India: e-Readiness Assessment Report 2008

For States/Union Territories

Department of Information Technology
Ministry of Communications and Information Technology
Government of India

NCAER

INDIA: e-Readiness Assessment Report 2008

For States/Union Territories

January 2010

Department of Information Technology (DIT)
'Electronics Niketan', 6, CGO Complex
New Delhi–110 003, INDIA
Tel: +91-11-2436 0160 Fax: 91-11-2436 3079
website: www.mit.gov.in

National Council of Applied Economic Research (NCAER)
Parisila Bhawan, 11, I.P. Estate
New Delhi–110 002, INDIA
Tel: +91-11-2337 9861-63
Fax: +91-11-2337 0164
website: www.ncaer.org

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ஆ. இராசா
ए. राजा
A. RAJA

मंत्री
संचार एवं सूचना प्रौद्योगिकी
भारत सरकार,
इलेक्ट्रानिक्स निकेतन, 6, सी.जी.ओ. काम्प्लेक्स,
नई दिल्ली-110 003
MINISTER
COMMUNICATIONS & INFORMATION TECHNOLOGY,
GOVERNMENT OF INDIA,
ELECTRONICS NIKETAN, 6, C.G.O. COMPLEX,
NEW DELHI-110 003

MESSAGE

e-Readiness Assessment Report 2008, is the fifth in the series of the report being published by Department of Information Technology since 2003.

The report has been a referral to most top-level decision makers in matters of resource allocation and policy formulation. Over the years, the publication of these rankings has led to direct policy competition between the States to attain higher ranking.

I am pleased that the states of Tamil Nadu, Karnataka, Andhra Pradesh, Delhi & Maharashtra, and the union territory of Chandigarh have held their position of Leaders in the e-Readiness ranking.

The 2008 e-Readiness report has taken the analysis one step further, by evaluating the e-Governance of states and UTs. The e-Governance ranking measures the level of usage by governments of available ICT infrastructure for delivering better citizen services.

The hard-working and committed team of the Department of Information Technology has worked closely with National Council of Applied Economic Research (NCAER) to conduct this study and bring out the report.

We hope that the e-Readiness report goes a long way in providing valuable measurable indicators to the States and UTs who have helped tremendously in providing crucial information for this report.

(A. RAJA)

सचिन पायलट
SACHIN PILOT

संचार एवं सूचना प्रौद्योगिकी राज्य मंत्री
भारत सरकार
नई दिल्ली-110 003
MINISTER OF STATE FOR
COMMUNICATIONS & INFORMATION TECHNOLOGY
GOVERNMENT OF INDIA
NEW DELHI-110003

Message

In the last 20 years, India has been one of the fastest growing economies in the world. The role of technology has been crucial in its transformation into a knowledge economy. Given the dramatic growth in the IT sector, it is clear that its role in the macro economy is becoming increasingly important.

One of the important objectives of the e-readiness exercise is to identify the areas of focus and challenges for the respective states and provide policy inputs based on the findings of the study. It also ranks different states, and this induces a healthy policy competition among the states, which in turn has the potential to improve the e-readiness environment directly and their capability to use the technology and the actual usage more indirectly.

It is our hope that the efforts put into this report by the team at the Department of Information Technology and our partner in this exercise – National Council of Applied Economic Research – will contribute towards supporting policy advisement on the best use ICT for achieving poverty alleviation and inclusive economic growth in the country.

