attempted has been on 35×19 data set to decide in the range of each CSF value for each cluster. The data set used is a matrix of 35 states and UTs with corresponding values of all 19 CSFs. The differences in the range of CSF values for each cluster can be found out only if we have clearly demarcated cluster with different set of minimum and maximum CSF values for each cluster.

A combination of a set of CSFs shall govern the strategy to be adopted by states and UTs to enhance G2C-U and G2C-R services of states and UTs in each cluster. A set of CSFs governing strategy for each clearly demarcated cluster can be found out by extricating the set of CSFs whose increase/decrease influence the cumulative assessment index eGAI. Clustering of data set to get clearly demarcated clusters has been attempted by statistical techniques and fuzzy clustering technique. Clustering by hierarchical clustering methods

yielded arbitrary clusters, however K-means and fuzzy c-means technique yielded same results with respect to minimum eGAI values and maximum eGAI values for each cluster. The serial order of sequence of clusters in both the cases was however different from each other.

5.2 Clustering Techniques with Respect to CSF and eGAI Values

Cluster analysis is the organization of a collection of patterns (usually represented as a vector of measurements, or a point in a multidimensional space) into clusters based on similarity. Intuitively, patterns within a valid cluster are more similar to each other than they are to a pattern belonging to a different cluster (Jain et al., 1999). NeGP envisages development of uniform e-Governance facilities for all states and union territories of India and its implementation started from 2006. The early initiatives of e-Governance in India started in form of pilot projects undertaken by various states and UTs. Thus, in course of early e-governance initiatives a few states and UTs surged ahead of other states and UTs as some of them did not get the opportunity to implement such pilot projects. An extensive multi-stakeholder survey (involving all multi-stakeholders involved in implementation of G2C-R and G2C-U services as part of NeGP) analyses the status of each state and union territory as regards Jan 2010, post NeGP. Based on the multi-stakeholder survey inputs on each CSF and summation index eGAI the states and union territories are clustered. This baseline data creates a repository of data for all states and UTs with respect to CSFs and e-governance cumulative assessment index, eGAI for concentration of efforts and resources, and future e-governance implementations. The summation index eGAI can be mathematically illustrated as in equation [1] below:-

$$eGAI = \sum_{i=1}^{19} \alpha_i CSF_i \qquad [5.1]$$

Subject to constraint $\sum_{i=1}^{19}\alpha_i \le 1$ where α_i is the weightage of each CSF. $eGAI = \{CSF_1, CSF_2, \ldots\ldots\ldots\ldots\ldots\ldots\ldots CSF_{19}\}$ where CSF_i is feature or attribute for classification. The pattern set is denoted $\Re = \{CSF_1, CSF_2, \ldots\ldots\ldots\ldots CSF_{19}\}$, the i^{th} pattern in $\Re$ is denoted by $x_i = \{CSF_{i,1} \ldots\ldots\ldots CSF_{i,19}\}$ the pattern matrix $\Re$ is 35×19 representing 35 states and UTs and 19 CSFs corresponding to each state /UT.

Hard clustering technique assigns a label l_i to pattern x_i, identifying its class. The set of labels for pattern set $\Re$ is given by $\Im = \{l_{i1}, l_{i2} \ldots\ldots\ldots l_{i19}\}$ where $l_i \in \{1 \ldots\ldots k\}$ where k is the number of clusters. Fuzzy clustering procedure assigns to each input pattern x_i a fractional degree of membership f_{ij} in each output cluster j (Jain et al., 1999). Therefore we attempted two types of hard clustering technique viz., Hierarchical clustering and K-means clustering and fuzzy c-means clustering to identify clearly demarcated clusters.

5.3 Hierarchical Clustering

Hierarchical clustering is a way to investigate grouping in your data, simultaneously over a variety of scales, by creating a cluster tree. The tree is not a single set of clusters, but rather a multi-level hierarchy, where clusters at one level are joined as clusters at the next higher level. This allows you to decide what level or scale of clustering is most appropriate in your application. The following steps were followed for hierarchical clustering of 35×19 data set:-

(a) Find the similarity or dissimilarity between every pair of objects in the data set.

(b) Group the objects into a binary, hierarchical cluster tree.

(c) Determine where to divide the hierarchical tree into clusters.

(i) In this step, you divide the objects in the hierarchical tree into clusters using the cluster function.

(ii) The cluster function can create clusters by detecting natural groupings in the hierarchical tree or by cutting off the hierarchical tree at an arbitrary point.

(d) The Statistics Toolbox of Matlab includes the Dendrogram function that plots this hierarchical tree information as a graph.

(e) The numbers along the horizontal axis represent the indices of the objects in the original data set.

(f) The links between objects are represented as upside down U-shaped lines.

(g) The height of the U indicates the distance between the objects.

(h) The states and UTs could not be segregated into clearly demarcated clusters.

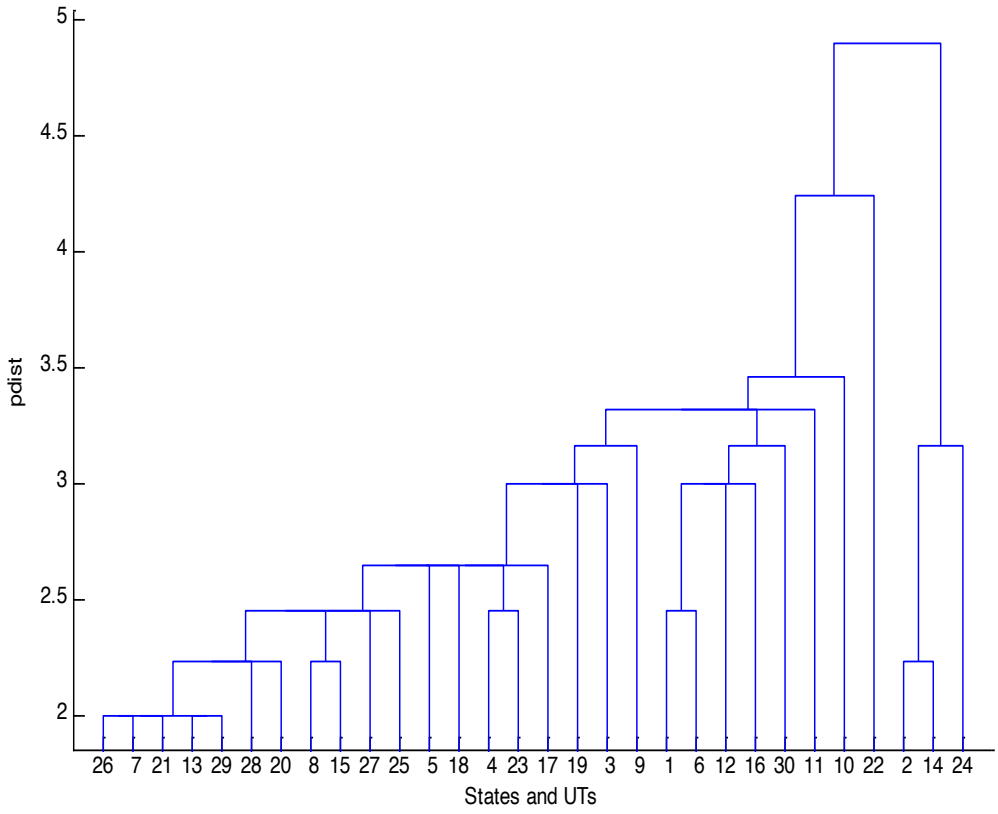

Figure 5.1: Hierarchical Clustering of states and UTs

The cluster information generated by the linkage function is compared with the original proximity data generated by the pdist function. If the clustering is valid, the linking of objects in the cluster tree should have a strong correlation with the distances between objects in the distance vector. The Cophenet function compares these two sets of values and computes their correlation, returning a value called the cophenetic correlation coefficient. The closer the value of the cophenetic correlation coefficient is to 1, the better the clustering solution. Cophenetic correlation coefficient obtained in this case is 0.7337 but clearly demarcated clusters could not be obtained. The results obtained through hierarchical clustering have been tabulated along with k-means and FCM results in Table 5.1.

5.4 K-means Clustering

K-means clustering can best be described as a partitioning method. K-means partitions the observations in the 35×19 dataset into K mutually exclusive clusters, and returns a vector of indices indicating to which of the k clusters it has assigned each observation. K-means clustering uses the actual observations of objects or individuals in the dataset, and not just their proximities. K-means treats each observation in the 35×19 dataset as an object having a location in space. Each cluster in the partition is defined by its member objects and by its centroid, or center. The centroid for each cluster is the point to which the sum of distances from all objects in that cluster is minimized. K-means computes cluster centroids differently for each distance measure, to minimize the sum with respect to the measure that is specified. K-means uses an iterative algorithm that minimizes the sum of distances from each object to its cluster centroid, over all clusters. This algorithm moves objects between clusters until the sum cannot be decreased further.It finds a partition in which objects within each cluster are as close to each other as possible, and as far from objects in other clusters as possible. *K-means* is the simplest and most commonly used algorithm employing a squared error criterion. The squared error for a clustering $\mathfrak{J}$ of pattern set $\mathfrak{R}$ (containing K clusters) is:

$$e^2(\mathfrak{J},\mathfrak{R}) = \sum_{j=1}^{k}\sum_{i=1}^{n_j}\left\|x_i^{(j)} - c_j\right\|^2 \qquad [5.2]$$

where $x_i^{(j)}$ is the i^{th} pattern belonging to j^{th} cluster and c_j is the centroid of the j^{th} cluster. It starts with a random initial partition and keeps reassigning the patterns to clusters based on the similarity between the pattern and the cluster centres until a convergence criterion is met (e.g., there is no reassignment of any pattern from one cluster to another, or the squared error ceases to decrease significantly after some number of iterations). The *k*-means algorithm is popular

because it is easy to implement, and its time complexity is $O(n)$, where n is the number of patterns (Jain et al., 1999). The silhouette plot displays a measure of how close each point in one cluster is to points in the neighbouring clusters. This measure ranges from +1, through 0, to -1 and following can be concluded from silhouette values:-

(a) Silhouette value = +1 $\Rightarrow$ indicating points that are very distant from neighboring clusters

(b) Silhouette value = 0 $\Rightarrow$ indicating points that are not distinctly in one cluster or another

(c) Silhouette value = -1 $\Rightarrow$ indicating points that are probably assigned to the wrong cluster.

K-means clustering of data set 35×19 was carried out for k = 2, 3, 4, 5 and 6. The best silhouette values were obtained for k = 4, average silhouette value greater than 0.6, indicating that the cluster is somewhat separated from neighboring clusters. The plot does not contain many points with low silhouette values, and points with negative values, indicating the clusters are well separated.The plots obtained for value K = 4 has been depicted in figure 5.2. below.For value K = 3 we get silhouette values which are negative, indicating points that are probably assigned to the wrong cluster.For value K = 5 we get silhouette values, which are negative indicating points that are probably assigned to the wrong cluster.

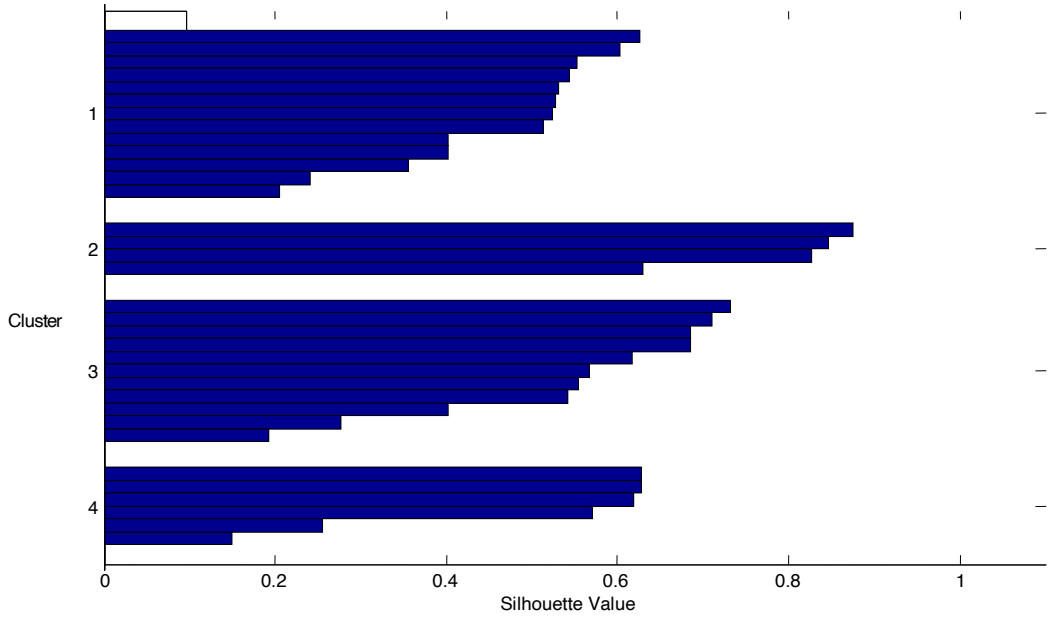

Figure 5.2.: Silhouette Values for k = 4

5.5 Fuzzy C-means Clustering

Traditional clustering approaches generate partitions; in a partition, each pattern belongs to one and only one cluster. Hence, the clusters in a hard clustering are disjoint. Fuzzy clustering extends this notion to associate each pattern with every cluster using a membership function [Zadeh 1965].The output of such algorithms is a clustering, but not a partition [Jain et al., 1999]. The fuzzy clustering algorithm is described below:-

1. Select an initial fuzzy partition of the N objects into K clusters by selecting the $N \times K$ membership matrix U. An element u_{ij} of this matrix represents the grade of membership of object x_i in cluster c_j. Typically, $u_{ij} \in [0,1]$

2. Using U, find the value of a fuzzy criterion function, e.g., a weighted squared error criterion function, associated with the corresponding partition. One possible fuzzy criteria is $E^2(\Re, \mathrm{U}) = \sum_{\mathrm{i}=1}^{\mathrm{N}} \sum_{j=1}^{K} u_{ij} \left\| x_i - \mathrm{c_k} \right\|^2$,

where $c_k = \sum_{i=1}^{N} u_{ik} x_i$ is the k^{th} fuzzy cluster

Reassign patterns to clusters to reduce this criterion function value and re-compute U.

3. Repeat step 2 until entries in U does not change significantly.

Fuzzy c-means (FCM) is a data clustering technique wherein each data point belongs to a cluster to some degree that is specified by a membership grade. The fuzzy clustering steps are described below:-

(a) FCM starts with an initial guess for the cluster centers, which are intended to mark the mean location of each cluster.

(b) By iteratively updating the cluster centers and the membership grades for each data point, FCM iteratively moves the cluster centers to the right location within a data set.

(c) This iteration is based on minimizing an objective function that represents the distance from any given data point to a cluster center weighted by that data point's membership grade

The steps outlined were used to partition the data set and results were found to be accurate for four clusters with membership grade U greater than 0.45.

5.6 Cluster Results

The consolidated results for hierarchical clustering, k-means clustering and fuzzy c-means clustering for all 35 states and UTs based on 19 CSFs and eGAI values as outlined in section 5.3., section 5.4., and section 5.5. is given in table 5.1. below. It is emphasised that all the three techniques divided the 35×19 data set into four clusters. The order of sequence in each case is different but there

appears to be some similarity between the cluster results obtained by k-means and fuzzy c-means as depicted in remarks column.

Table 5.1: Consolidated Cluster results for Hierarchical clustering, K-means Clustering and Fuzzy c-means clustering for all 35 states and UTs

Sr. No	States/UTs	Hierarchical Cluster Result	K-means Cluster Result	FCM Cluster Result		eGAI values	Remarks w.r.to ser. no. of k-means & FCM
				Cluster	Membership		
1	Andaman & Nicobar	2	2	1	0.64	47.99	Interchange 2 and 1
2.	Andhra Pradesh	2	4	4	0.86	82.66	Same
3.	Arunachal Pradesh	4	3	3	0.96	22.96	Same
4.	Assam	2	2	1	0.86	58.67	Interchange 2 and 1
5.	Bihar	2	2	1	0.69	49.61	Interchange 2 and 1
6.	Chandigarh	2	4	4	0.66	76.51	Same
7.	Chattisgarh	2	1	2	0.63	71.26	Interchange 1 and 2
8.	Dadar & Nagar Haveli	4	3	3	0.92	22.98	Same
9.	Daman & Diu	2	2	1	0.75	50.15	Interchange 2 and 1
10.	Delhi	2	1	2	0.49	70.83	Interchange 1 and 2
11.	Goa	1	1	2	0.48	71.44	Interchange 1 and 2
12.	Gujarat	2	4	4	0.71	85.59	Same
13.	Haryana	2	4	4	0.77	83.87	Same

Sr. No	States/UTs	Hierarchical Cluster Result	K-means Cluster Result	FCM Cluster Result		eGAI values	Remarks w.r.to ser. no. of k-means & FCM
				Cluster	Membership		
14.	Himachal Pradesh	2	1	2	0.60	63.15	Interchange 1 and 2
15.	Jammu & Kashmir	4	3	3	0.90	20.51	Same
16.	Jharkhand	2	2	1	0.81	50.70	Interchange 2 and 1
17.	Karnataka	2	4	4	0.72	88.83	Same
18.	Kerala	2	1	2	0.61	70.95	Interchange 1 and 2
19.	Lakshadweep	2	1	2	0.64	72.80	Interchange 1 and 2
20.	Madhya Pradesh	2	1	2	0.54	70.50	Interchange 1 and 2
21.	Maharashtra	2	1	2	0.68	70.51	Interchange 1 and 2
22.	Manipur	2	2	1	0.75	54.70	Interchange 2 and 1
23.	Meghalaya	3	2	1	0.46	49.75	Interchange 2 and 1
24.	Mizoram	2	2	1	0.73	46.98	Interchange 2 and 1
25.	Nagaland	4	3	3	0.73	32.46	Same
26	Orissa	2	1	2	0.72	66.79	Interchange 1 and 2
27.	Pondicherry	2	2	1	0.77	55.59	Interchange 2 and 1
28.	Punjab	2	1	2	0.63	72.32	Interchange 1 and 2

Sr. No	States/UTs	Hierarchical Cluster Result	K-means Cluster Result	FCM Cluster Result		eGAI values	Remarks w.r.to ser. no. of k-means & FCM
				Cluster	Membership		
29.	Rajasthan	2	1	2	0.55	65.73	Interchange 1 and 2
30.	Sikkim	2	2	1	0.77	46.86	Interchange 2 and 1
31.	Tamil Nadu	2	4	4	0.63	84.99	Same
32.	Tripura	2	2	1	0.60	59.39	Interchange 2 and 1
33.	Uttarakhand	2	2	1	0.55	59.38	Interchange 2 and 1
34.	Uttar Pradesh	2	1	2	0.64	65.14	Interchange 1 and 2
35.	West Bengal	2	1	2	0.80	64.27	Interchange 1 and 2

5.6.1 Analysis of Results

Clustering results by hierarchical clustering as regards number of clusters was exact and accurate as it matched with k-means and fuzzy c-means results. The clusters as regards number of members and minimum eGAI and maximum eGAI values were not accurate as these did not match with k-means and fuzzy c-means results. The results obtained by k-means clustering and fuzzy c-means clustering were found to be the same for set of four clusters as regards minimum and maximum eGAI values for each cluster, and number of members in each cluster. The serial order of sequence of clusters are found to be different as cluster serial No. 1 by k-means has to be interchanged with cluster serial No. 2 by FCM. Cluster serial no.1 by FCM needs to be interchanged with cluster

serial no.2. of k-means as has been depicted in table 5.1 above. The cluster results for cluster serial no.3 and cluster serial no.4 has been found to be identical in each of the case by both the techniques. The results for clustering obtained by k-means and Fuzzy c-means techniques giving details of minimum eGAI and maximum eGAI value and number of members in each of the four clusters have been tabulated in Table 5.2.below.