With Best Wishes

Pilot

(Sachin Pilot)

6, इलेक्ट्रॉनिक निकेतन, सीजीओ कॉम्प्लेक्स, नई दिल्ली-110003 / 6, Electronics Niketan, C.G.O. Complex, New Delhi-110003
Tel : 24368757-58 • Fax : 24360958

R Chandrashekhar

सचिव
संचार एवं सूचना प्रौद्योगिकी मंत्रालय
सूचना प्रौद्योगिकी विभाग
इलेक्ट्रॉनिक्स निकेतन
6, सी.जी.ओ. कॉम्प्लेक्स, नई दिल्ली-110003

Secretary
Ministry of Communications & Information Technology
Department of Information Technology
Electronics Niketan,
6, C.G.O. Complex, New Delhi-110003
Tel. : (011) 24364041, Fax : (011) 24363134

Message

Technologies such as the Internet, personal computers and mobile telephony have turned the world into an increasingly interconnected network of individuals, firms and governments. The Indian economy has made significant headway in tapping the potential of Information & Communication Technologies to transform itself into a knowledge economy. This has resulted in increased communication and interaction between citizens, government, industry and service providers at various levels.

The e-Readiness report 2008 highlights the contribution of the IT sector. I am delighted to note that the share of computer-related services in the GDP has grown exponentially from a mere 1 percent in 1999-2000 to 3.3 percent in 2007-08. Also, the phenomenal growth in the ICT enabled services export has meant that exports of software and services (ITES) account for over 80 percent of all IT exports; software services account for 46 percent of all exports.

This is the fifth in a series of e-Readiness reports of Indian States/UTs that NCAER has prepared for Department of Information Technology, Government of India. We hope that this report continues to contribute immensely to the strategic decision making of all States and UTs. We look forward to the continued support of the State Governments and Central Ministries in making this report a facilitator and trigger for transformation.

(R Chandrashekhar)

एस. आर. राव
S. R. RAO

अपर सचिव
संचार एवं सूचना प्रौद्योगिकी मंत्रालय
सूचना प्रौद्योगिकी विभाग
इलेक्ट्रॉनिक्स निकेतन
६, सी०जी०ओ० कॉम्प्लेक्स, नई दिल्ली-११०००३

ADDITIONAL SECRETARY
MINISTRY OF COMMUNICATIONS & I.T.
DEPARTMENT OF INFORMATION TECHNOLOGY
ELECTRONICS NIKETAN
6, C.G.O. COMPLEX, NEW DELHI-110003
TEL : (011) 24363078, FAX : (011) 24363101
e-mail : srrao@mit.gov.in, WEB : www.mit.gov.in

Message

Information and Communication Technologies together with innovative applications have given fillip to the progress of nations over the past couple of decades. Understanding and leveraging ICT for inclusion of the unreached is critical for nations striving to achieve ecore competitiveness and sustainable socio-economic progress.

The National e-Governance Plan (NeGP) aims to bring citizen centric services to the doorstep of the individual through effective use of ICT. E-Readiness is an important factor in promoting e-Governance. The former provides capabilities, while the latter is an indicator of implementation.

This report not only ranks states according to the e-Readiness of the State(s) but also assesses how the ICT infrastructure and environment is positively used for delivering services to the citizens.

We hope this report will be discussed and analysed widely and thus help bring about awareness to catapult our nation to greater heights of good governance. I congratulate the team at Department of Information Technology and National Council of Applied Economic Research for successfully bringing out this report.

With Best Wishes

(S R Rao)

Shankar Aggarwal, IAS
Joint Secretary

Tel: 24363114
Fax: 24363119
e-mail: sagg-js@mit.gov.in

D.O No.

भारत सरकार
GOVERNMENT OF INDIA
संचार और सूचना प्रौद्योगिकी मंत्रालय
MINISTRY OF COMMUNICATIONS AND INFORMATION TECHNOLOG
सूचना प्रौद्योगिकी विभाग
DEPARTMENT OF INFORMATION TECHNOLOGY
इलेक्ट्रॉनिक्स निकेतन
ELECTRONICS NIKETAN
6, सी जी ओ कॉम्पलेक्स/6, C.G.O. COMPLEX
नई दिल्ली/New Delhi-110003
दिनांक/Dated 15-02-2010

Message

India's increased participation in the global ICT market and the government's proactive policies in promoting investment in ICT and e-governance at home has created a need for a regular track of the progress and achievements of the different States and UTs in their e-Readiness. To fulfil this need, the Department of Information Technology (DIT) in association with National Council of Applied Economic Research (NCAER) has been publishing the e-Readiness Assessment Report since 2003.