Table 5.2.: FCM and K-means Cluster Results Obtained with eGAI Values and Number of Members in each Cluster

Sr No	Cluster	Clustering with K-means eGAI values		Clustering with Fuzzy c-means eGAI values		Members		Remarks w.r.to ser. no. of k-means & FCM
		Min	Max	Min	Max	K-means	FCM	
1	III	64.27	72.80	46.86	59.69	13	11	Interchange serial no.1 of k-means with serial no.2 of FCM
2	II	46.86	59.69	64.27	72.80	11	13	Interchange serial no.2 of k-means with serial no.1 of FCM
3	I	20.51	32.45	20.51	32.45	4	4	Same
4	IV	76.51	88.80	76.51	88.80	6	6	Same

5.6.2 Inference from Clustering Results

The cluster results by the two techniques viz., k-means and FCM are accurate as the cumulative summation index values i.e., minimum eGAI values and maximum eGAI values are same for all four clusters except their serial order of sequence changes. The number of members for minimum and maximum eGAI cluster limits is found to be the same except their order of sequence changes for first two clusters. The minimum membership value by FCM clustering is for the state of Meghalaya membership = 0.46 ≅ 0.5, indicating that most of the membership values for all states and UTs are approximately above 0.5. The division thus achieved using these robust techniques are based on all nineteen CSF and eGAI values, thus giving us a CSF or a combination of CSFs controlling their strategy in a particular cluster. A detailed analysis is attempted in succeeding sections from 5.7 to 5.10 to extricate a set of CSFs or a set of combination of CSFs for each of the clusters. A set of CSFs or a set of combination of CSFs for each of the clusters that govern the strategy for the states/UTs in respective cluster are called 'Critical CSFs' for that cluster.

5.7 eGAI & CSF Min and Max values Cluster I

This cluster contains four states and UTs viz., Arunachal Pradesh, Dadar & Nagar Haveli, Jammu & Kashmir and Nagaland with minimum eGAI value = 20.512 in case of Jammu & Kashmir and maximum eGAI value = 32.446 in case of Nagaland. The range of eGAI values for this cluster is approximately from 20 to 33. A detailed list of values for each CSF for all four states/ UTs has been given in table 5.3. The minimum and maximum value for each CSF has been tabulated to indicate change in values of each CSF. The changing values of CSF in the cluster indicate that these are critical CSFs and responsible for increase/decrease of eGAI values. A set of CSFs or a set of combination of CSFs whose values increase/decrease within the cluster limits contribute to the

increase/decrease of eGAI values. These CSFs or set of CSFs shall govern the strategy for states/UTs of this cluster to graduate to higher cluster i.e., clusters having higher minimum and maximum eGAI values.

Table 5.3: CSF Inputs for Cluster I Indicating Change in Values of CSFs

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Arunachal Pradesh	1	2	1	1	1	1	2	2	1	1	1	1	1	1	1	1	2	2	2	22.96
2	Dadar & Nagar Haveli	1	1	1	2	1	1	1	2	2	1	1	1	1	2	1	1	2	2	2	22.98
3	Jammu & Kashmir	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20.51
4	Nagaland	3	3	1	1	2	2	1	2	2	2	1	1	1	2	2	2	2	2	2	32.46
Minimum CSF Values		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Maximum CSF Values		3	3	1	2	1	2	1	2	2	2	1	1	1	2	2	2	2	2	2	
Change in CSF Values		√	√	×	√	×	√	×	√	√	√	×	×	×	√	√	√	√	√	√	

5.7.1 Analysis of CSF Values in Cluster I

Table 5.3 above indicates that a combination of CSFs that are responsible for controlling strategy for states and UTs in cluster I are **CSF 1, CSF 2, CSF 4, CSF 6, CSF 8, CSF 9, CSF 10, CSF 14, CSF 15, CSF 16, CSF 17, CSF 18 and CSF 19.** The CSFs which do not have impact on minimum and maximum eGAI values of the cluster are CSF 3, CSF 5, CSF 7, CSF 11, CSF 12, and CSF 13. A set of CSFs in order of relative importance that are controlling strategy for states and UTs in cluster I are: ***Clear cut vision and goals, E-content, e-Gov***

program management, Service delivery paradigm, Technology Architecture, Understanding e-Gov prospects, Continuous feedback, Cost benefit analysis, Sustainable business model, Change management, Human capacity building, Evaluation and performance assessment, Formulation of e-Gov roadmap. A set of interlinkages of CSFs have to be identified to draw a systemic loop of these CSFs. The systemic loops of CSFs have already been identified through five interlinkage loops based on common KPIs in previous chapter section 4.11. A mapping between set of CSFs governing strategy of states/UTs of cluster I and the interlinkages already established in section 4.11 shall help us identify futuristic strategy to be adopted by each state/UT of cluster I to graduate to higher cluster with higher minimum and maximum eGAI values. A closer analysis of the mapping between the CSFs governing strategy i.e., 'Critical CSFs' and the interlinkages established in section 4.11 suggest that the interlinkage developed by CSFs viz., **Interlinkage II** (*Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecture)* ***and*** **III**(*Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture*) shall control futuristic strategy of states and UTs of cluster I. The futuristic strategies derived through closer analysis and mappings need to be verified through offline process diagnosis and simulation technique which has been attempted in next chapter using offline process diagnosis and simulation technique called Fuzzy Inference systems (FIS).

5.8 eGAI & CSF Min and Max values Cluster II

This cluster contains twelve states and UTs viz., Andaman & Nicobar, Assam, Bihar, Daman & Diu, Jharkhand, Manipur, Meghalaya, Mizoram, Pondicherry,

Sikkim, Tripurs, Uttarkhand with minimum eGAI value = 46.86 in case of Sikkim and maximum eGAI value = 59.39 in case of Tripura. The range of eGAI values for this cluster is approximately from 45 to 60. A detailed list of values for each CSF for all twelve states/ UTs has been given in table 5.4. The minimum and maximum value for each CSF has been tabulated to indicate change in values of each CSF. The changing values of CSF in the cluster indicate that these are 'Critical CSFs' and are responsible for increase/decrease of eGAI values. A set of CSFs or a set of combination of CSFs whose values increase/decrease within the cluster limits control increase/decrease of eGAI values. These set of CSFs shall govern the strategy of twelve states/UTs of cluster II to graduate to higher cluster i.e., clusters having higher minimum and maximum eGAI values.

Table 5.4: CSF Inputs for Cluster II Indicating Change in Values of CSFs

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Andaman & Nicobar	2	2	3	2	2	3	5	3	2	2	4	2	2	3	2	2	3	3	2	47.99
2	Assam	3	4	3	3	4	4	5	2	2	3	3	2	2	3	3	3	2	3	3	58.67
3	Bihar	4	2	2	3	1	3	5	3	2	2	2	2	2	3	2	1	2	3	2	49.61
4	Daman & Diu	2	3	2	3	2	3	5	3	3	2	2	2	2	3	2	3	3	2	3	50.15
5	Jharkhand	3	3	2	3	1	3	5	3	3	2	2	2	2	3	3	2	3	3	3	50.70
6	Manipur	3	4	2	3	2	3	5	3	2	3	3	2	2	3	2	2	3	3	3	54.70
7	Meghalaya	3	3	3	3	2	2	5	3	2	2	2	2	2	2	2	2	2	3	2	49.75
8	Mizoram	3	2	2	3	2	2	5	3	2	2	2	2	2	2	2	2	2	2	3	46.98

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
9	Pondicherry	3	3	3	3	3	3	5	3	3	2	2	2	2	3	3	2	2	3	3	55.59
10	Sikkim	3	2	2	2	2	3	5	3	2	2	2	2	2	2	2	2	2	3	3	46.86
11	Tripura	3	4	3	3	2	4	5	3	3	3	3	2	2	3	3	2	3	3	3	59.39
12	Uttara khand	3	4	3	3	3	3	5	3	3	3	2	3	2	3	3	2	3	3	3	59.38
Minimum CSF Values		2	2	2	2	1	2	5	3	2	2	2	2	2	2	2	1	2	2	2	
Maximum CSF Values		4	4	3	3	3	4	5	3	3	3	3	3	2	3	3	3	3	3	3	
Change in CSF Values		√	√	√	√	√	√	×	×	√	√	√	√	×	√	√	√	√	√	√	

5.8.1 Analysis of CSF Values In Cluster II

Table 5.4. above indicates that a combination of CSFs that are responsible for controlling strategy for states and UTs in cluster II are **CSF 1, CSF 2, CSF 3, CSF 4, CSF 5, CSF 6, CSF 9, CSF 10, CSF 11, CSF 12, CSF 14, CSF 15, CSF 16, CSF 17, CSF 18, CSF 19.** The CSFs which do not have impact on minimum and maximum eGAI values of the cluster are CSF 7, CSF 8, and CSF 13. A set of CSFs in order of relative importance that are controlling strategy for states and UTs in cluster II are: ***Clear cut vision and goals, E-content, e-Gov program management, Service delivery paradigm, Technology Architecture, Re-engineering process, Understanding e-Gov prospects,***

Continuous feedback, Info infrastructure, Awareness and communication strategy, , Integrated e-governance, Cost benefit analysis, Sustainable business model, Human capacity building, Evaluation and performance assessment, Formulation of e-Gov roadmap.A set of interlinkages of CSFs have to be identified to draw a systemic loop of these CSFs. The systemic loops of CSFs have already been identified through five interlinkage loops based on common KPIs in previous chapter section 4.11. A mapping between set of CSFs governing strategy of states/UTs of cluster II and the interlinkages already established in section 4.11 shall help us identify futuristic strategy to be adopted by each state/UT of cluster II to graduate to higher cluster with higher minimum and maximum eGAI values. A closer analysis of the mapping between the CSFs governing strategy and the interlinkages established in section 4.11 suggests that the interlinkage developed by CSFs viz., **Interlinkage II** (*Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, Service Delivery Paradigm**,** Privacy and Security and Technical Architecture**)*** **III** (*Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis**,** Formulation of e-Governance Roadmapand Technical Architecture*) ***and IV (****Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure)* shall control futuristic strategy of states and UTs of cluster II. The futuristic strategies derived through closer analysis and mappings need to be verified through offline process diagnosis and simulation technique which has been attempted in next chapter using offline process diagnosis and simulation technique called Fuzzy Inference systems (FIS). FIS for each interlinkage has been developed and simulated with the rule set developed from the data base of each cluster and thus critical interlinkage is finalized for each cluster.

5.9 eGAI & CSF Min and Max values Cluster III

This cluster contains thirteen states and UTs viz., Chattisgarh, Delhi, Goa, Himachal Pradesh, Kerala, Lakshadweep, Madhya Pradesh, Maharastra, Orissa, Punjab, Rajasthan, Uttar Pradesh, West Bengal with minimum eGAI value = 64.27 in case of Himachal Pradesh and maximum eGAI value = 72.80 in case of Lakshadweep. The range of eGAI values for this cluster is approximately from 63 to 73. A detailed list of values for each CSF for all thirteen states/ UTs has been given in table 5.5. The minimum and maximum value for each CSF has been tabulated to indicate change in values of each CSF. The changing values of CSF in the cluster indicate that these are 'Critical CSFs' and responsible for increase/decrease of eGAI values. A set of CSFs or a set of combination of CSFs whose values increase/decrease within the cluster limits control increase/decrease of eGAI values. These set of CSFs shall govern the strategy of thirteen states/UTs of cluster III to graduate to higher cluster i.e., clusters having higher minimum and maximum eGAI values.

Table 5.5: CSF Inputs for Cluster III Indicating Change in Values of CSFs

Sr. No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Chhattisgarh	4	5	3	4	3	4	5	3	4	4	4	3	3	4	4	3	3	3	3	71.26
2	Delhi	3	4	5	4	3	5	5	4	3	2	3	3	4	4	2	4	4	4	3	70.83
3	Goa	3	4	4	4	3	4	5	4	4	3	5	5	4	4	2	2	4	3	3	71.44
4	Himachal Pradesh	4	4	3	3	3	3	5	3	3	3	3	3	3	4	3	2	3	3	3	63.15
5	Kerala	3	4	3	4	5	5	5	4	4	3	3	2	3	3	3	3	3	3	3	70.95
6	Lakshadweep	4	4	4	4	4	4	5	4	4	3	4	3	3	3	2	3	3	3	4	72.80
7	Madhya	4	4	3	4	4	4	5	3	3	3	4	4	5	4	3	4	3	3	3	70.50

	Pradesh																			
8	Maharashtra	3	5	3	4	5	4	5	3	3	3	3	4	3	4	3	2	3	3	3	70.51
9	Orissa	3	4	4	4	3	4	5	3	3	3	4	3	3	4	3	3	3	4	4	66.79
10	Punjab	3	5	4	4	5	4	5	3	3	3	3	3	4	4	3	3	4	3	4	72.32
11	Rajasthan	4	4	3	4	4	3	5	3	3	3	3	3	2	3	2	2	3	3	3	65.73
12	Uttar Pradesh	3	4	3	4	3	3	5	3	4	4	4	3	3	4	4	3	3	3	3	65.14
13	West Bengal	3	4	3	3	4	4	5	3	3	3	3	3	3	4	3	3	3	3	3	64.27
Minimum CSF Values		3	4	3	3	3	3	5	3	3	3	3	2	3	3	2	2	3	3	3	
Maximum CSF Values		4	5	5	4	5	5	5	4	4	4	4	5	5	4	4	4	4	4	4	
Change in CSF Values		√	√	√	√	√	√	×	√	√	√	√	√	√	√	√	√	√	√	√	

5.9.1 Analysis of CSF Values In Cluster III

Table 5.5 above indicates that a combination of CSFs that are responsible for controlling strategy of all thirteen states and UTs in cluster III are **CSF 1, CSF 2, CSF 3, CSF 4, CSF 5, CSF 6, CSF 8, CSF 9, CSF 10, CSF 11, CSF 12, CSF 13, CSF 14, CSF 15, CSF 16, CSF 17, CSF 18, CSF 19.** The CSF which do not have impact on minimum and maximum eGAI values of the cluster is CSF 7. A set of CSFs in order of relative importance that are controlling strategy for all thirteen states and UTs in cluster III are: ***Clear cut vision and goals, E-content, e-Gov program management, Service delivery paradigm, Universal accessibility, Technology Architecture, Re-engineering process, Understanding e-Gov prospects, Continuous feedback, Info infrastructure, Awareness and communication strategy, , Integrated e-governance, Cost benefit analysis, Sustainable business model, Change management, Human***

capacity building, Evaluation and performance assessment, Formulation of e-Gov roadmap.A set of interlinkages of CSFs have to be identified to draw a systemic loop of these CSFs. The systemic loops of CSFs have already been identified through five interlinkage loops based on common KPIs in previous chapter section 4.11. A mapping between set of CSFs governing strategy of states/UTs of cluster III and the interlinkages already established in section 4.11. shall help us identify futuristic strategy to be adopted by each state/UT of cluster III to graduate to higher cluster with higher minimum and maximum eGAI values. A closer analysis of the mapping between the CSFs governing strategy and the interlinkages established in section 4.11. suggest that the interlinkage developed by CSFs viz., ***Interlinkage II*** (*Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, Service Delivery Paradigm**,** Privacy and Security and Technical Architecture**), III*** (*Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis**,** Formulation of e-Governance Roadmapand Technical Architecture*) ***and IV (****Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure)*shall control futuristic strategy of all thirteen states and UTs of cluster III. These futuristic strategies derived through closer analysis and mappings need to be verified through offline process diagnosis and simulation technique which has been attempted in next chapter using offline process diagnosis and simulation technique called Fuzzy Inference systems (FIS). Offline simulation for finalization of critical interlinkage has been attempted using rule set developed from the data repository of the cluster and FIS of the interlinkage.