India with a federal structure, where the central government frames general policies and much of the implementation is carried out by the respective States, it becomes imperative to identify the challenges and achievements of each. This in turn enables meaningful changes in the policy framework at the central and provincial levels.

One of the key objectives of the National e-Governance Plan (NeGP) is improvement of citizen-service delivery to the last mile. Assessment of readiness of governments and departments with direct interaction with public and business is crucial to understanding how to optimally leverage ICT to bring people closer to the government. The e-Readiness study has proved to be an effective way of assessing the progress of departments, ministries and provinces of the country.

I take this opportunity to congratulate my team at DIT and NCAER for their efforts in bringing out this report for the 5th year.

With Best Wishes

(Shankar Aggarwal)

Message

India has been one of the fastest growing economies of the world since the 1980s. Not only has the growth been relatively stable, it has also been accompanied by poverty decline. This phenomenon has been primarily led by the services sector whose exports, both technology embedded and technology enabled services, are becoming a key factor in India's economic development currently. The Indian government, recognising the importance of this sector, has adopted pro-active policies in promoting investment in ICT for economic development. e-Readiness is a multidimensional concept that measures a state's ability to participate in an increasingly networked world. It can be viewed as the ability of the States/UTs to pursue value creation opportunities facilitated by ICT and their readiness to use technology skillfully at the level of the individual, business and government. Successive e-Readiness Reports had the mandate of bringing out the relative performance of the governments of Indian States/UTs in their efforts to utilize the potential gains from being e-Ready in the matters of governance and public service delivery.

The e-Readiness Assessment Report 2008 is fifth in this series. It retains the broad methodology adopted in the previous reports thereby allowing for a comparison of the relative ranks of the states with the previous years. For the first time, NCAER's e-Readiness Report 2008 provides an assessment of Indian states/UTs in the area of e-Governance. It is an attempt to keep track of the progress in ICT adoption in the governance unit and to benchmark this progress with the leaders and best practices. It is NCAER's belief that even further value addition to this enterprise will be possible in the future. We are grateful to the Department of Information Technology for the continuing trust that they have reposed in us.

New Delhi
January 2010

Suman Bery
Director-General
NCAER

From the Editorial Desk

The Department of Information Technology and the National Council of Applied Economic Research have collaborated in producing the India e-Readiness reports since 2003. The focus of these reports has been to evaluate the ability of the state governments and union territories to pursue value creation opportunities and accompanying inclusive economic development, facilitated by ICT. Consequently, the DIT-NCAER Reports/methodology, which is specific to India, emphasises on application of ICT based services to the served and underserved section of people and geographical areas. Thus, the emphasis is on access rather than the ownership and penetration of computers as well as networks. The report also analyses the role of ICT enabled services exports as the key factor to an inclusive economic development accompanied by reduction in poverty.

e-Readiness measures a state's ability to participate in an increasingly networked world. The e-Readiness growth path is charted out in a hierarchical manner starting from creation of conducive environment to capacity building and finally to effective usage of the technology. The broad framework of analysis uses robust methodologies; Principal Component Analysis for e-Readiness assessment and a mix of Analytical Hierarchy Approach along with PCA for e-Governance assessment. The choice of PCA is primarily due to its simplistic technique of using objective choices and its broader acceptability. However, the methodology limits the scope of relative ranking to comparisons across the states only as comparison across years requires cautious interpretation.

This report, for the first time, incorporates a comprehensive assessment of various aspects of e-Governance in states and UTs with due attention to a citizen centric and inclusive approach. e-Governance is considered broadly as an approach to provide ICT- enabled governance at the ministry/ departmental level in states/UTs. It helps in transforming the governance process for improving the public service delivery mechanism and in achieving inclusive development in the states as has been the case of Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh states. Therefore, assessment of the progress of ICT adoption by states/UTs is of importance in view of the gigantic e-Governance projects, their scope and coverage.