5.10 eGAI & CSF Min and Max values Cluster IV

This cluster contains six states and UTs viz., Andhara Pradesh, Chandigarh, Gujarat, Haryana, Karnataka, Tamil Nadu with minimum eGAI value = 76.51 in case of Chandigarh and maximum eGAI value = 88.83 in case of Karnataka. The range of eGAI values for this cluster is approximately from 75 to 90. A detailed list of values for each CSF for all six states/ UTs has been given in table 5.6. The minimum and maximum value for each CSF has been tabulated to indicate change in values of each CSF. The changing values of CSF in the cluster indicate that these are critical CSFs and responsible for increase/decrease of eGAI values. A set of CSFs or a set of combination of CSFs whose values increase/decrease within the cluster limits control increase/decrease of eGAI values.

Table 5.6: CSF Inputs for Cluster IV Indicating Change in Values of CSFs

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Andhra Pradesh	5	4	5	4	5	4	5	4	5	4	4	4	5	5	4	4	4	4	4	82.66
2	Chandigarh	4	4	5	4	4	4	5	4	4	3	4	4	4	5	4	4	4	3	4	76.51
3	Gujarat	5	4	5	5	4	5	5	4	5	5	5	5	4	5	2	5	4	3	5	85.59
4	Haryana	5	4	5	5	4	4	5	4	5	5	5	5	4	4	4	4	4	5	5	83.87
5	Karnataka	5	5	5	5	5	5	5	4	5	5	4	4	5	4	5	5	5	5	4	88.83
6	Tamil Nadu	5	4	4	5	4	5	5	4	5	4	4	5	5	5	3	3	3	3	3	84.99
Minimum CSF Values		4	4	4	4	4	4	5	4	4	3	4	4	4	4	2	3	3	3	3	
Maximum CSF Values		5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	
Change in CSF Values		√	√	√	√	√	√	×	×	√	√	√	√	√	√	√	√	√	√	√	

5.8.1 Analysis of CSF Values In Cluster IV

Table 5.6. above indicates that a combination of CSFs that are responsible for controlling strategy for states and UTs in cluster IV are **CSF 1, CSF 2, CSF 3, CSF 4, CSF 5, CSF 6, CSF 9, CSF 10, CSF 11, CSF 12, CSF 13, CSF 14, CSF 15, CSF 16, CSF 17, CSF 18, CSF 19.** The CSF which do not have impact on minimum and maximum eGAI values of the cluster is CSF 7 and CSF 8. A set of CSFs in order of relative importance that are controlling strategy for states and UTs in cluster IV are: *Clear cut vision and goals, E-content, e-Gov program management, Service delivery paradigm, Universal accessibility, Technology Architecture, Re-engineering process, Understanding e-Gov prospects, Continuous feedback, Info infrastructure, Awareness and communication strategy, Integrated e-governance, Cost benefit analysis, Sustainable business model, Human capacity building, Evaluation and performance assessment, Formulation of e-Gov roadmap.* A set of interlinkages of CSFs have to be identified to draw a systemic loop of these CSFs. The systemic loops of CSFs have already been identified through five interlinkage loops based on common KPIs in previous chapter section 4.11. A mapping between set of CSFs governing strategy of states/UTs of cluster III and the interlinkages already established in section 4.11. shall help us identify futuristic strategy to be adopted by each state/UT of cluster III to graduate to higher cluster with higher minimum and maximum eGAI values. A closer analysis of the mapping between the CSFs governing strategy and the interlinkages established in section 4.11. suggest that the interlinkage developed by CSFs viz., ***Interlinkage II*** (*Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, Service Delivery Paradigm, Privacy and Security and Technical Architecture*)**, *III*** (*Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-*

Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, *Formulation of e-Governance Roadmapand Technical Architecture*) ***and IV (****Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure)*shall control futuristic strategy of states and UTs of cluster IV. This interlinkage has been depicted through combination of interlinkages II, III and IV in section 4.11 of preceeding chapter. These futuristic strategies derived through closer analysis and mappings need to be verified through offline process diagnosis and simulation technique which has been attempted in next chapter using offline process diagnosis and simulation technique called Fuzzy Inference systems (FIS).

5.11 Conclusion

This chapter has through three clustering techniques i.e., hierarchical clustering, k-means clustering and fuzzy c-means clustering has divided the states and UTs into four clusters. The division has not been achieved on the basis of cumulative assessment index, eGAI only, but also on the multi-stakeholder inputs on 19 CSFs. The data set considered for clustering by all the three techniques are multi-stakeholder inputs of all 35 states and UTs on all 19 CSFs. The multi-stakeholder inputs as has been pointed out in previous chapters are inputs of all stakeholders involved in G2C-R and G2C-U implementation in states and UTs of India as part of NeGP implementation. These multi-stakeholder inputs on all 19 CSFs in each cluster have helped us identify critical CSFs that control eGAI values i.e. increase/decrease in values of these CSFs shall increase/decrease eGAI values within cluster limits. This combination of critical CSFs of a particular cluster shall control the strategy of the states/UTs of the respective cluster. These critical CSFs or a lesser number combination of these critical CSFs could also contribute to the set of CSFs that would govern the strategy of

states and UTs of that cluster to graduate to a higher cluster with higher minimum and maximum eGAI values.

The combinatorial combinations of CSFs that contribute to the increase/decrease of cumulative assessment index, eGAI have been identified as interlinkages. These interlinkages between CSFs have been developed after analysing scope and definition of each CSF and finding common KPIs between each of them. The CSFs having common KPIs have been linked with each other thereby interlinked loops have been developed that contribute to increase/decrease of cumulative assessment index, eGAI.

Five such interlinked loops were identified in previous chapter that contribute to increase/decrease of cumulative assessment index, eGAI. In this chapter we have identified specifically for each cluster the number of such interlinked loops that contribute to increase/decrease of cumulative assessment index, eGAI. The details of interlinked loops that contribute to the increase/decrease of cumulative assessment index for each cluster are given below:-

(a) Cluster I: Interlinkage II and III

(b) Cluster II: Interlinkage II, III and IV

(c) Cluster III: Interlinkage II, III and IV

(d) Cluster IV: Interlinkage II, III and IV. They are leaders in e-governance implementation in India. States/UTs of cluster I, II and III are trying to emulate them and adopt their strategy of NeGP implementation for enhancing G2C-R and G2C-U services.

A detailed analysis has been attempted in next chapter through offline process diagnosis technique viz., Fuzzy Inference Systems to identify the optimal number of CSFs that would contribute to increase/decrease of cumulative

assessment index, eGAI for states/UTs of that cluster. The process of each interlinkage has been developed with suitable rule base and then multi-stakeholder inputs are fed into the system. A combinatorial combination of CSFs is identified through simulation techniques of fuzzy inference systems. The combination containing minimum number of CSFs is identified as the optimal strategy for states/UTs of each cluster. This strategy could be adopted by states/UTs of that cluster to graduate to a higher cluster with higher minimum and maximum eGAI values.

ISBN: 978-81-946587-3-3

Chapter 6

Strategy Finalization Through FIS

6.1 Introduction

A set of CSFs or a combination of set of CSFs have been identified in each cluster whose increase/decrease in values increase/decrease the cumulative assessment index, eGAI values within the cluster limits. This set of CSFs or a combination of CSFs have to be reduced to an optimal number so as to govern the strategy of states/UTs beyond the cluster limits. This optimal set of CSFs or combination of CSFs shall govern the strategy of states and UTs to graduate to a higher cluster i.e, higher minimum and maximum eGAI values. It is therefore pertinent to use offline process simulation and diagnosis and process control tools. Fuzzy Inference Systems (FIS) is one such tool that could help us perform nonlinear mappings between inputs i.e., set of CSFs and output i.e., eGAI. Our data set so created is a perception based multi-stakeholder input obtained on a Likert scale. Due to impreciseness of data it is prudent to convert such data to linguistic terms while generating a rule base. The strength of FIS is to handle linguistic concepts and act as universal approximators to perform nonlinear mappings between input and output [Guillaume et al., 2001].

In the previous chapter a data repository for all nineteen CSF values has been created for each of the four clearly demarcated clusters. This repository of data for each of the four clusters shall be used to design data based self-learning FIS. Sugeno [Sugeno et al., 1985] was one of the first to propose self-learning FIS and to open the way to a second kind of FIS; those designed from data. Rule generation from data can be decomposed into two main steps: 1) rule induction

and 2) rule-base optimization. Originally, automatic induction methods were applied to simple systems with a few variables. In these conditions, there was no need for optimizing the rule base. The situation is different for large systems. The number of induced rules becomes enormous and the rule description is complex because of the number of variables. Obviously, the rules will be easier to interpret if they are defined by the most influential variables and the system behaviour will be easier to understand as the number of rules would be less. Variable selection and rule reduction are, thus, two important steps of the rule generation process. They are usually referred as structure optimization.

6.2 Structure Optimization

In our work the variable selection is done among the 'critical CSFs' (whose increase/decrease leads to increase/decrease in the values of eGAI within the cluster limits) identified for each clearly demarcated cluster and the rule reduction is achieved by generating rules for each cluster with the data inputs of the multi-stakeholders implementing G2C-U and G2C-R services in states/UTs of India post NeGP. Optimal number of 'critical CSFs' that might control strategy of adoption of G2C-U and G2C-R services states/UTs of each cluster if they are mapped to the interlinkages already developed between all the nineteen CSFs.A set of CSFs that are interlinked with each other based on common KPIs and perform non-linear mappings with cumulative assessment index, eGAI have been termed as Interlinkages in our work. A set of five such interlinkages were established based on the aim and scope of each CSF and the common KPIs between them. In the previous chapter an approximate mapping between interlinkages and critical CSFs have been developed our emphasis would thus be analyse which of these identified linkages or a combination of linkages shall help the states/UTs to graduate to next higher cluster with minimum perturbations.

The non-linear mappings between optimal number of 'critical CSFs' and cumulative assessment index, eGAI would be established for each clearly demarcated clusters through a set of rules. The rule generation for each clearly demarcated cluster could be done more effectively if the CSF perception based inputs of multi-stakeholders are converted to four point fuzzy scale of very low, low, medium, and high. This has been diagrammatically represented with respect to 0 to 5 scale on Likert scale in figure 6.1. The limits of Very low range from [0,1,2], limits of low range from [1,2,3], limits of medium range from [2,3,4] and limits of high range from [3,4,5]

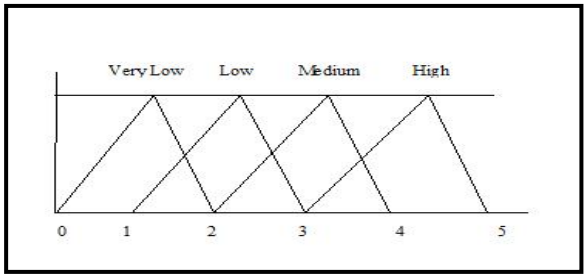

Figure 6.1 Fuzzy Scale for CSF representation

The fuzzy scale has been chosen to remove any bias in perception of multi-stakeholders while generating rules for the cluster and analysing the suitability of the interlinked CSFs through FIS process analysis and simulation. Each interlinkage is again derived from the aim and scope definition equations of the CSFs in succeeding paragraphs.

6.2.1 Interlinkage I

A set of six critical CSFs interlinked with each other based on commonality of KPIs form a systemic loop to form a non-informal mapping between the cumulative assessment index eGAI and these six interlinked critical CSFs are termed as Interlinkage I. The aim and scope definitions for each CSF have been outlined in chapter 4 and thus common KPIs have been identified among them. Interlinkage I comprises of six CSFs viz., *Clear Cut Vision and Goals,*

Understanding e-Governance Prospects, Universal Accessibility, Re-engineering Processes, Formulation of e-Governance Plan and Technical Architecture. Equations [4.2], [4.19], [4.18], [4.14], [4.9], and [4.17] are equations giving the aim and scope of CSFs with respect to the KPIs. In equations [4.2] and [4.19] the aim and scope equations of Clear Cut Vision and Goals and Understanding e-Governance Prospects have service orientation citizen centric KPI 1 (degree of alignment of service design to user requirement) in common. In equations [4.19] and [4.18] the aim and scope equations of Understanding e-Governance Prospects and Universal Accessibility have service orientation citizen centric KPI 2 (user interface is local language) in common. In equations [4.18] and [4.14] the aim and scope equations of Universal Accessibility and Re-engineering Processes have Technical Reliability KPI 3 (availability of alternate service delivery channel in case of system breakdown) in common. In equations [4.14] and [4.9] the aim and scope equations of Re-engineering Processes and Formulation of e-governance roadmap have Technical Reliability KPI 1 (degree of availability) in common. In equations [4.9] and [4.17] the aim and scope equations of Formulation of e-governance roadmap and Technical Architecture have Technical Reliability KPI 1 (degree of availability) in common. In equations [4.2] and [4.17] the aim and scope equations of Clear Cut vision and Goals and Technical Architecture have three KPIs in common viz., Service Orientation User centricity KPI 2 (Compliance to committed time frame), Technical Architecture (comprehensiveness of technical architecture to meet the needs of the citizens) and Technical Standards Architecture (mechanism in place for enforcing standards). The aim and scope equations for all six CSFs viz., *Clear Cut Vision and Goals, Understanding e-Governance Prospects, Universal Accessibility, Re-engineering Processes, Formulation of e-Governance Plan and Technical Architecture* have common KPIs (with underlined KPIs) depicted in equations [6.1], [6.2], [6.3], [6.4], [6.5], and [6.6] given below. Interlinkage I has been

diagrammatically depicted in figure 6.1 and with respect to all five interlinkages has been depicted in Figure 6.5.

CCVG = SOUC2+TA+TSA+TS+SUOS1+SUOS2+SUOS4+ SOCC1 [6.1]

UEGP = SOCC1+RT1+RT2+SOCC2 [6.2]

UA = SOCC2+SOUC3+ SOUC4+SOUC6+ SUCS4+TR3 [6.3]

REP = SUL1+TSA+TR1+TR3 [6.4]

FEGR = TR1 +*CE3* [6.5]

TA = SOUC1+SOUC2+ TA+TSA+TR1 [6.6]

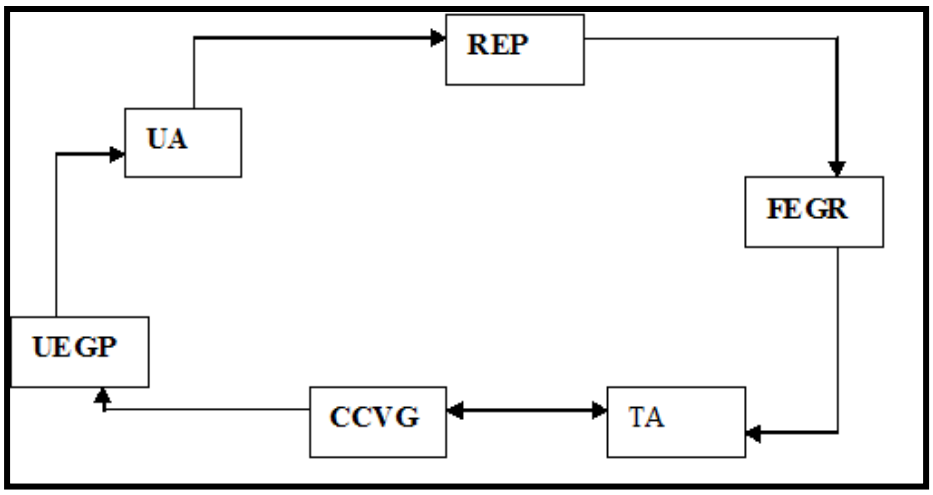

Figure 6.2: Interlinkage I

6.2.2 Interlinkage II

A set of seven critical CSFs interlinked with each other based on commonality of KPIs form a systemic loop to form a non-informal mapping between the cumulative assessment index eGAI and these seven interlinked critical CSFs are termed as Interlinkage II.The aim and scope definitions for each CSF have been

outlined in chapter 4 and thus common KPIs have been identified among them. Interlinkage II comprises of seven CSFs viz., *Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecture*. Equations [4.2], [4.8], [4.4], [4.10], [4.15], [4.13] and [4.17] are equations giving the aim and scope of CSFs with respect to the KPIs. Of the seven only six can be controlled as Privacy and Security of Data has values either 0 or 5 thus systemic loop for six critical CSFs was developed for process diagnosis and offline simulation. In equations [4.2] and [4.8] the aim and scope equations of Clear Cut Vision and Goals and Evaluation and Performance Assessment have sustainability organizational KPI 4 (Existence and effectiveness of User Groups and Service Reviews) in common. In equations [4.8] and [4.4] the aim and scope equations of Evaluation and Performance Assessment and Continuous Feedback have sustainability organizational KPI 4 (Existence and effectiveness of User Groups and Service Reviews) in common. In equations [4.4] and [4.10] the aim and scope equations of Continuous Feedback and Info Infrastructure have service orientation user centricity KPI 3 (% users benefited from CSCs) in common. In equations [4.10] and [4.15] the aim and scope equations of Info Infrastructure and Service Delivery Paradigm have service orientation user centricity KPI 5 (ease of access to service) in common. In equations [4.15] and [4.13] the aim and scope equations of Service Delivery Paradigm and Privacy and Security have Technology Security KPI (mechanism in place for enforcing secure transactions) in common. In equations [4.13] and [4.17] the aim and scope equations of Privacy and Security and Technology Architecture have Technology Architecture KPI (comprehensiveness of architecture to meet the user needs) in common. In equations [4.2] and [4.17] the aim and scope equations of Clear Cut vision and Goals and Technical Architecture have three KPIs in common viz., Service Orientation User centricity KPI 2 (Compliance to committed time frame),

Technical Architecture (comprehensiveness of technical architecture to meet the needs of the citizens) and Technical Standards Architecture (mechanism in place for enforcing standards). The aim and scope equations for all seven CSFs viz., *Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecture*. have common KPIs (with underlined KPIs) depicted in equations [6.7], [6.8], [6.9], [6.10], [6.11], [6.12]and [6.13] given below. Interlinkage II has been diagrammatically depicted in figure 6.2 and with respect to all five interlinkages has been depicted in Figure 6.5.

CCVG = SOUC2+TA+TSA+TS+SUOS1+SUOS2+SUOS4+ SOCC1 **[6.6]**

EPA = SUOS4 **[6.7]**

CFB = SOUC3+SOCC3+SUOS4 **[6.8]**

II = SOUC3+ SOUC4+SOUC5+ SUCS5+ TR3 **[6.9]**

SDP = SOUC1+SOUC5+SOUC6+SUCS4+CE1+TS **[6.10]**

PSD = TS+TA **[6.11]**

TA = SOUC1+SOUC2+ TA*+TSA+TR1 **[6.12]**

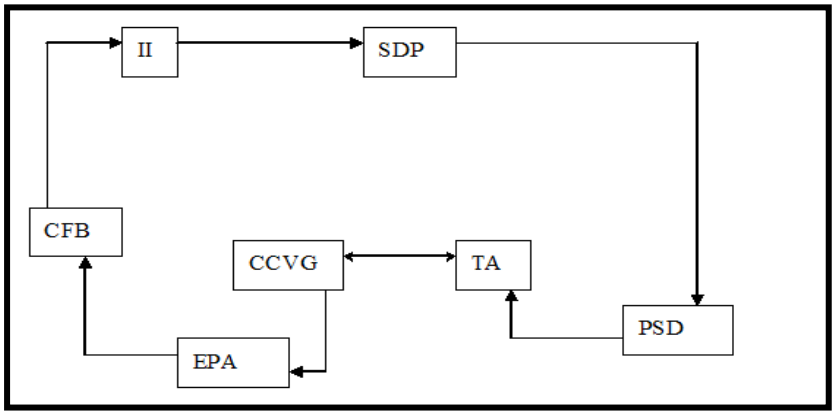

Figure 6.3: Interlinkage II

6.2.3 Interlinkage III. A set of ten critical CSFs interlinked with each other based on commonality of KPIs form a systemic loop to form a non-informal mapping between the cumulative assessment index eGAI and these ten interlinked critical CSFs are termed as Interlinkage III**.** The aim and scope definitions for each CSF have been outlined in chapter 4 and thus common KPIs have been identified among them. Interlinkage III comprises of ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture*.

Equations [4.2], [4.12], [4.3], [4.7] [4.11], [4.16], [4.1], [4.5], [4.9] and [4.17] are equations giving the aim and scope of CSFs with respect to the KPIs. In equations [4.2] and [4.12] the aim and scope equations of Clear Cut Vision and Goals and Human Capacity Building have sustainability organizational KPI 1 (Existence and functioning of organizational structure for managing the NeGP implementation) in common. In equations [4.12] and [4.3] the aim and scope equations of Human Capacity Building and Change Management have sustainability organizational KPI 1 (Existence and functioning of organizational structure for managing the NeGP implementation) and sustainability organizational KPI 2 (role clarity and degree of employee buy-in) in common. In equations [4.3] and [4.7] the aim and scope equations of Change Management and e-Governance Program Management have sustainability organizational KPI 1 (Existence and functioning of organizational structure for managing the NeGP implementation) and sustainability organizational KPI 2 (role clarity and degree of employee buy-in) in common. In equations [4.7] and [4.11] the aim and scope equations of e-Governance Program Management and Integrated e-Governance have sustainability commercial KPI 2 (strength of PPP arrangement) in common. In equations [4.11] and [4.16] the aim and scope

equations of Integrated e-Governance and Sustainable Business Model have sustainability commercial KPI 2 (strength of PPP arrangement) and cost effectiveness KPI 2 (enhanced revenue benefit to the government) in common. In equations [4.16] and [4.1] the aim and scope equations of Sustainable Business Model and Awareness and Communication Strategy have cost effectiveness KPI 2 (enhanced revenue benefit to the government) in common. In equations [4.1] and [4.5] the aim and scope equations of Awareness and Communication Strategy and Cost Benefit Analysishave cost effectiveness KPI 2 (enhanced revenue benefit to the government) in common. In equations [4.5] and [4.9] the aim and scope equations of Cost Benefit Analysisand Formulation of e-Governance Roadmap have cost effectiveness KPI 3 (degree of reduction in corruption) in common. In equations [4.9] and [4.17] the aim and scope equations of Formulation of e-Governance Roadmap and Technical Architecture have technology reliability KPI 2 (availability of service level agreement) in common. In equations [4.2] and [4.17] the aim and scope equations of Clear Cut vision and Goals and Technical Architecture have three KPIs in common viz., Service Orientation User centricity KPI 2 (Compliance to committed time frame), Technical Architecture (comprehensiveness of technical architecture to meet the needs of the citizens) and Technical Standards Architecture (mechanism in place for enforcing standards). The aim and scope equations for all ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture* have common KPIs (with underlined KPIs) depicted in equations [6.14], [6.15], [6.16], [6.17], [6.18], [6.19], [6.20], [6.21], [6.22]and [6.23] given below. Interlinkage III has been diagrammatically depicted in Figure 6.2 and with respect to all five interlinkages has been depicted in Figure 6.5.

CCVG = SOUC2+TA+TSA+TS+SUOS1+SUOS2+SUOS4+ SOCC1 **[6.14]**

HCB = SUOS1+ SUOS2 + SUOS3 **[6.15]**

CM = SUOS1+ SUOS2 **[6.16]**

EGPM=SUOS1+SUOS2+SUOS3+SUOS4+SUCS2+RT1+RT2+RC1 **[6.17]**

IEG = SUCS1 + SUCS2+ SUCS4+TAS+TR2 **[6.18]**

SBM = SUCS2+SUCS3+CE2 **[6.19]**

ACS = CE1+ CE2 + CE3 **[6.20]**

CBA = CE1+CE2+CE3 **[6.21]**

FEGR = TR1 +CE3 **[6.22]**

TA = SOUC1+SOUC2+ TA+TSA+TR1 **[6.23]**

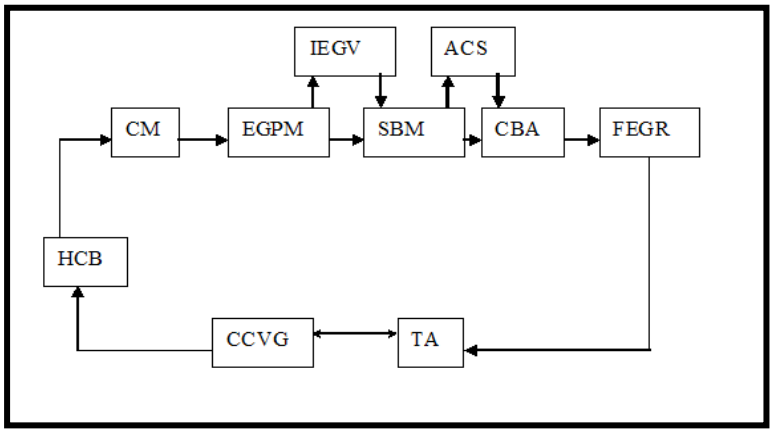

Figure 6.4: Interlinkage III

6.2.4 Interlinkage IV

A set of five critical CSFs interlinked with each other based on commonality of KPIs form a systemic loop to form a non-informal mapping between the cumulative assessment index eGAI and these three interlinked critical CSFs are termed as Interlinkage IV. The aim and scope definitions for each CSF have been outlined in chapter 4 and thus common KPIs have been identified among them. Interlinkage IV comprises of five CSFs viz., *Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure*. Equations [4.2], [4.17], [4.6], [4.14], and [4.10] are equations giving the aim and scope of CSFs with respect to the KPIs. In equations [4.2] and [4.17] the aim and scope equations of Clear Cut vision and Goals and Technical Architecture have three KPIs in common viz., Service Orientation User centricity KPI 2 (Compliance to committed time frame), Technical Architecture (comprehensiveness of technical architecture to meet the needs of the citizens) and Technical Standards Architecture (mechanism in place for enforcing standards).

In equations [4.6] and [4.17] the aim and scope equations of E-Content and Technical Architecture have technical reliabilty KPI 1 (degree of availability) in common. In equations [4.6] and [4.14] the aim and scope equations of E-Content and Re-engineering Processes have sustainability legal KPI (extent of business process engineering undertaken) in common. In equations [4.14] and [4.10] the aim and scope equations of Re-engineering Processes and Info Infrastructure have Technical Reliability KPI 3 (availability of alternate service delivery channels in case of breakdown) in common. In equations [4.10] and [4.2] the aim and scope equations of Info Infrastructure and Clear Cut vision and Goals have service orientation user centric KPI 2 (compliance to committed time frame) in common. The aim and scope equations for all five CSFs viz., *Clear Cut Vision and Goals, Technical Architecture, E-content, Re-engineering*

Processes, and Info Infrastructure KPIs (with underlined KPIs) depicted in equations [6.24], [6.25], [6.26], [6.27], [6.28], and [6.29] given below. Interlinkage IV has been diagrammatically depicted in figure 6.4 and with respect to all five interlinkages has been depicted in figure 6.5.

CCVG = SOUC2*+TA+TSA+TS+SUOS1+SUOS2+SUOS4+ SOCC1 **[6.24]**

TA = SOUC1+SOUC2+ TA+TSA+TR1 **[6.25]**

EC= SOCC1+SOCC2+SUL1+TR1 **[6.26]**

REP = SUL1+TSA+TR1+TR3 **[6.27]**

II = SOUC2+SOUC3+ SOUC4+SOUC5+ SUCS5+ TR3 **[6.28]**

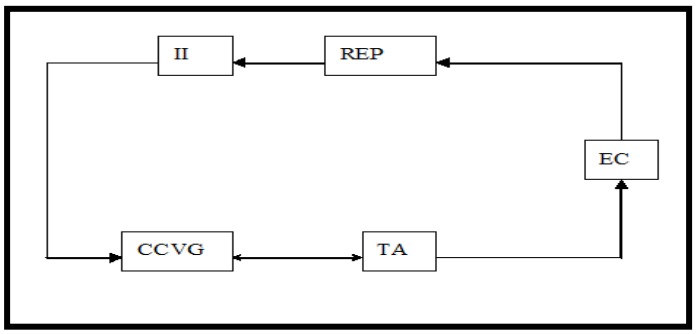

Figure 6.5: Interlinkage IV

6.2.5. Interlinkage V.

A set of two critical CSFs interlinked with each other based on commonality of KPIs form a systemic loop to form a non-informal mapping between the cumulative assessment index eGAI and these two interlinked critical CSFs are termed as Interlinkage V. The vision document shall be basis for development of architecture, standards and protocols to be followed and security infrastructure in place. These two CSFs are responsible for development of

holistic e-governance application framework, though alone they may not suffice as a strategy framework. In equations [4.2] and [4.17] the aim and scope equations of Clear Cut vision and Goals and Technical Architecture have three KPIs in common viz., Service Orientation User centricity KPI 2 (Compliance to committed time frame), Technical Architecture (comprehensiveness of technical architecture to meet the needs of the citizens) and Technical Standards Architecture (mechanism in place for enforcing standards). The aim and scope equations for both the CSFs viz., *Clear Cut Vision and Goals and Technical Architecture,* KPIs (with underlined KPIs) depicted in equations [6.30], and [6.31] given below. Interlinkage V has been diagrammatically depicted in figure 6.5 along with other four interlinkages.

CCVG = <u>SOUC2+TA+TSA</u>+TS+SUOS1+SUOS2+SUOS4+ SOCC1 **[6.30]**

TA = SOUC1+<u>SOUC2+ TA+TSA</u>+<u>TR1</u> **[6.31]**

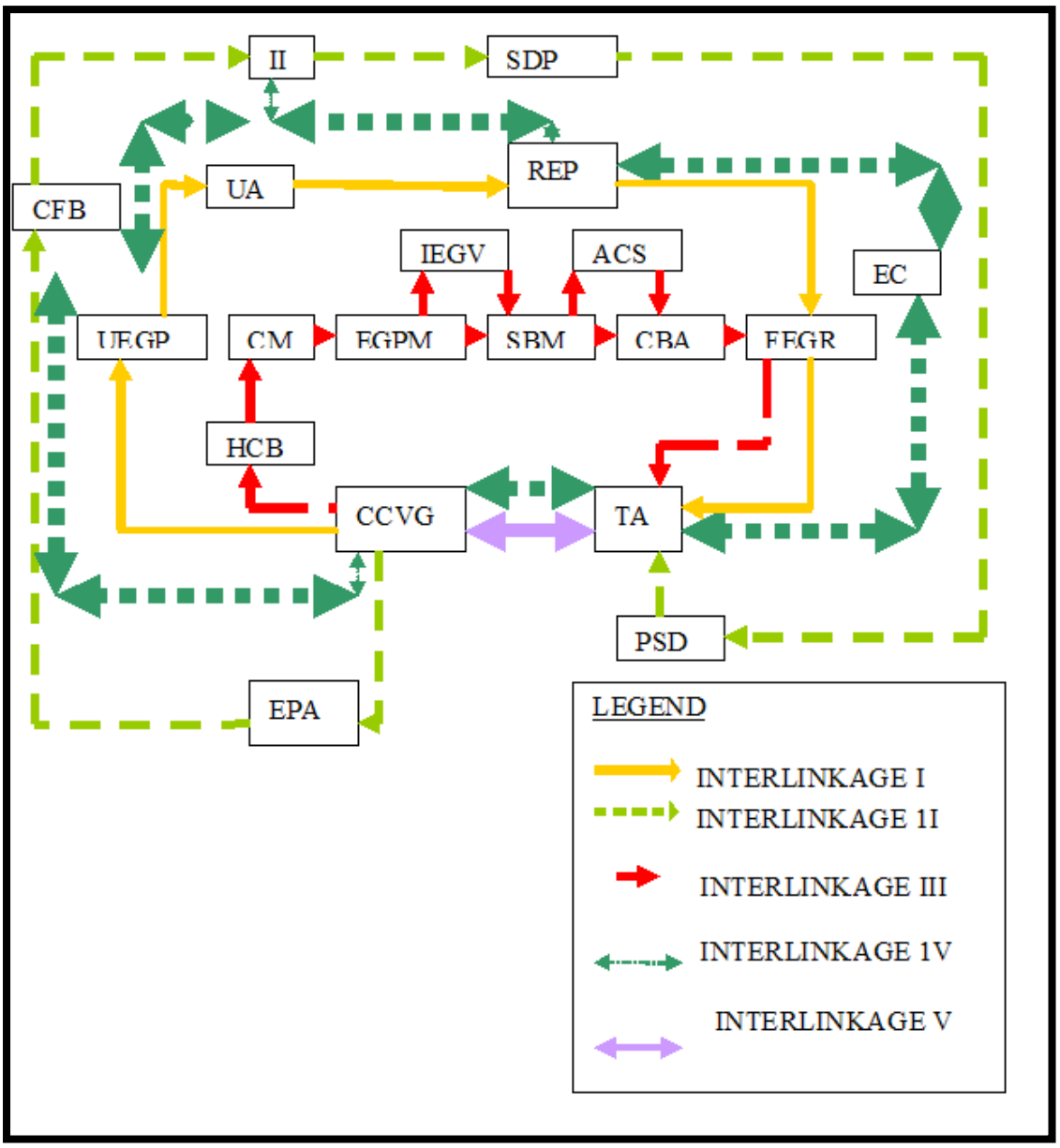

Figure 6.6: All Five Interlinkages of CSFs

6.3 Rule Base Optimization

Design of Rule base for development of FIS for each cluster of states and UTs have been done based on the data repository developed for each cluster in previous chapter. The data obtained from multiple stakeholders' are based on perception and use of these adopted e-governance systems, therefore fuzzy scale described in section 6.1. has been used to remove biases. The five interlinkages (form an informal mapping between input variables i.e., critical CSFs and

output variable i.e., cumulative assessment index eGAI) described in previous section is the basis of development of FIS. Of these five interlinkages, four interlinkages (fifth interlinkage being a combination of only two CSFs did not represent a holistic strategy guideline) were used to form systemic links and the rule base developed from data repository of each cluster was used to analyse the suitability among the four of them The rule set was designed using the data repository of each cluster and the weightages to the rule set was obtained observing the number of repetitions of the data set in the data repository of each cluster. FIS thus developed with interlinkages and the data repository of each cluster was simulated for each cluster to identify which used minimum CSF perturbations to help graduate states and UTs of the cluster to the next higher cluster with higher minimum eGAI and maximum eGAI values.

6.3.1 Cluster I

The data repository for cluster 1 based on inputs of multiple stakeholders' has been compiled in table 5.3**.** A closer analysis of the data repository for this cluster suggests that the CSFs governing strategy (as deduced in previous chapter) are: *Clear cut vision and goals, Evaluation and performance assessment, Continuous feedback,Info Infrastructure, Service delivery paradigm, Privacy and Security, Technology Architecture, Formulation of e-Gov roadmap, Cost benefit analysis,Sustainable business model, e-Gov program management, Change management, Human capacity building,Understanding e-Gov prospects, and E-content*. These when mapped with respect to interlinkages developed in previous section are depicted in terms of two interlinkages viz., InterlinkageII (*Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecture) and* III (*Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-*

Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture). Thus interlinkage II and interlinkage III shall have different set of rule set for analysis which shall be derived from the data of the data repository of cluster I. The data compiled from the data repository (depicted in table 5.3.) of cluster I for interlinkage II has been depicted in table 6.1. and for interlinkage III has been depicted in Table 6.2.