We sincerely hope that the fifth edition e-Readiness report, contributes to an improved understanding of the factors that enhance e-Readiness and e-Governance of the states.

R. Venkatesan
Project Leader and
Senior Consultant, NCAER

Acknowledgements

The comprehensive study of e-Readiness within the specified time frame would not have been possible but for the cooperation of a number of people and organisations.

The Department of Information Technology team guided by Secretary, Shri R Chandrashekar and consisting of Shri S R Rao, Additional Secretary, Shri Shankar Aggarwal, Joint Secretary, Shri B N Sathpathy, Economic Advisor, Vineeta Dixit, Principal Consultant, NeGP PMU and Sulakshana Bhattacharya, Consultant, NeGP PMU, have put in a great deal of effort to give this study a final shape.

The Department of Information Technology appreciates the valuable inputs and suggestions received from the IT Secretaries of various States and Union Territories.

We thank the NCAER team led by Mr. R. Venkatesan, Project Leader. We thank the main contributors Dr. Sucharita Sen, Dr. Wilima Wadhwa and Mr. Siddharth Kumar, Mrs. Diane Rai and Ms. Kiran Sheokand for their valuable input, intellectual coordination of the research content and compilation of this report. We thank Dr Rumki Majumdar for her valuable comments and suggestions, Mr Udyan Namboodiri who edited the report and Ms Jaya Koti for her assistance.

We thank the IT Secretaries of all State Governments and Union Territories for their collaboration as well as the representatives of all Central Ministries that participated in the survey exercise.

Last of all, we express our indebtedness to all those who have not been explicitly mentioned above but who have worked to make this report a reality.

Contents

List of Tables

List of Figures

Abbreviations

ASI	Annual Survey of Industries
BPL	Below Poverty Line
BPO	Business Process Outsourcing
BPR	Business Process Re-engineering*
BR	Business Readiness
BU	Business Usage
CARG	Compounded Annual Rate of Growth
CSC	Common Services Centre
CSO	Central Statistical Organisation
DIT	Department of Information Technology
EIU	Economist Intelligence Unit
G2B	Government to Business
G2C	Government to Citizen
G2G	Government to Government
GDP	Gross Domestic Product
GOI	Government of India
GR	Government Readiness
GU	Government Usage
HA	Hierarchic Analysis
ICT	Information and Communication Technology
IE	Infrastructure Environment
IL&FS	Infrastructure Leasing and Financial Services Ltd.
IR	Individual Readiness
IT	Information Technology
ITES	Information Technology Enabled Services
ITU	International Telecommunication Union
IU	Individual Usage
ME	Market Environment
MMP	Mission Mode Project
NAS	National Accounts Statistics
NASSCOM	National Association of Software and Services Companies
NCAER	National Council of Applied Economic Research
NeGP	National e- Governance Plan
NIC	National Industrial Classification
NREGA	National Rural Employment Guarantee Act
PPP	Public Private Partnership
NRI	Networked Readiness Index
NSDP	National State Domestic Product
NSS	National Sample Survey
PCA	Principal Component Analysis
PRE	Political and Regulatory Environment
RTI	Right to Information Act
SDC	State Data Centre
SeMT	State e- Governance Mission Team
SWAN	State Wide Area Network
UIN	Unique Identification Number
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UT	Union Territory
VA	Value Added
VPN	Virtual Private Networks
WEF	World Economic Forum