6.3.1.1 Development of Rule Set for Interlinkage II

Interlinkage II consist of seven CSFs viz., *Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecture.* The minimum and maximum values of each CSF of Interlinkage II in cluster I with the corresponding serial no. in data repository (table 5.3.) has been tabulated below in Table 6.1

Table 6.1.: Interlinkage II with respect to Cluster 1 Data Repository

CSF Values

CSF & Serial No in Data Repository Table		Cluster I	
CSF	Ser. No in Data Repository Table	Min	Max
Clear Cut Vision & Goals	1	1	3
Evaluation & Performance Assessment	19	1	2
Continuous Feedback	11	1	2

Info Infrastructure	3	1	1
Service Delivery Paradigm	14	1	2
Privacy & Security	7	1	2
Technical Architecture	6	1	2

6.3.1.2 Inference of Rules

The rule set is developed from the data repository of cluster I given in Table 5.3 and four point fuzzy scales of input variables i.e., CSFs. The four point fuzzy scale for 0 to 5 likert scale can be represented with four points viz., very low, low, medium and high. The limits of Very low range from [0,1,2], limits of low range from [1,2,3], limits of medium range from [2,3,4] and limits of high range from [3,4,5].

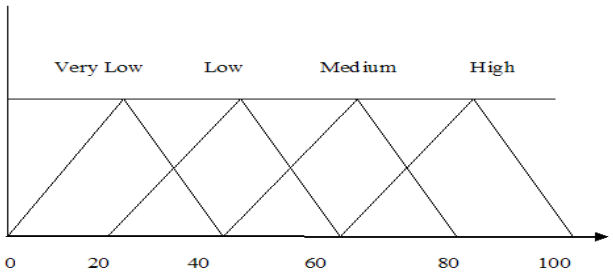

Figure 6.7: Fuzzy Scale for Output Variable eGAI

The output variable viz., eGAI can also be represented on a four point fuzzy scale. The four point fuzzy scale for 0 to 100 scale is represented with very low [0, 20, 40], low [20, 40, 60], medium [40, 60, 80] and high [60, 80, 100] and is

diagrammatically represented in Figure 6.7. The rule set developed from data repository of cluster I given in Table 6.7 and using fuzzy scale for input and output variables as outlined below in form of following rules:-

1. If CCVG is Very Low, EPA is Low, CFB is Very Low, II is Very Low, SDP is Very Low and TA is Very Low then eGAI is Very Low [weightage (1)].

2. If CCVG is Very Low, EPA is Low, CFB is Very Low, II is Very Low, SDP is Low and TA is Very Low then eGAI is Very Low [weightage (1)].

3. If CCVG is Very Low, EPA is Very Low, CFB is Very Low, II is Very Low, SDP is Very Low and TA is Very Low then eGAI is Very Low [weightage (1)].

4. If CCVG is Medium, EPA is Low, CFB is Low, II is Very Low, SDP is Low and TA is Low then eGAI is Low [weightage (1)].

Table 6.2.: Data repository of Cluster I with CSF input values (in bold)

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
1	Arunachal Pradesh	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	2	2	22.96
2	Dadar & Nagar Haveli	1	1	1	2	1	1	1	2	2	1	1	1	1	2	1	1	2	2	2	22.98
3	Jammu & Kashmir	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20.51
4	Nagaland	3	3	1	1	2	2	1	2	2	2	1	1	1	2	2	2	2	2	2	32.46

6.3.1.3 Development of Rule Set for Interlinkage III

Interlinkage III comprises of ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management,*

Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture. The minimum and maximum values of each CSF of Interlinkage III in cluster I with the corresponding serial no. in data repository (table 5.3.) has been tabulated below in table 6.3

Table 6.3 Interlinkage III w.r. to Cluster 1 Data Repository Values

CSF & Corresponding Serial No. in Data Repository		Cluster I	
CSF	**Sr. No**	**Min**	**Max**
Clear Cut Vision & Goals	1	1	3
Human Capacity Building	4	1	2
Change Management	8	1	2
e-Governance Program Management	10	1	2
Integrated e-governance	11	1	1
Sustainable Business Model	18	1	2
Awareness & Communication Strategy	5	1	1
Cost Benefit Analysis	17	1	2
Formulation of e-Governance roadmap	9	1	2
Technical Architecture	6	1	2

6.3.1.4 Inference of Rules

The rule set is developed from the data repository of cluster I given in table 5.3. and using four point fuzzy scales for input (depicted in figure 6.1.) and output

variables (depicted in figure 6.2.). The cluster data repository with CSF values in bold is depicted in Table 6.4. for generation of rules.

Table 6.4: Cluster I data repository with respect to Interlinkage III CSF inputs

Sr. No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
1	Arunachal Pradesh	1	2	1	1	1	1	1	2	1	1	1	1	1	1	1	1	2	2	2	22.96
2	Dadar & Nagar Haveli	1	1	1	2	1	1	1	2	2	1	1	1	1	2	1	1	2	2	2	22.98
3	Jammu & Kashmir	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20.51
4	Nagaland	3	3	1	1	2	2	1	2	2	2	1	1	1	2	2	2	2	2	2	32.46

The following four rules can be deduced from the data repository of cluster I:-

1. If CCVG is Very low, HCB is Very Low, ACS is Very Low, TA is Very Low, CM is Low, FEGR is Very Low, EGPM is Very Low, IEG is Very Low, CBA is Low, SBM is Low then eGAI is Very Low [weightage (1)].
2. If CCVG is very low, HCB is Low, ACS is Very Low, TA is Very Low, CM is Low, FEGR is Low, EGPM is Very Low, IEG is Very Low, CBA is Low, SBM is Low then eGAI is Very Low [weightage (1)].
3. If CCVG is Very low, HCB is Very Low, ACS is Very Low, TA is Very Low, CM is Low, FEGR is Very Low, EGPM is Very Low, IEG is Very Low, CBA is Very Low, SBM is Very Low then eGAI is Very Low [weightage (1)].

4. If CCVG is Medium, HCB is Very Low, ACS is Low, TA is Low, CM is Low, FEGR is Low, EGPM is Low, IEG is Very Low, CBA is Low, SBM is Low then eGAI is Low [weightage (1)].

6.3.2 Cluster II

The data repository for cluster 1I based on inputs of multiple stakeholders' has been compiled in table 5.4**.** A closer analysis of the data repository for this cluster suggests that the CSFs governing strategy (as deduced in previous chapter) are: *Clear cut vision and goals, E-content, e-Gov program management, Service delivery paradigm, Technology Architecture, Re-engineering process, Understanding e-Gov prospects, Continuous feedback, Info infrastructure, Awareness and communication strategy, Integrated e-governance, Cost benefit analysis, Sustainable business model, Human capacity building, Evaluation and performance assessment, Formulation of e-Gov roadmap.*These when mapped with respect to interlinkages developed in previous section are depicted in terms of two interlinkages viz., InterlinkageII (*Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, Service Delivery Paradigm, Privacy and Security and Technical Architecture)* III (*Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture*) *and IV (Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure)* Thus interlinkage II, interlinkage III and interlinkage IV shall have different set of rule set for analysis which shall be derived from the data of the data repository of cluster II.

6.3.2.1 Development of rule set for Interlinkage II

Interlinkage II consist of seven CSFs viz., *Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecture.* The minimum and maximum values of each CSF of Interlinkage II in cluster I with the corresponding serial no. in data repository (table 5.4.) has been tabulated below in table 6.5.

Table 6.5: Interlinkage II w. r. to Cluster II Data Repository CSF values

CSF & Serial No in Data Repository Table		Cluster I	
CSF	**Sr. No in Data Repository Table**	**Min**	**Max**
Clear Cut Vision & Goals	1	2	4
Evaluation & Performance Assessment	19	2	3
Continuous Feedback	11	2	3
Info Infrastructure	3	2	3
Service Delivery Paradigm	14	2	3
Privacy & Security	7	5	5
Technical Architecture	6	2	4

6.3.2.2 Inference of Rules

The rule set is developed from the data repository of cluster II given in table 5.4. and using four point fuzzy scales for input (depicted in figure 6.1.) and output variables (depicted in figure 6.2.). The cluster data repository with CSF values in bold is depicted in table 6.6. for generation of rules.

Table 6.6.: Cluster II Data repository for Interlinkage II

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
1	Andaman & Nicobar	2	2	3	2	2	3	5	3	2	2	4	2	2	3	2	2	3	3	2	47.99
2	Assam	3	4	3	3	4	4	5	2	2	3	3	2	2	3	3	3	2	3	3	58.67
3	Bihar	4	2	2	3	1	3	5	3	2	2	2	2	2	3	2	1	2	3	2	49.61
4	Daman & Diu	2	3	2	3	2	3	5	3	3	2	2	2	2	3	2	3	3	2	3	50.15
5	Jharkhand	3	3	2	3	1	3	5	3	3	2	2	2	2	3	3	2	3	3	3	50.70
6	Manipur	3	4	2	3	2	3	5	3	2	3	3	2	2	3	2	2	3	3	3	54.70
7	Meghalaya	3	3	3	3	2	2	5	3	2	2	2	2	2	2	2	2	2	3	2	49.75
8	Mizoram	3	2	2	3	2	2	5	3	2	2	2	2	2	2	2	2	2	2	3	46.98
9	Pondicherry	3	3	3	3	3	3	5	3	3	2	2	2	2	3	3	2	2	3	3	55.59
10	Sikkim	3	2	2	2	2	3	5	3	2	2	2	2	2	2	2	2	2	3	3	46.86

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	
11	Tripura	**3**	4	**3**	3	2	**4**	**5**	3	3	3	**3**	2	2	**3**	3	2	3	3	**3**	59.39
12	Uttarakhand	**3**	4	**3**	3	3	**3**	**5**	3	3	3	**2**	3	2	**3**	3	2	3	3	**3**	59.38

1. If CCVG is Low, II is Medium, TA is Medium, CFB is High, SDP is Medium, EPA is Low and then eGAI is Low [weightage (1)].
2. If CCVG is Medium, II is Medium, TA is High, CFB is Medium, SDP is Medium, EPA is Medium and then eGAI is Medium [weightage (1)].
3. If CCVG is High, II is Medium, TA is High, CFB is Low, SDP is Medium, EPA is Low and then eGAI is Low [weightage (1)].
4. If CCVG is Low, II is Low, TA is Medium, CFB is Low, SDP is Medium, EPA is Medium and then eGAI is Low [weightage (1)].
5. If CCVG is Medium, II is Low, TA is Medium, CFB is Low, SDP is Medium, EPA is Medium and then eGAI is Low [weightage (1)].
6. If CCVG is Medium, II is Low, TA is Medium, CFB is Low, SDP is Medium, EPA is Medium and then eGAI is Low [weightage (1)].
7. If CCVG is Medium, II is Low, TA is Medium, CFB is Low, SDP is Medium, EPA is Medium and then eGAI is Low [weightage (1)].[can be neglected as same as rule 6]
8. If CCVG is Medium, II is Low, TA is Low, CFB is Low, SDP is Low, EPA is Medium and then eGAI is Low [weightage (1)].
9. If CCVG is Medium, II is Medium, TA is Medium, CFB is Low, SDP is Low, EPA is Medium and then eGAI is Low [weightage (1)].

10. If CCVG is Medium, II is Low, TA is Medium, CFB is Low, SDP is Low, EPA is Medium and then eGAI is Low [weightage (1)].
11. If CCVG is Medium, II is Medium, TA is High, CFB is Medium, SDP is Medium, EPA is Medium and then eGAI is Medium [weightage (1)].
12. If CCVG is Medium, II is Medium, TA is Medium, CFB is Low, SDP is Medium, EPA is Medium and then eGAI is Medium [weightage (1)].

Note: - The identical rules developed can be neglected as rule serial no.6 and serial no. 7 are identical and only one of them be considered while designing the fuzzy inference systems. The rule set thus developed shall comprise of only eleven rules for interlinkage II in cluster II.

6.3.2.3 Development of Rule Set for Interlinkage III

Interlinkage III comprises of ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture*. The minimum and maximum values of each CSF of Interlinkage III in cluster II with the corresponding serial no. in data repository (table 5.4.) has been tabulated below in Table 6.7.

Table 6.7.: Interlinkage III w. r. to Cluster II Data Repository CSF

CSF & Corresponding Serial No in Data repository		Cluster I	
CSF	**Ser. No**	**Min**	**Max**
Clear Cut Vision & Goals	1	1	3
Human Capacity Building	4	1	2
Change Management	8	1	2

CSF & Corresponding Serial No in Data repository		Cluster I	
CSF	**Ser. No**	**Min**	**Max**
e-Governance Program Management	10	1	2
Integrated e-Governance	11	1	1
Sustainable Business Model	18	1	2
Awareness & Communication Strategy	5	1	1
Cost Benefit Analysis	17	1	2
Formulation of e-Governance roadmap	9	1	2
Technical Architecture	6	1	2

6.2.3.4 Inference of Rules

The rule set is developed from the data repository of cluster II given in table 5.4. and using four point fuzzy scales for input (depicted in Figure 6.1.) and output variables (depicted in Ffigure 6.2.). The cluster data repository with CSF values in bold is depicted in table 6.8. for generation of rules. The rules are as under:-

1. If CCVG is Low, HCB is Low, ACS is Low, TA is Medium, CM is Low, FEGR is Low, EGPM is Low, IEG is High, CBA is Low, SBM is Low then eGAI is Low [weightage (1)].

2. If CCVG is Medium, HCB is Medium, ACS is High, TA is High, CM is Low, FEGR is Low, EGPM is Medium, IEG is Medium, CBA is Low, SBM is Medium then eGAI is Medium [weightage (1)].

3. If CCVG is High, HCB is Medium, ACS is Very Low, TA is Medium, CM is Medium, FEGR is Low, EGPM is Low, IEG is Low, CBA is Low, SBM is Medium then eGAI is Low [weightage (1)].

4. If CCVG is Low, HCB is Medium, ACS is Low, TA is Medium, CM is Medium, FEGR is Medium, EGPM is Low, IEG is Low, CBA is Medium, SBM is Low then eGAI is Low [weightage (1)].

Table 6.8.: Cluster II Data Repository for Interlinkage III

Sr. No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Andaman & Nicobar	2	2	3	2	2	3	5	3	2	2	4	2	2	3	2	2	3	3	2	47.99
2	Assam	3	4	3	3	4	4	5	2	2	3	3	2	2	3	3	3	2	3	3	58.67
3	Bihar	4	2	2	3	1	3	5	3	2	2	2	2	2	3	2	1	2	3	2	49.61
4	Daman & Diu	2	3	2	3	2	3	5	3	3	2	2	2	2	3	2	3	3	2	3	50.15
5	Jharkhand	3	3	2	3	1	3	5	3	3	2	2	2	2	3	3	2	3	3	3	50.70
6	Manipur	3	4	2	3	2	3	5	3	2	3	3	2	2	3	2	2	3	3	3	54.70
7	Meghalaya	3	3	3	3	2	2	5	3	2	2	2	2	2	2	2	2	2	3	2	49.75
8	Mizoram	3	2	2	3	2	2	5	3	2	2	2	2	2	2	2	2	2	2	3	46.98
9	Pondicherry	3	3	3	3	3	3	5	3	3	2	2	2	2	3	3	2	2	3	3	55.59
10	Sikkim	3	2	2	2	2	3	5	3	2	2	2	2	2	2	2	2	2	3	3	46.86
11	Tripura	3	4	3	3	2	4	5	3	3	3	3	2	2	3	3	2	3	3	3	59.39
12	Uttarakhand	3	4	3	3	3	3	5	3	3	3	2	3	2	3	3	2	3	3	3	59.38

5. If CCVG is Medium, HCB is Medium, ACS is Very Low, TA is Medium, CM is Medium, FEGR is Medium, EGPM is Low, IEG is Low, CBA is Low, SBM is Medium then eGAI is Low [weightage (1)].
6. If CCVG is Medium, HCB is Medium, ACS is Low, TA is Medium, CM is Medium, FEGR is Low, EGPM is Medium, IEG is Medium, CBA is Medium, SBM is Medium then eGAI is Low [weightage (1)].
7. If CCVG is Medium, HCB is Medium, ACS is Low, TA is Low, CM is Medium, FEGR is Low, EGPM is Low, IEG is Low, CBA is Low, SBM is Medium then eGAI is Low [weightage (1)].
8. If CCVG is Medium, HCB is Medium, ACS is Low, TA is Low, CM is Medium, FEGR is Low, EGPM is Low, IEG is Low, CBA is Low, SBM is Low then eGAI is Low [weightage (1)].
9. If CCVG is Medium, HCB is Medium, ACS is Medium, TA is Medium, CM is Medium, FEGR is Medium, EGPM is Low, IEG is Low, CBA is Low, SBM is Medium then eGAI is Low [weightage (1)].
10. If CCVG is Medium, HCB is Low, ACS is Low, TA is Medium, CM is Medium, FEGR is Low, EGPM is Low, IEG is Low, CBA is Medium, SBM is Medium then eGAI is Low [weightage (1)].
11. If CCVG is Medium, HCB is Medium, ACS is Low, TA is High, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is Medium, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].
12. If CCVG is Medium, HCB is Medium, ACS is Medium, TA is Medium, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is Low, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].

6.3.2.3 Interlinkage IV.

Interlinkage IV comprises of five CSFs viz., *Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure*. The minimum and maximum values of each CSF of Interlinkage

IV in cluster II with the corresponding serial no. in data repository (table 5.4.) has been tabulated below in table 6.9.

Table 6.9.: Interlinkage IV with respect to Cluster II Data Repository CSF

CSF & Corresponding Serial No in Data Repository		Cluster I	
CSF	**Ser. No**	**Min**	**Max**
Clear Cut Vision & Goals	1	2	4
e-Content	2	2	4
Info Infrastructure	3	2	3
Technical Architecture	6	2	4
Re-engineering Process	12	2	3

The rule set is developed for interlinkage IV from the data repository of cluster II given in table 5.4. and using four point fuzzy scales for input (depicted in Figure 6.1.) and output variables (depicted in Ffigure 6.2.). The cluster data repository with CSF values in bold is depicted in table 6.10. for generation of rules. The rules are as under:-

1. If CCVG is Low, EC is Low, II is Medium, TA is Medium, REP is Low, then eGAI is Low [weightage (1)].

2. If CCVG is Medium, EC is High, II is Medium, TA is High, REP is Low, then eGAI is Medium [weightage (1)].

3. If CCVG is High, EC is Low, II is Low, TA is Medium, REP is Low, then eGAI is Low [weightage (1)].

4. If CCVG is Low, EC is Medium, II is Low, TA is Medium, REP is Low, then eGAI is Low [weightage (1)].

5. If CCVG is Medium, EC is medium, II is Low, TA is Medium, REP is Low, then eGAI is Low [weightage (1)].

6. If CCVG is Medium, EC is High, II is Low, TA is Medium, REP is Low, then eGAI is Low [weightage (1)].

Table 6.10.: Data Repository for Cluster II for Interlinkage IV

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Andaman & Nicobar	2	2	3	2	2	3	5	3	2	2	4	2	2	3	2	2	3	3	2	47.99
2	Assam	3	4	3	3	4	4	5	2	2	3	3	2	2	3	3	3	2	3	3	58.67
3	Bihar	4	2	2	3	1	3	5	3	2	2	2	2	2	3	2	1	2	3	2	49.61
4	Daman & Diu	2	3	2	3	2	3	5	3	3	2	2	2	2	3	2	3	3	2	3	50.15
5	Jharkhand	3	3	2	3	1	3	5	3	3	2	2	2	2	3	3	2	3	3	3	50.70
6	Manipur	3	4	2	3	2	3	5	3	2	3	3	2	2	3	2	2	3	3	3	54.70
7	Meghalaya	3	3	3	3	2	2	5	3	2	2	2	2	2	2	2	2	2	3	2	49.75
8	Mizoram	3	2	2	3	2	2	5	3	2	2	2	2	2	2	2	2	2	2	3	46.98
9	Pondicherry	3	3	3	3	3	3	5	3	3	2	2	2	2	3	3	2	2	3	3	55.59
10	Sikkim	3	2	2	2	2	3	5	3	2	2	2	2	2	2	2	2	2	3	3	46.86
11	Tripura	3	4	3	3	2	4	5	3	3	3	3	2	2	3	3	2	3	3	3	59.39

12	Uttarakhand	3	4	3	3	3	3	5	3	3	3	2	3	2	3	3	2	3	3	3	59.38

7. If CCVG is Medium, EC is Medium, II is Medium, TA is Low, REP is Low, then eGAI is Low [weightage (1)].

8. If CCVG is Medium, EC is Low, II is Low, TA is Low, REP is Low, then eGAI is Low [weightage (1)].

9. If CCVG is Medium, EC is Medium, II is Medium, TA is Medium, REP is Low, then eGAI is Low [weightage (1)].

10. If CCVG is Medium, EC is Low, II is Low, TA is Medium, REP is Low, then eGAI is Low [weightage (1)].

11. If CCVG is Medium, EC is High, II is Medium, TA is High, REP is Low, then eGAI is Medium [weightage (1)].

12. If CCVG is Medium, EC is High, II is Medium, TA is Medium, REP is Medium, then eGAI is Medium [weightage (1)].

6.3.3 Cluster III

The data repository for cluster III based on inputs of multiple stakeholders' has been compiled in table 5.6**.** A closer analysis of the data repository for this cluster suggests that the CSFs governing strategy (as deduced in previous chapter) are: *Clear cut vision and goals, Evaluation and performance assessment, Continuous feedback, Info infrastructure, Service delivery paradigm, Technology Architecture, Formulation of e-Gov roadmap, Re-engineering process, Universal accessibility, Understanding e-Gov prospects, Human capacity building, Change management, e-Gov program management, Integrated e-governance, Sustainable business model, Awareness and communication strategy, Cost benefit analysis, and E-content.* These when

mapped with respect to interlinkages developed in previous section are depicted in terms of three interlinkages viz., **Interlinkage II** (*Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, Service Delivery Paradigm, Privacy and Security and Technical Architecture)***III** (*Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis**,** Formulation of e-Governance Roadmapand Technical Architecture*) ***and IV (****Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure)* Thus interlinkage II, interlinkage III and interlinkage IV shall have different set of rule set for analysis which shall be derived from the data of the data repository of cluster III.

6.3.3.1 Development of Rule Set for Interlinkage II

Interlinkage II consist of seven CSFs viz., *Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecture.* The minimum and maximum values of each CSF of Interlinkage II in cluster III with the corresponding serial no. in data repository (table 5.6.) has been tabulated below in Table 6.11.

Table 6.11.: Interlinkage II w. r. to Cluster III Data Repository CSF Values

CSF & Serial No in Data Repository Table		Cluster I	
CSF	**Ser. No in Data Repository Table**	**Min**	**Max**
Clear Cut Vision & Goals	1	3	4

CSF & Serial No in Data Repository Table		Cluster I	
CSF	**Ser. No in Data Repository Table**	**Min**	**Max**
Evaluation & Performance Assessment	19	3	4
Continuous Feedback	11	3	4
Info Infrastructure	3	3	5
Service Delivery Paradigm	14	3	4
Privacy & Security	7	5	5
Technical Architecture	6	3	5

6.3.3.2 Inference of Rules

The rule set is developed from the data repository of cluster III given in table 5.6. and using four point fuzzy scales for input (depicted in figure 6.1.) and output variables (depicted in figure 6.2.). The cluster data repository with CSF values in bold is depicted in table 6.12. for generation of rules. The rules are as under:-

1. If CCVG is High, II is Medium, TA is High, CFB is High, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].
2. If CCVG is Medium, II is High, TA is High, CFB is Medium, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].
3. If CCVG is Medium, II is High, TA is High, CFB is High, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].

4. If CCVG is High, II is Medium, TA is Medium, CFB is Medium, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].
5. If CCVG is Medium, II is Medium, TA is High, CFB is Medium, SDP is Medium, EPA is Medium and then eGAI is Medium [weightage (1)].
6. If CCVG is High, II is High, TA is High, CFB is High, SDP is Medium, EPA is High and then eGAI is Medium [weightage (1)].
7. If CCVG is High, II is Medium, TA is High, CFB is High, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].
8. If CCVG is Medium, II is Medium, TA is High, CFB is Medium, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].
9. If CCVG is Medium, II is High, TA is High, CFB is High, SDP is High, EPA is High and then eGAI is Medium [weightage (1)].
10. If CCVG is Medium, II is High, TA is High, CFB is Medium, SDP is High, EPA is High and then eGAI is Medium [weightage (1)].
11. If CCVG is High, II is Medium, TA is Medium, CFB is Medium, SDP is Medium, EPA is Medium and then eGAI is Medium [weightage (1)].
12. If CCVG is Medium, II is Medium, TA is Medium, CFB is High, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].
13. If CCVG is Medium, II is Medium, TA is High, CFB is Medium, SDP is High, EPA is Medium and then eGAI is Medium [weightage (1)].

Table 6.12.: Data Repository of Cluster III with respect to Interlinkage II

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Chattisgarh	4	5	3	4	3	4	5	3	4	4	4	3	3	4	4	3	3	3	3	71.26

2	Delhi	3	4	5	4	3	5	5	4	3	2	3	3	4	4	2	4	4	4	3	70.83
3	Goa	3	4	4	4	3	4	5	4	4	3	5	5	4	4	2	2	4	3	3	71.44
4	Himachal Pradesh	4	4	3	3	3	3	5	3	3	3	3	3	3	4	3	2	3	3	3	63.15
5	Kerala	3	4	3	4	5	5	5	4	4	3	3	2	3	3	3	3	3	3	3	70.95
6	Lakshadweep	4	4	4	4	4	4	5	4	4	3	4	3	3	3	2	3	3	3	4	72.80
7	Madhya Pradesh	4	4	3	4	4	4	5	3	3	3	4	4	5	4	3	4	3	3	3	70.50
8	Maharashtra	3	5	3	4	5	4	5	3	3	3	3	4	3	4	3	2	3	3	3	70.51
9	Orissa	3	4	4	4	3	4	5	3	3	3	4	3	3	4	3	3	3	4	4	66.79
10	Punjab	3	5	4	4	5	4	5	3	3	3	3	3	4	4	3	3	4	3	4	72.32
11	Rajasthan	4	4	3	4	4	3	5	3	3	3	3	3	2	3	2	2	3	3	3	65.73
12	Uttar Pradesh	3	4	3	4	3	3	5	3	4	4	4	3	3	4	4	3	3	3	3	65.14
13	West Bengal	3	4	3	3	4	4	5	3	3	3	3	3	3	4	3	3	3	3	3	64.27

6.3.3.3 Development of Rule Set for Interlinkage III

Interlinkage III comprises of ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture*.

Table 6.13.: Interlinkage III with respect to Cluster III Data Repository CSFs

CSF & Corresponding Serial No in Data repository		Cluster I	
CSF	**Ser. No**	**Min**	**Max**
Clear Cut Vision & Goals	1	3	4
Human Capacity Building	4	3	4
Change Management	8	3	4
e-Governance Program Management	10	3	4
Integrated e-Governance	11	3	4
Sustainable Business Model	18	3	4
Awareness & Communication Strategy	5	3	5
Cost Benefit Analysis	17	3	4
Formulation of e-Governance roadmap	9	3	4
Technical Architecture	6	3	5

6.3.3.4 Inference of Rules

The minimum and maximum values of each CSF of Interlinkage III in cluster III with the corresponding serial no. in data repository (table 5.6.) has been tabulated above in Table 6.13. The rule set is developed from the data repository of cluster III given in table 5.6. and using four point fuzzy scales for input (depicted in figure 6.1.) and output variables (depicted in figure 6.2.). The cluster data repository with CSF values in bold is depicted in Table 6.14 for generation of rules. The rules are as under:-

1. If CCVG is High, HCB is High, ACS is Medium, TA is High, CM is Medium, FEGR is High, EGPM is High, IEG is High, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].

2. If CCVG is Medium, HCB is High, ACS is Medium, TA is High, CM is High, FEGR is Medium, EGPM is Low, IEG is Medium, CBA is High, SBM is High then eGAI is Medium [weightage (1)].
3. If CCVG is Medium, HCB is High, ACS is Medium, TA is High, CM is High, FEGR is High, EGPM is Medium, IEG is High, CBA is High, SBM is Medium then eGAI is Medium [weightage (1)].
4. If CCVG is High, HCB is Medium, ACS is Medium, TA is Medium, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is Medium, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].
5. If CCVG is Medium, HCB is High, ACS is High, TA is High, CM is High, FEGR is High, EGPM is Medium, IEG is Medium, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].
6. If CCVG is High, HCB is High, ACS is High, TA is High, CM is High, FEGR is High, EGPM is Medium, IEG is High, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].
7. If CCVG is High, HCB is High, ACS is High, TA is High, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is High, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].
8. If CCVG is Medium, HCB is High, ACS is High, TA is High, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is Medium, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].
9. If CCVG is Medium, HCB is High, ACS is Medium, TA is High, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is High, CBA is Mediumh, SBM is High then eGAI is Medium [weightage (1)].
10. If CCVG is Medium, HCB is High, ACS is High, TA is High, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is Medium, CBA is High, SBM is Medium then eGAI is Medium [weightage (1)].

11. If CCVG is Medium, HCB is High, ACS is Medium, TA is Medium, CM is Medium, FEGR is High, EGPM is High, IEG is High, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].

12. If CCVG is Medium, HCB is High, ACS is Medium, TA is Medium, CM is Medium, FEGR is High, EGPM is High, IEG is High, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].

13. If CCVG is Medium, HCB is Medium, ACS is High, TA is High, CM is Medium, FEGR is Medium, EGPM is Medium, IEG is Medium, CBA is Medium, SBM is Medium then eGAI is Medium [weightage (1)].

Table 6.14.: Data Repository of Cluster III with respect to Interlinkage III

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Chattisgarh	4	5	3	4	3	4	5	3	4	4	4	3	3	4	4	3	3	3	3	71.26
2	Delhi	3	4	5	4	3	5	5	4	3	2	3	3	4	4	2	4	4	4	3	70.83
3	Goa	3	4	4	4	3	4	5	4	4	3	5	5	4	4	2	2	4	3	3	71.44
4	Himachal Pradesh	4	4	3	3	3	3	5	3	3	3	3	3	3	4	3	2	3	3	3	63.15
5	Kerala	3	4	3	4	5	5	5	4	4	3	3	2	3	3	3	3	3	3	3	70.95
6	Lakshadweep	4	4	4	4	4	4	5	4	4	3	4	3	3	3	2	3	3	3	4	72.80
7	Madhya Pradesh	4	4	3	4	4	4	5	3	3	3	4	4	5	4	3	4	3	3	3	70.50
8	Maharashtra	3	5	3	4	5	4	5	3	3	3	3	4	3	4	3	2	3	3	3	70.51
9	Orissa	3	4	4	4	3	4	5	3	3	3	4	3	3	4	3	3	3	4	4	66.79
10	Punjab	3	5	4	4	5	4	5	3	3	3	3	3	4	4	3	3	4	3	4	72.32
11	Rajasthan	4	4	3	4	4	3	5	3	3	3	3	3	2	3	2	2	3	3	3	65.73
12	Uttar Pradesh	3	4	3	4	3	3	5	3	4	4	4	3	3	4	4	3	3	3	3	65.14
13	West Bengal	3	4	3	3	4	4	5	3	3	3	3	3	3	4	3	3	3	3	3	64.27

6.3.3.5 Interlinkage IV

Interlinkage IV comprises of five CSFs viz., *Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure*. The minimum and maximum values of each CSF of Interlinkage IV in cluster III with the corresponding serial no. in data repository (table 5.6.) has been tabulated below in table 6.15.

Table 6.15.: Interlinkage IV with respect to cluster I1I data repository

CSF & Corresponding Serial No in Data Repository		Cluster I	
CSF	**Ser. No**	**Min**	**Max**
Clear Cut Vision & Goals	1	3	4
e-Content	2	4	5
Info Infrastructure	3	3	5
Technical Architecture	6	3	5
Re-engineering Process	12	2	5

6.3.3.6 Inference of Rules

The rule set is developed for interlinkage IV from the data repository of cluster III given in table 5.6. and using four point fuzzy scales for input (depicted in figure 6.1.) and output variables (depicted in figure 6.2.). The cluster data repository with CSF values in bold is depicted in table 6.10. for generation of rules. The rules are as under:-

1. If CCVG is High, EC is High, II is Medium, TA is High, REP is Medium, then eGAI is Medium [weightage (1)].

2. If CCVG is Medium, EC is High, II is High, TA is High, REP is Medium, then eGAI is Medium [weightage (1)].

3. If CCVG is Medium, EC is High, II is High, TA is High, REP is High, then eGAI is Medium [weightage (1)].

4. If CCVG is High, EC is High, II is Medium, TA is Medium, REP is Medium, then eGAI is Medium [weightage (1)].

5. If CCVG is Medium, EC is High, II is Medium, TA is High, REP is Low, then eGAI is Medium [weightage (1)].

6. If CCVG is High, EC is High, II is High, TA is High, REP is Medium, then eGAI is Medium [weightage (1)].

7. If CCVG is High, EC is High, II is Medium, TA is High, REP is High, then eGAI is Medium [weightage (1)].

8. If CCVG is Medium, EC is High, II is Medium, TA is High, REP is High, then eGAI is Medium [weightage (1)].

9. If CCVG is Medium, EC is High, II is High, TA is High, REP is Medium, then eGAI is Medium [weightage (1)].

10. If CCVG is Medium, EC is High, II is High, TA is High, REP is Medium, then eGAI is Medium [weightage (1)].

11. If CCVG is High, EC is High, II is Medium, TA is Medium, REP is Medium, then eGAI is Medium [weightage (1)].

12. If CCVG is Medium, EC is High, II is Medium, TA is Medium, REP is Medium, then eGAI is Medium [weightage (1)].

13. If CCVG is Medium, EC is High, II is Medium, TA is High, REP is Medium, then eGAI is Medium [weightage (1)].

14.

Table 6.16.: Data Repository of Cluster III with respect to Interlinkage IV

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Chattisgarh	4	5	3	4	3	4	5	3	4	4	4	3	3	4	4	3	3	3	3	71.26
2	Delhi	3	4	5	4	3	5	5	4	3	2	3	3	4	4	2	4	4	4	3	70.83
3	Goa	3	4	4	4	3	4	5	4	4	3	5	5	4	4	2	2	4	3	3	71.44
4	Himachal Pradesh	4	4	3	3	3	3	5	3	3	3	3	3	3	4	3	2	3	3	3	63.15
5	Kerala	3	4	3	4	5	5	5	4	4	3	3	2	3	3	3	3	3	3	3	70.95
6	Lakshadweep	4	4	4	4	4	4	5	4	4	3	4	3	3	3	2	3	3	3	4	72.80
7	Madhya Pradesh	4	4	3	4	4	4	5	3	3	3	4	4	5	4	3	4	3	3	3	70.50
8	Maharashtra	3	5	3	4	5	4	5	3	3	3	3	4	3	4	3	2	3	3	3	70.51
9	Orissa	3	4	4	4	3	4	5	3	3	3	4	3	3	4	3	3	3	4	4	66.79
10	Punjab	3	5	4	4	5	4	5	3	3	3	3	3	4	4	3	3	4	3	4	72.32
11	Rajasthan	4	4	3	4	4	3	5	3	3	3	3	3	2	3	2	2	3	3	3	65.73
12	Uttar Pradesh	3	4	3	4	3	3	5	3	4	4	4	3	3	4	4	3	3	3	3	65.14
13	West Bengal	3	4	3	3	4	4	5	3	3	3	3	3	3	4	3	3	3	3	3	64.27

6.3.4. Cluster IV. There are six states/UTs in cluster IV viz., Andhra Pradesh, Chandigarh, Gujarat, Haryana, Karnataka and Tamil Nadu with eGAI values ranging from 76 to 90 . They are leaders in NeGP adoption and implementation in India and their strategy of implementation has been found to be appropriate for adoption of multitude of e-governance initiatives in India. The states/UTs

post NeGP should emulate their strategy. The data repository for states and UTs in cluster IV has been depicted in table 6.17.