** In the case of Governments, BPR can be construed as Government Process Re-engineering (GPR)*

Executive Summary

Executive Summary

- India has been one of the fastest growing economies of the world since the 1980s. Not only has the growth been relatively stable, it has also been accompanied by poverty decline. This phenomenon has been primarily led by the Services sector – it has grown faster than others and is the dominant sector of the economy.
- Currently, services exports, both technology embedded and technology enabled services are becoming a key factor in India's economic development. The reasons for above are as follows :
  - Skill stock to capture opportunities
  - Employment
  - Demographic Dividend
  - Dynamic Exporters – India & China only developing nations in top 10; rest developed nations
  - India's share US$ 90 billion in International trade in services valued at US$ 3.7 trillion which is significant for a developing country.
- Prior to the advent of ICT enabled services, service Exports comprised mainly of traditional services exports i.e. finance, transportation & travel associated with merchandise exports. In ICT Enabled Services Exports, the focus is on all Commercial Services exports i.e. financial, insurance, commercial, R&D, legal accounts, etc. Such services sector led growth is not constrained by domestic demand conditions.
- Within Services, the fastest growing sectors are computer-related services and communications, both of which have been growing at rates in excess of 20 per cent since 1999-2000. The share of computer-related services in GDP has also grown exponentially – from a mere 1 per cent in 1999-2000 to 3.3 per cent in 2007-08. The output multiplier of this industry is 1.52.
- The importance of the computer-related industry is further brought out by its contribution to the external sector. Current exports of software and services (ITES enabled) account for 80 per cent of all IT exports; software services accounts for 46 percent of all services export.
- The development of new communication technologies that allow offshore development of software and the emergence of professional and more flat organisations in the post-liberalisation scenario, partly explain the Indian software industry's success.
- Reasons for sustainability of technology embedded services/software exports are focus on an appropriate market segment. This is mainly users of software in developed economies where bulk of value added employment opportunities exist rather than software products dependent development.
- Proactive public policy also has been the driving force in sustaining growth of technology enabled services; policies that have played a significant role are :
  - e-Governance program
  - Interstate competition in e-Readiness status
  - Technology Embedded (Software) and Technology Enabled Services Exports
  - Telecommunication Reforms
  - Favorable Environment – Entrepreneurship and openness
  - PPP facilitation

  New directions for sustainable technology embedded exports would be:
  - Encouraging Organizational Capability – intensive services in niche areas e.g. Bio informatics
  - Diversifying geographic customer base
  - Moving up value chain in terms of R&D and engineering services exports.
- The Indian government, recognising the importance of this sector, has adopted pro-active policies in promoting investment in ICT for economic development. Therefore, it becomes important to assess and track the progress of ICT adoption in different states/UTs.
- This is the fifth in a series of e-Readiness reports of Indian states/UTs that NCAER has been preparing for the Department of Information Technology, Government of India. The basic analytical framework has remained the same since 2004, allowing a comparison of state rankings across years. The approach uses the Networked Readiness Index framework.