Table 6.17.: Data Repository of Cluster IV

S.No	State/UT	CSFs inputs on 1 to 5 scale																			eGAI value
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1	Andhra Pradesh	5	4	5	4	5	4	5	4	5	4	4	4	5	5	4	4	4	4	4	82.66
2	Chandigarh	4	4	5	4	4	4	5	4	4	3	4	4	4	5	4	4	4	3	4	76.51
3	Gujarat	5	4	5	5	4	5	5	4	5	5	5	5	4	5	2	5	4	3	5	85.59
4	Haryana	5	4	5	5	4	4	5	4	5	5	5	5	4	4	4	4	4	5	5	83.87
5	Karnataka	5	5	5	5	5	5	5	4	5	5	4	4	5	4	5	5	5	5	4	88.83
6	Tamil Nadu	5	4	4	5	4	5	5	4	5	4	4	5	5	5	3	3	3	3	3	84.99

6.4 Design of FIS

Fuzzy Inference Systems for each of the interlinkages were designed using Matlab 7.0 fuzzy toolbox and these systems were simulated to identify the most appropriate interlinkage for each cluster.

6.4.1 Interlinkage I

Interlinkage I consist of a combination of six CSFs viz., *Clear Cut Vision and Goals, Understanding e-Governance Prospects, Universal Accessibility, Re-engineering Processes, Formulation of e-Governance Plan and Technical Architecture* that contribute towards eGAI values. The systemic links have been

developed using common KPIs between the CSFs. The interlinkage FIS structure has been depicted in the Figure 6.8.

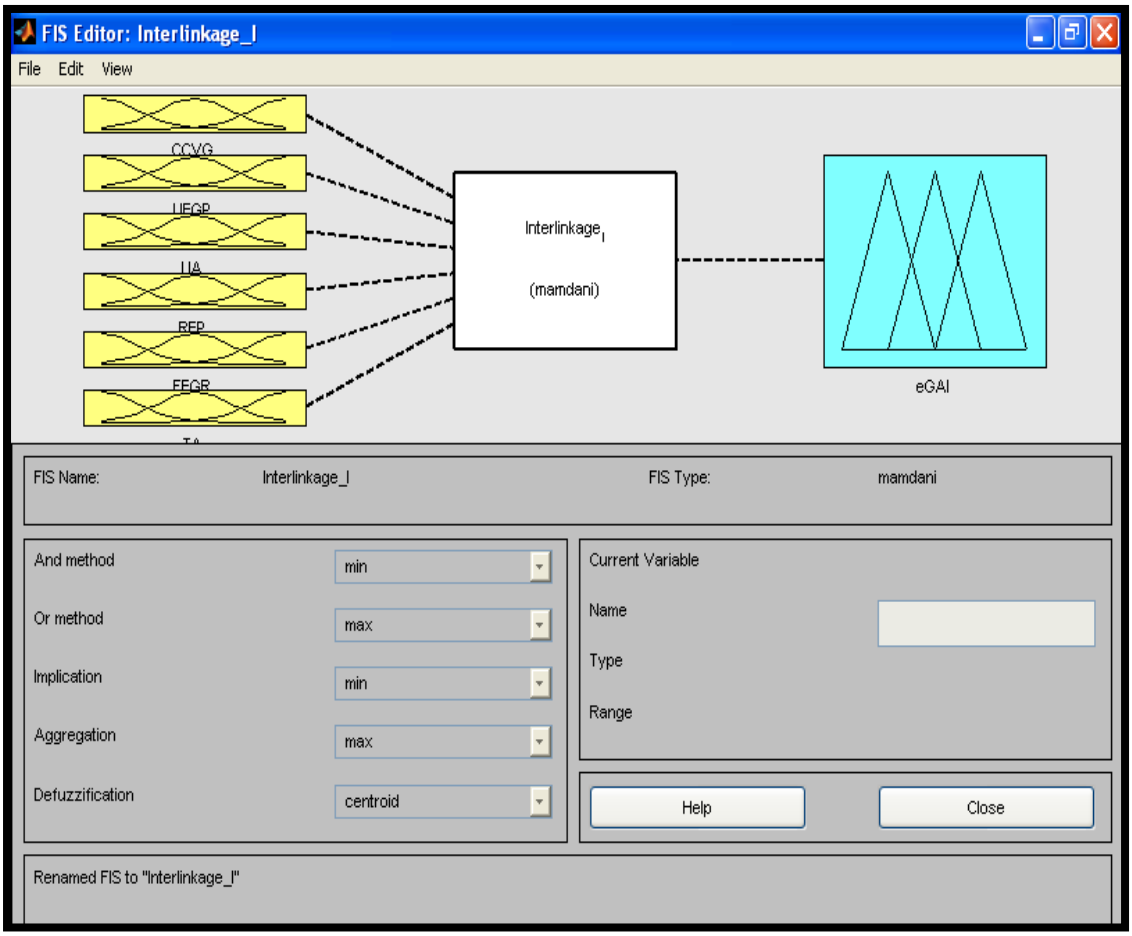

Figure 6.8.: FIS structure Interlinkage I

6.4.2 Interlinkage II

Interlinkage II consist of seven CSFs viz., ***Clear Cut Vision and Goals***, ***Evaluation and performance Assessment***, ***Continuous Feedback***, ***Info Infrastructure***, ***service Delivery Paradigm***, ***Privacy and Security*** *and* ***Technical Architecture*** that contribute towards eGAI values. The systemic links have been developed using common KPIs between the CSFs. This interlinkage FIS structure has been depicted in the Figure 6.9 below.

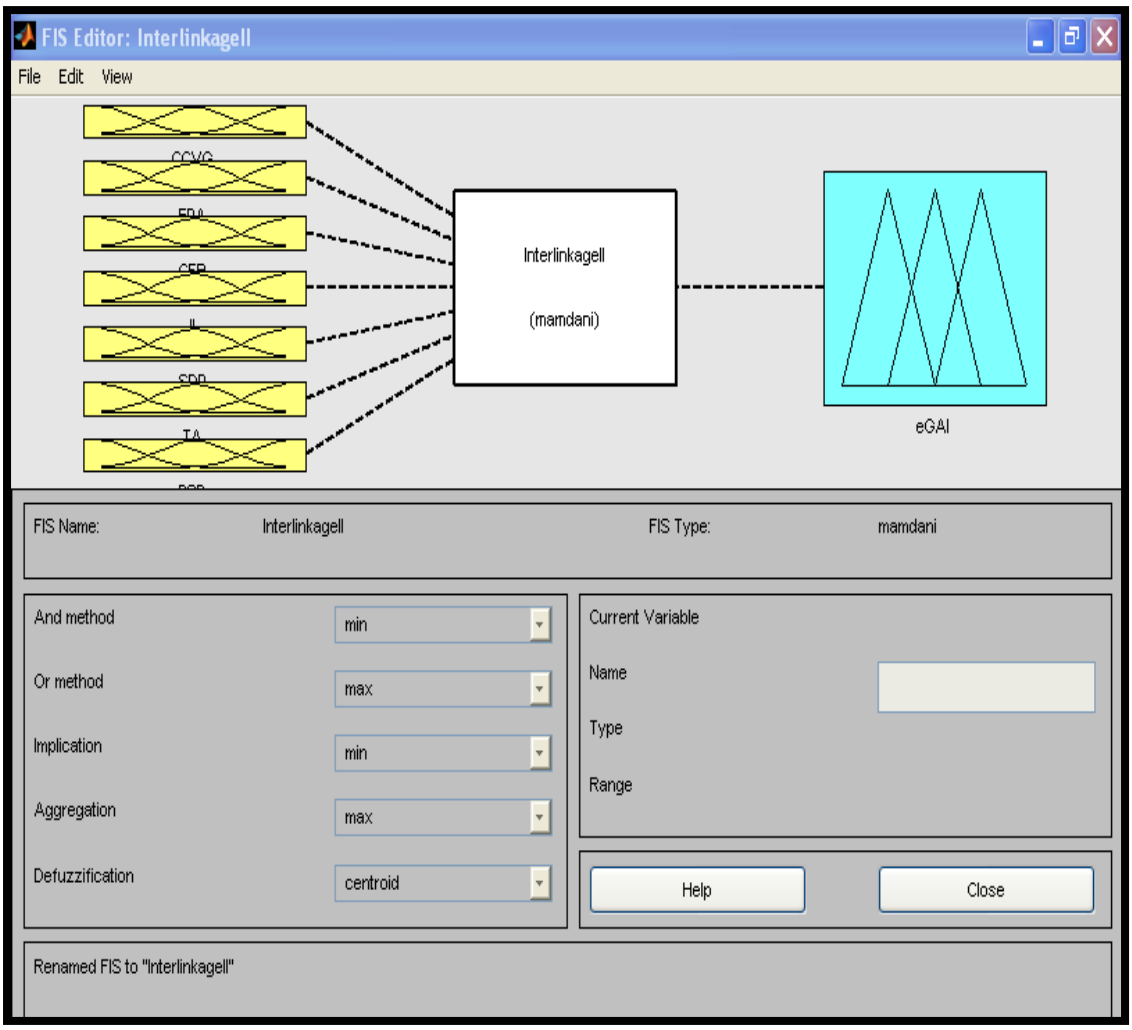

Figure 6.9: FIS structure Interlinkage II

6.4.3 Interlinkage III.

Interlinkage III comprises of ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture* that contribute towards eGAI values. The systemic links have been developed using common KPIs between the CSFs. This interlinkage FIS structure has been depicted in the figure 6.10 below.

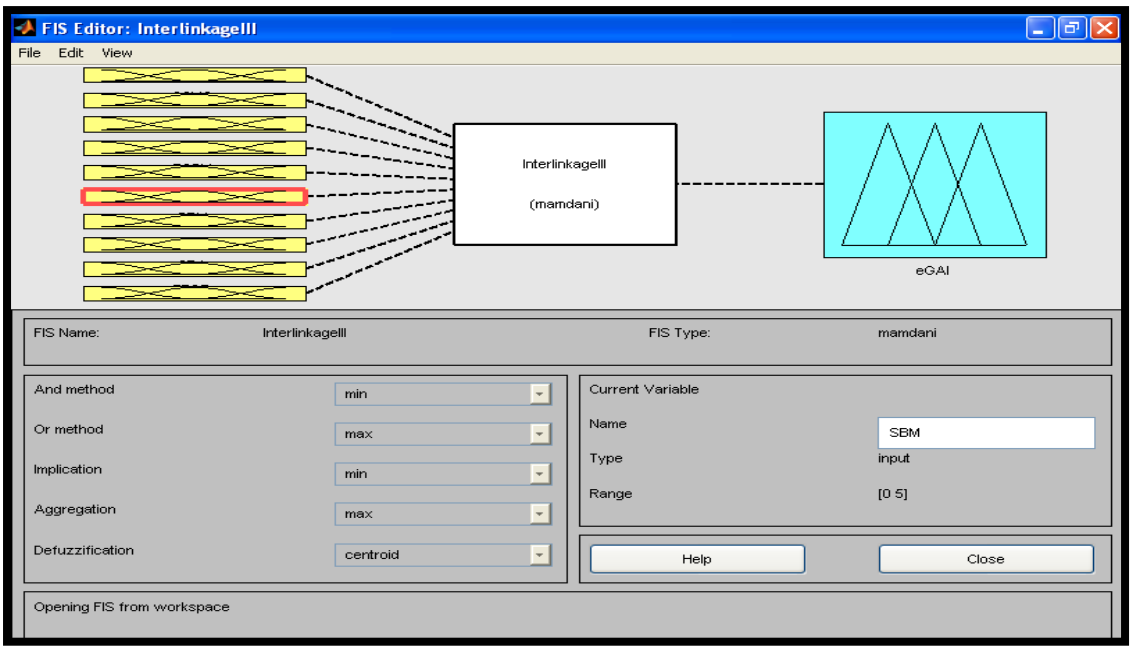

Figure 6.10: FIS structure for Interlinkage III

6.4.4 Interlinkage IV.

Interlinkage IV comprises of five CSFs viz., *Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure* that contribute towards eGAI values. The systemic links have been developed using common KPIs between the CSFs. This interlinkage FIS structure has been depicted in the Figure 6.11 below.

6.5 Cluster I: Finalization of Interlinkage

Interlinkage II and III were analyzed for appropriateness of strategy for all four states/UTs belonging to this cluster. Interlinkage II with seven CSFs viz., Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecturewere analyzed for increase of eGAI values from 20.51 to 32.45 to next range of values 46.86 to 59.69. The average eGAI value was taken to be 50.

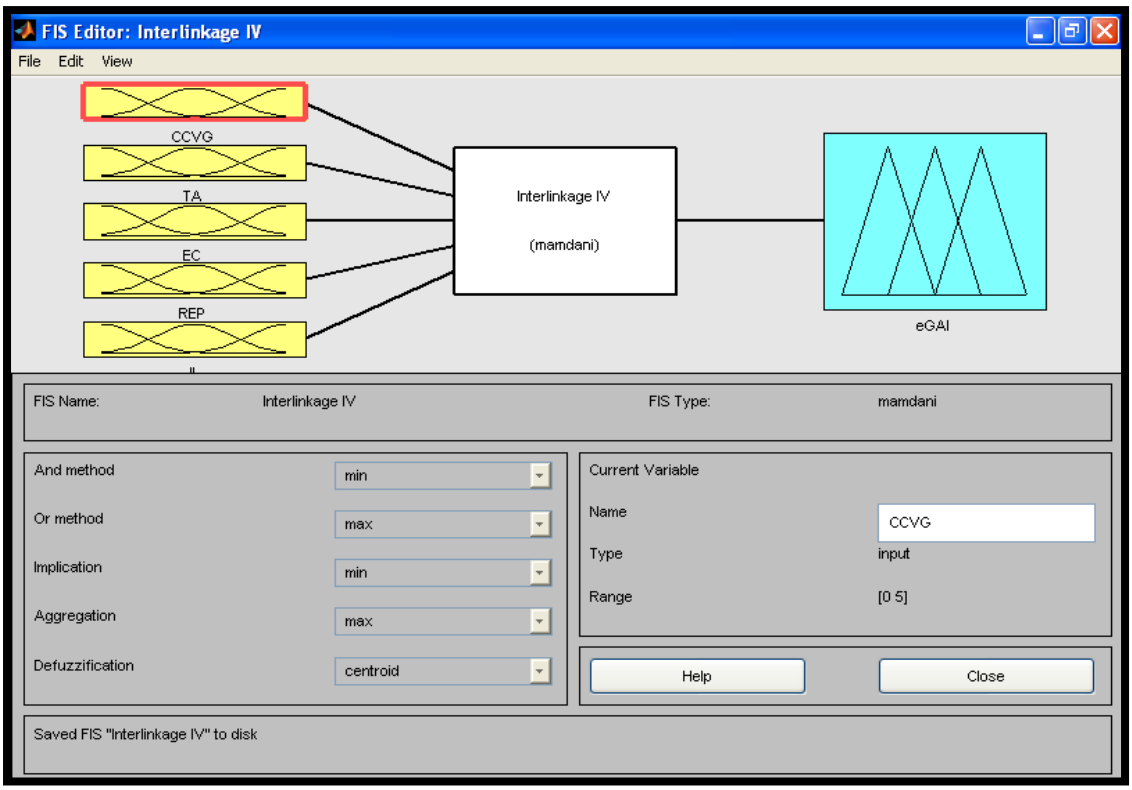

Figure 6.11.: FIS structure for Interlinkage IV

Interlinkage II was analyzed for minimum no. of CSF perturbations, it is concluded that by increasing the value of Info Infrastructure from [0 1 2] to [1 2 3] eGAI value graduates to 50. Interlinkage III with ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture.* Interlinkage III was analyzed for minimum no. of CSF perturbations to graduate to eGAI value 50. One CSF was perturbed by 0.25 to yield eGAI values i.e., Clear Cut Vision and Goals. Interlinkage III is most appropriate strategy for cluster I as minimum perturbations of minimum no. of CSFs are required to progress eGAI = 50 in the range of low [20 40 60]. Only CCVG values have to be changed to values ≥ 0.25 to reach eGAI ≈50.