- However, the methodology is such that it allows only relative ranking in a particular year. This is important while comparing ranking of states/UTs across years. The fact that the rank of a state/UT has gone down in a particular year does not mean that its absolute level of e-Readiness has declined. All that it implies is that relative to the other states/UTs, its level is lower. This could happen, for instance, if other states/UTs were improving faster than it.
- For the first time, NCAER's e-Readiness Report 2008 provides an assessment of Indian states/UTs in the area of e-Governance. One of the most important applications of ICT is in transforming the governance process by acting as a tool for improving the public services delivery mechanism. In this background, it becomes important to keep track of the progress in ICT adoption in the governance unit and to benchmark this progress with the leaders and best practices.
- After reviewing the macro picture and the international methodologies used for assessing e-Readiness, the Report proceeds to the state-wise picture. As in the past four years, a composite index is created for each state/UT to measure its e-Readiness. This composite index is then used to rank the states/UTs and compare their performance within and across years.
- In DIT-NCAER's e-Readiness Composite Index, the e-Readiness indicator is considered as the ability to pursue and realize value creation opportunities facilitated by ICT. For example: Technology embedded services, Technology enabled services exports, inclusive economic development, financial inclusion are major components.
- UN e-Government Readiness Index 2008 is the Citizen centric approach with effective use of ICT Infrastructure. India scores high on web measure index (55 out of 192 members), which reflects government readiness. It scores low on Telecommunication infrastructure (138 out of 192) and Human capital index (146 out of 192) due to the accent in ownership of computers, where we rank low.
- For similar reasons, EIU e-Readiness Index 2009 which focus on ICT infrastructure & stakeholders ability to use ICT infrastructure, does not rank India high on connectivity.
- e-Readiness is a multidimensional concept. It measures a state's ability to participate in an increasingly networked world. It can be viewed as the ability to pursue value creation opportunities facilitated by ICT. Therefore, it is not simply a matter of the number of computers, internet connections, telephones and mobiles, etc. in the state but also the ability or readiness to use technology skillfully at the level of the individual, business and government.
- Given the multi-dimensional nature of what is being measured, the Report employs the use of composite indicators. These are used to compare performances in a given field between countries or states because of the practicality they present in measuring complex concepts through a single figure. They also lend themselves to interpretation by the general public, as it is easier to track the progression of a single composite indicator than study the trends of multiple variables. In particular, the report uses multi-stage Principal Component Analysis (PCA) to derive the composite indicator.
- To measure e-Readiness three main sub-indicators are used:
  - the environment that promotes the spread and usage of ICT
  - the readiness of different stake holders of the economy (the government - both the initiatives of the central government and the response of the state governments, businesses and the individual) to use ICT
  - the degree of usage of ICT by the three stakeholders.
- The data for computing these indices is obtained from both secondary and primary sources. Secondary sources included the Department of Telecommunication Annual Statistics, Statistical Abstracts of India, Economic Survey, Census publications and various GoI websites. Primary data collection was through a survey of the various departments of the state governments using a well-structured questionnaire.
- In an effort to improve upon earlier reports, the questionnaire has been designed more comprehensively and includes some more relevant variables along with appropriate consistency checks. The addition of new variables is necessary to take account of recent and new developments in both public and private domains.
- Like the composite index, even the sub-indices are multi-dimensional and need more than one variable to accurately reflect what they are trying to measure. Thus, our e-Readiness composite index is basically a

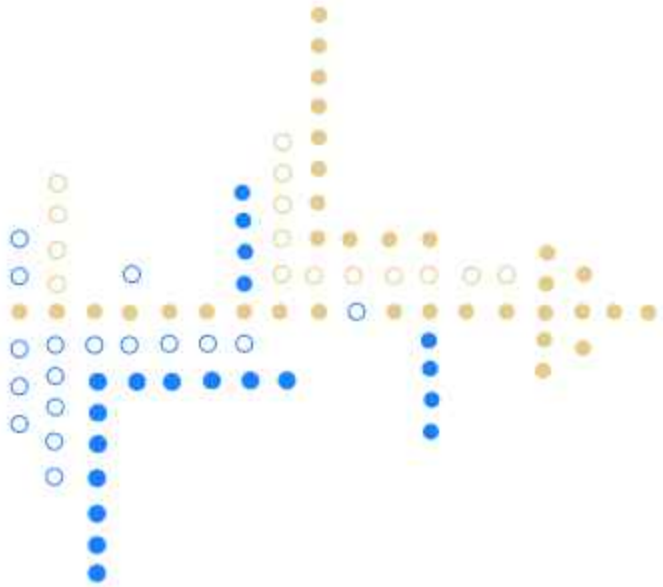
weighted average of a large number of quantitative and qualitative indicators organised into their basic categories.

- 'Environment' relates to conditions prevailing in the state like infrastructure and policies concerned with ICT adoption by different stakeholders. This includes the market environment, the political and regulatory environment as well as the infrastructural environment.
- 'Readiness' deals with those characteristics of the players (government, business and individuals) that enable them to respond to an environment that is enabling. Access of households to PCs, cell phones and qualification or training of individuals in IT is an example of readiness.
- 'Usage' is the actual utilisation of IT given a conducive environment and a positive state of readiness. This year's report drops business usage due to paucity of data. It is our understanding that the variation across states in business usage has less to do with policies in the respective states and more with the business groups that operate across several states. Thus, exclusion of this sub-component is not expected to have a significant bearing on our composite index.
- There are three steps involved in computing a state's e-Readiness index:
  - First, we use PCA to compress the minor category indicators under each sub–major category. So all the indicators measuring market environment are combined using PCA to give the market environment indicator. In a similar manner, indicators are obtained for Political and regulatory environment, Infrastructure environment, Individual readiness, Business readiness, Government readiness, Individual usage, Business usage and Government usage.
  - In the second step, PCA is used to combine these sub–major categories to construct indices for the next level of indicators, namely the Environment index, the Readiness index and the Usage index.
  - Finally, again applying PCA the aggregate e-Readiness index is constructed by combining the environment, readiness and usage indices.
- In the ranking of states/UTs by their e-Readiness, the Report differentiates between different levels:
  - Leaders – Karnataka, Chandigarh, Maharashtra, Tamil Nadu, Delhi, Andhra Pradesh
  - Aspiring Leaders – West Bengal, Kerala, Haryana, Gujarat, Punjab.
  - Expectants – Andaman and Nicobar, Madhya Pradesh, Goa, Orissa, Assam, Himachal Pradesh, Uttar Pradesh, Bihar.
  - Average Achievers – Chhattisgarh, Uttarakhand, Jharkhand, Sikkim, Rajasthan.
  - Below Average Achievers – Tripura, Nagaland, Puducherry, Meghalaya.
  - Least Achievers – Manipur, Mizoram, Jammu and Kashmir, Arunachal Pradesh, Lakshadweep, Dadra and Nagar Haveli, Daman and Diu.
- However, there is considerable variation in the ranking of states/UTs in terms of different sub-indices. For instance, among the leaders, only Karnataka and Chandigarh figure consistently as leaders in all three sub-categories. Maharashtra, an overall leader, is ranked much lower in terms of usage compared to the other two sub-components of environment and readiness. Similarly, states/UTs like Andaman and Nicobar, Uttarakhand, Jharkhand and Chhattisgarh that perform extremely well on the Usage component lag behind on the Environment and Readiness indices. This again brings to fore the fact that the ranking is relative.
- A regional comparison shows that states in southern India are clear leaders. The Eastern region performs consistently, with all the states being either the 'aspiring leaders' or 'expectants'. In the North-west region, Rajasthan lags behind other states which fall in the top two categories. Within the North-east region most of the states, except Assam and Sikkim, are in the bottom two categories. The Western region demonstrates a highly disparate performance, with Maharashtra as a leader and Dadra and Nagar Haveli and Daman and Diu as least achievers.
- However, simple ranking does not take into account two factors that might significantly impact the capability of any state to adopt ICT – total population and the percentage of rural to total population. Therefore, a modified index was computed with 10 per cent weights assigned to both the ratio of rural to total population and total population, and 80 per cent to the e-Readiness score.
- There is no substantial difference in the two indices except for the positions of a few states/UTs. Delhi falls from the 'leaders' category to the 'aspiring leaders' category, and Goa, falls five ranks within the 'expectants' category. On the other hand, Tripura and Manipur move up one rank into next category.