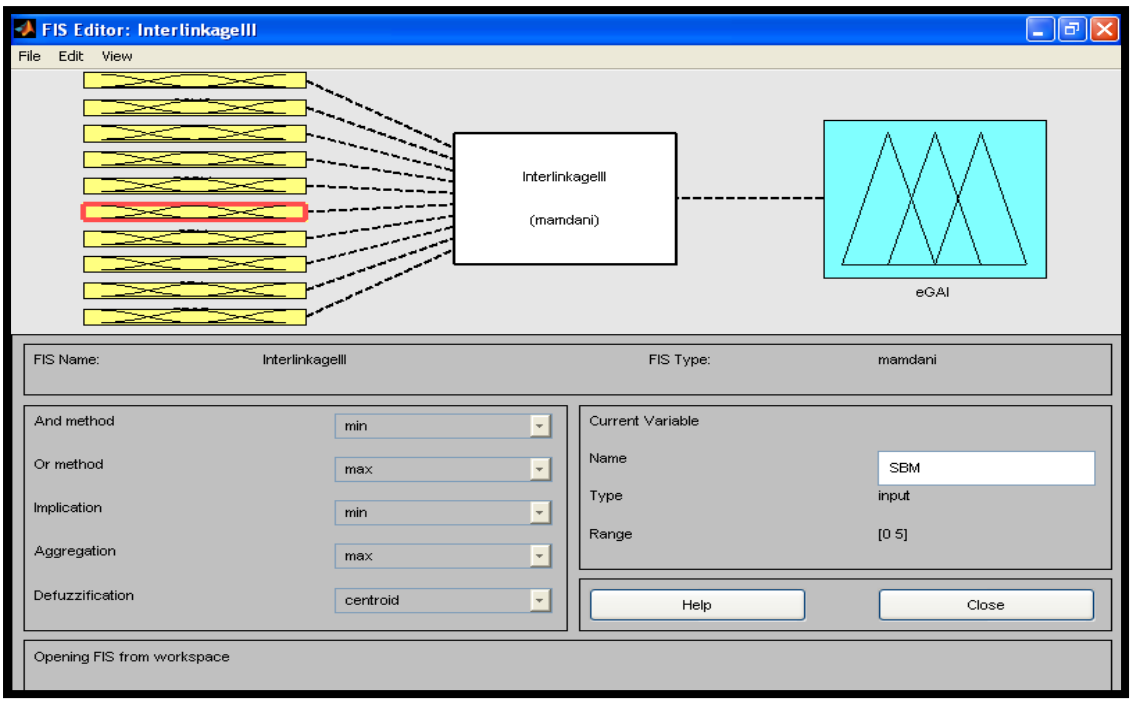

Figure 6.12: FIS simulation structure Interlinkage III

Thus we infer that Interlinkage III with ten CSFs viz., *Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture* is the most optimalstrategy for cluster I which includes four states/UTs i.e., Jammu and Kashmir, Arunachal Pradesh, Dadar & Nagar Haveli and Nagaland.

6.6 Cluster II: Finalization of Interlinkage

Interlinkage II, III and IV were analyzed for appropriateness of strategy for eleven states of Cluster II. Interlinkage II with seven CSFs viz., *Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security*

*and Technical Architecture*were analyzed for increase of eGAI values from 46.86 to 59.69 to next range of values 64.27 to 72.80.

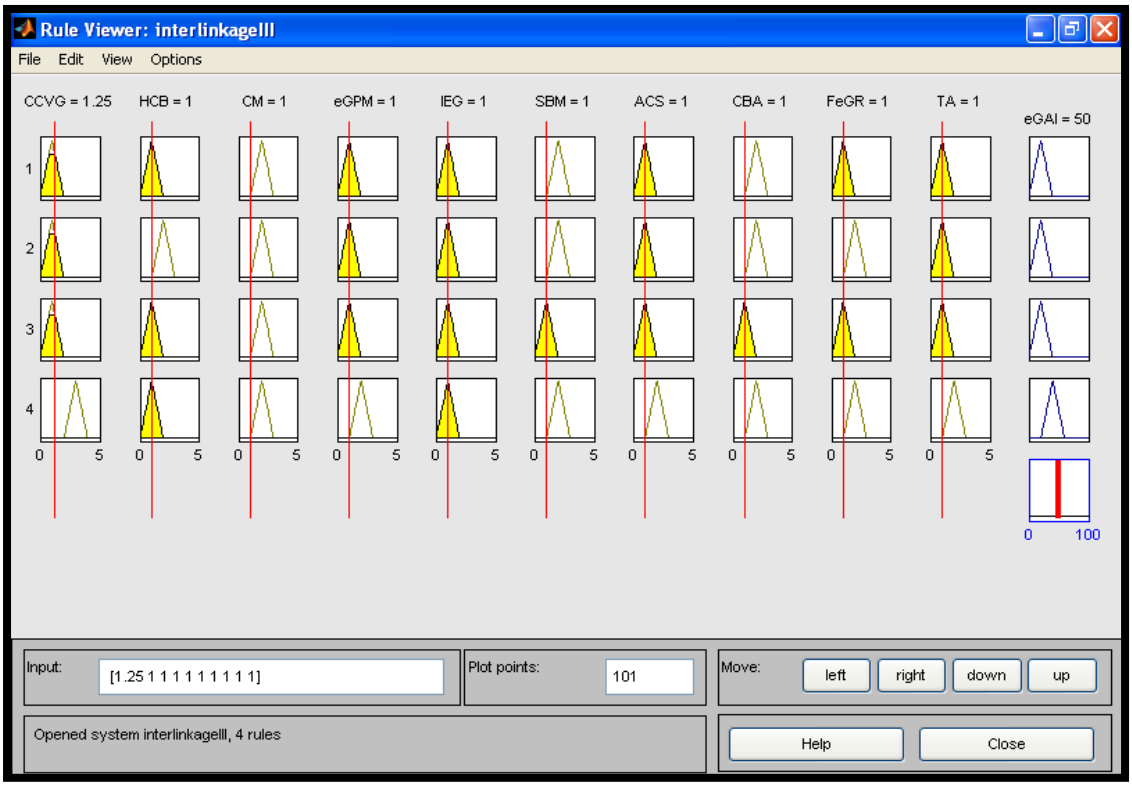

Figure 6.13.: FIS simulation structure for Interlinkage III Cluster I

Any amount of perturbations does not yield in change of values of eGAI. Thus this strategy may not be valid for this cluster along with its ruleset derived from the data. The eGAI value taken for approximation is 68.00.Interlinkage III with ten CSFs viz., Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture. Any amount of perturbations does not yield in change of values of eGAI. Thus this strategy may not be valid for this cluster along with its rule set derived from the data.Interlinkage IV is possible as only one CSFs i.e., E-content with a minimum no of perturbations ≥ 0.13 is responsible for turning the values of eGAI= 60. The states/UTs who improve their e-content shall graduate

to Cluster III with eGAI values [40 60 80]. E-content should be developed in local languages so as to enable high usage by citizens.

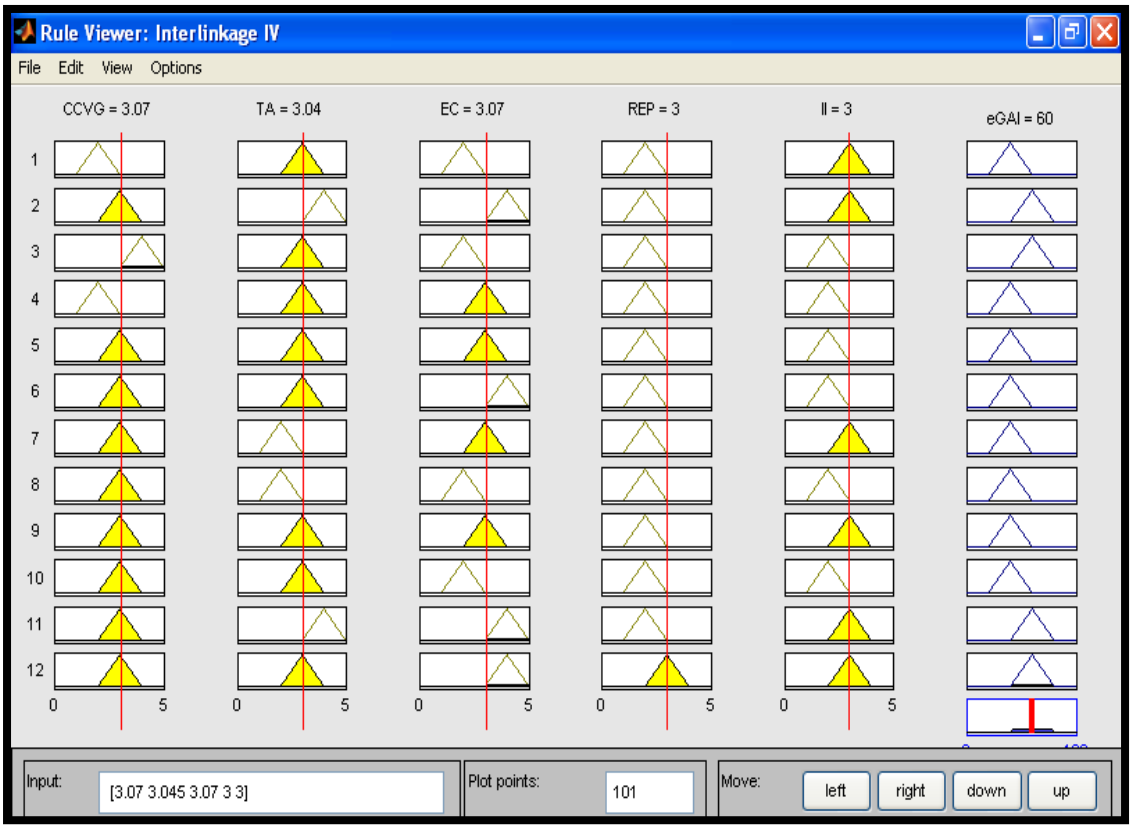

Figure 6.14: FIS simulation of interlinkage IV for cluster II

Thus we infer that Interlinkage IV with five CSFs viz., *Clear Cut Vision and Goals, Technical Architecture, e-Content, Re-engineering Processes and Info Infrastructure* is the most optimalstrategy for cluster II which includes twelve states/UTs i.e., Sikkim, Mizoram, Andaman & Nicobar, Bihar, Meghalaya, Daman & Diu, Jharkhand, Manipur, Pondicherry, Assam, Uttarakhand and Tripura.

6.7 Cluster III: Finalization of Interlinkage

Interlinkage II, III and IV were analyzed for appropriateness of strategy for eleven states of Cluster II. Interlinkage II with seven CSFs viz., Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous

Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architecturewere analyzed for increase of eGAI values from 64.27 to 72.80 to next range of values 76.51 to 88.80. eGAI values for approximation are assumed to be 80.00. A combination of two CSFs would lead to increase in eGAI values. Interlinkage III comprises of ten CSFs viz., Clear Cut Vision and Goals, Human Capacity Building, Change Management, e-Governance Program Management, Integrated e-Governance, Sustainable Business Model, Awareness and Communication Strategy, Cost Benefit Analysis, Formulation of e-Governance Roadmap and Technical Architecture. A combination of five CSFs leads to increase in eGAI = 80. Thus Interlinkage II is the optimal strategy.

Thus we infer that Interlinkage II with seven CSFs viz., Clear Cut Vision and Goals, Evaluation and performance Assessment, Continuous Feedback, Info Infrastructure, service Delivery Paradigm, Privacy and Security and Technical Architectureis the most optimalstrategy for cluster III which includes twelve states/UTs i.e., Himachal Pradesh, West Bengal, Uttar Pradesh, Rajasthan, Orissa, Madhya Pradesh, Maharastra, Delhi, Kerala, Chattisgarh, Goa, Punjab, Lakshya Dweep.

The simulation results of Interlinkage II for Cluster III states and UTs have been depicted in Figure 6.15.

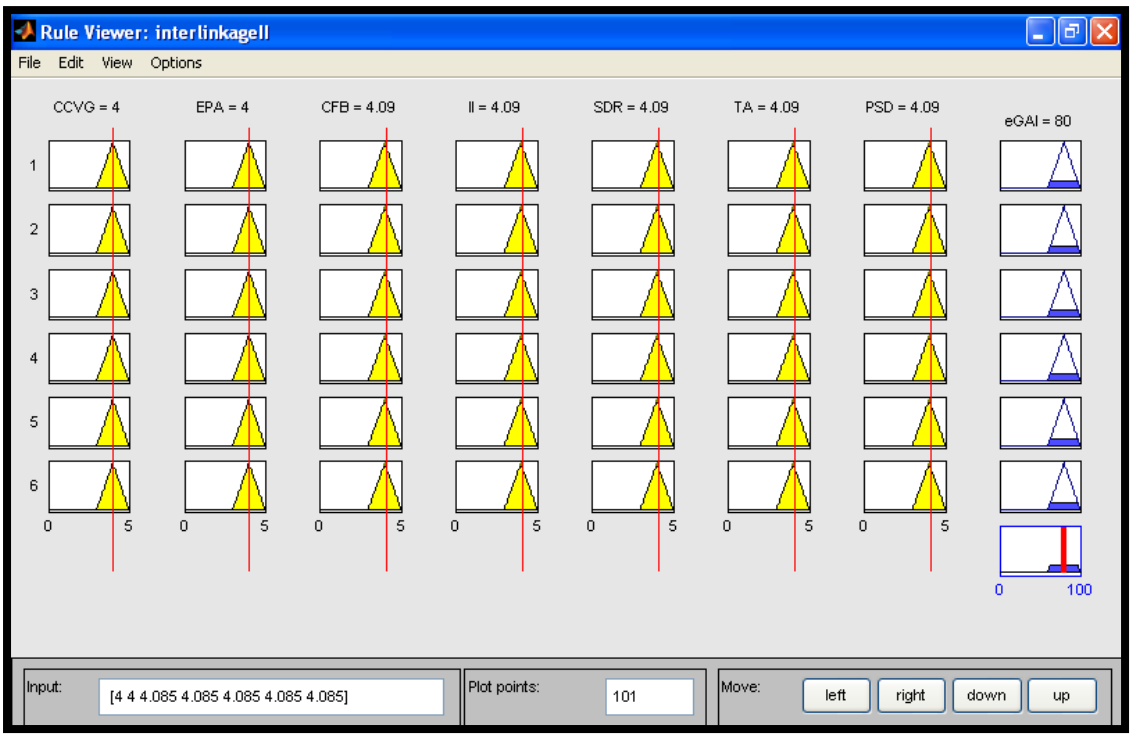

Figure 6.15: FIS simulation structure Interlinkage II for Cluster III

6.8. Cluster IV

No change in strategy is advocated for all states /UTs in this cluster. There needs to be a focus on increasing the number of projects to be adopted and interfaced with CSCs. Development of user interface in local languages need to be done to enhance use of these applications by semi-literate users.

6.9 Conclusion

This chapter has endeavoured to outline the strategy guidelines for each state/UT of India based on FIS rule set derived from the data obtained after multi-stakeholder assessment of each state and UT. The assessment data obtained from multi-stakeholder inputs and its subsequent analysis using clustering techniques, classified the states and UTs into four categories viz., average achievers, expectants, aspiring leaders and leaders. The following can be concluded based on FIS based simulation results:

(e) Average Achievers- Re look at the strategy using CSFs in Interlinkage III.

(f) Expectants- Realign their strategy using CSFs in Interlinkage IV.

(g) Aspiring Leaders-Invest more resources and replicate successful projects based on CSFs in Interlinkage II.

(h) Leaders- No change in strategy.

This chapter has outlined strategic guideline for only three lower clusters of states and UTs based on the multi-stakeholder assessment carried out in January 2010. The strategy for states and UTs in the topmost cluster based on eGAI values have not been suggested as their strategy has been assumed to be perfect providing targeted benefits to the users. The goals and mission defined in NeGP is same for all states and UTs and thus initiatives need to be progressed in such a manner that each of the states and UTs move up the cluster by enhancing benefits to the users through CSC offerings. A detailed assessment can further verify that the strategy predicted after FIS simulation yields the desired results. Further corrections in strategy can be fine tuned after a detailed assessment of states post implementation of predicted strategy.

ISBN: 978-81-946587-3-3

Chapter 7

Summary of Work Done and Conclusion

This chapter begins with a summary of work done in the thesis and then goes on to give the summary of findings of the research work, benefits of the research work and conclusions as envisaged for e-Governance adoption and implementation in India. The chapter finally concludes with the limitations in this study and the areas wherein research needs to be carried out in future.

7.1 Summary of Research Work

Important contributions of research work are as mentioned below:

- This research work develops a methodology for integrated assessment post adoption of e-Governance initiatives. The post adoption e-Governance offerings are assessed with help of multi-stakeholders inputs in developing countries as in India. The user inputs in developing countries do not give us the true perspective as they are characterized by low computer penetration, low computer literacy and use. Multi-stakeholders to be incorporated in such a survey should comprise of an ideal mix of users, implementers and private partners. The integrated assessment framework was based on already developed framework and in use in India i.e., e-Governance Assessment Framework (EAF) version 2.0. This framework was developed for analysis of e-Governance pilot projects in India since 2006. This framework along with its all 33 KPIs was modified for integrated assessment of e-Governance offerings in states and UTs of India.

- The thesis, through an in-depth study and analysis develops a methodology of continuous assessment of states and UTs of India based on multi-

stakeholder inputs. A questionnaire instrument was designed based on mappings of relevant CSFs and KPIs extracted from EAF version 2.0 framework for continuous assessment of states and UTs of India post NeGP. The questionnaire inputs were compiled using thematic analysis techniques. A novel cumulative index, e-Government Assessment Index (eGAI) was developed for continuous assessment of e-Governance offerings and for creation of baseline data.

- The thesis based on the multi-stakeholder inputs identifies clusters within states and UTs of India based on the CSF values and cumulative index, eGAI values. These clusters help us identify common strategies adopted by states and UTs in each cluster. A closer analysis of CSFs helps us identify all possible strategies for e-Governance adoption and implementation in India. It could be deduced that there are only five combinations (interlinkages) of CSF strategies of e-Governance adoption and implementation in India.

The thesis also develops an analysis of the e-Governance strategy through fuzzy Inference system (FIS) structures. It develops FIS rule bases based on data repository of each cluster. The FIS structures and rule base developed from data repository of each cluster help us identify optimal strategy for each cluster based on minimum number of CSFs and minimum perturbations to crossover the lower threshold value of next higher cluster.

ISBN: 978-81-946587-3-3

Chapter 8

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Kripa-Drishti Publications
A/ 503, Poorva Height, SNO 148/1A/1/1A, Sus Road,
Near Padmalayas, Pashan- 411021, Pune, Maharashtra, India.
Mob: +91-8007068686
Email: editor@kdpublications.in
Web: https://www.kdpublications.in

ISBN: 978-81-946587-3-3