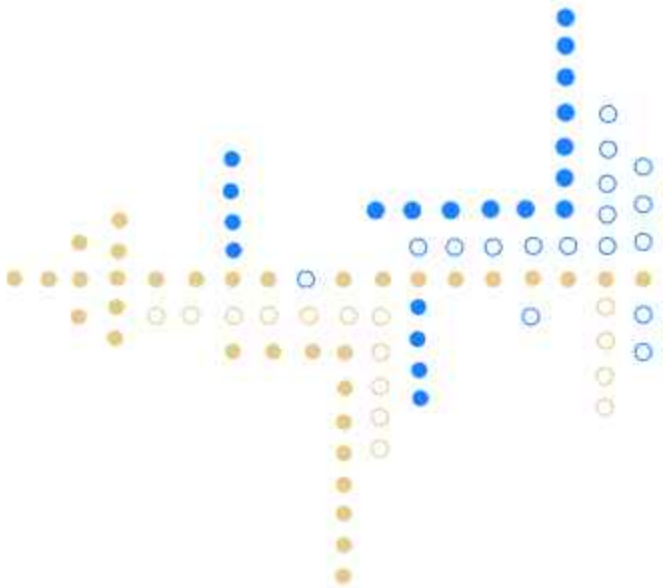
- While comparing rankings of states/UTs over time (2006–08), it is important to recall that though the broad methodology of the e-Readiness index has not changed over the past four years, variables that have been used to construct indices have changed over a period of time. Thus, a comparison of ranks for states/UTs over different years has to be seen along with its limitations. There could be three reasons for the movement of states/UTs across categories:
  - Because of their actual relative growth in ICT vis-à-vis the rest of the states/UTs
  - Because of the change in variables in the two years
  - Because of difference in clarity and comparability of the data provided by the respective states/UTs
- There is a fair amount of inter-temporal variation in the rankings. The states/UTs that show significant relative upward movement are Andaman and Nicobar, Assam and Bihar. They have climbed up two notches, from the category of 'below average achievers' to 'expectants'. The states that have shown less significant upward movements are Maharashtra, West Bengal, Madhya Pradesh, Orissa and Tripura. What is notable here is that all the three states in the eastern zone have experienced an upward movement and hence the performance of the eastern states has gone up significantly. Mizoram is the only state that has shown significant downward movement by moving down in two categories; from that of an 'average achiever' to a 'least achiever'. The states/UTs that have shown some downward mobility are Kerala, Puducherry and Lakshadweep within the Southern region; Punjab, Haryana, Rajasthan and Uttar Pradesh within the North-western and the Northern region; Meghalaya in the North-east region and Goa in the western region. The movement of states/UTs across catogories between 2006-08 in terms of e-Readiness index is captured in Table 5.12 in Chapter 5. The individual components, that is, environment, readiness and usage are mentioned in Annex tables 5.5 through 5.7.
- The 2008 e-Readiness report takes the analysis one step further, by evaluating the e-Governance of states and UTs. For e-Governance, a combination of Hierarchic Analysis and PCA are used.
- The questionnaire employs a series of filtering questions to establish hierarchy. However, since in the initial stages of e-Governance adoption states/UTs may have neither the capacity nor the willingness to undergo a complete transformation of their governance mechanism, the report restricts these filters to G2C and G2B services for application of ICT and G2G services for increasing efficiency of governance.
- All the states/UTs reported adoption of ICT-enbled governance. Further, only seven responded as not having used Business Process Re-engineering (BPR) to facilitate ICT adoption in governance.
- Hierarchy was established on the basis of the following five indicators:
  - Institutional mechanism to promote e-Governance such as a separate e-Governance department, separate agency for overseeing the e-Governance initiatives, etc.
  - Web presence of the institutional mechanism for promoting e-Governance initiatives; interactive portal with web links to individual e-Governance projects.
  - Documented policy or road map for e-Governance.
  - Establishment of State e-Governance Mission Team (SeMT) or separate task force for e-Governance.
  - Separate e-Governance budget.
- Three levels of hierarchy in e-Governance were established:
  - H1 (*Advanced*) – Andhra Pradesh, Chandigarh, Chhattisgarh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Punjab and Tamil Nadu.
  - H2 (*Middle*) – Delhi, Goa, Haryana, Jharkhand, Lakshadweep, Maharashtra, Orissa, Rajasthan, Uttar Pradesh, Uttarakhand and West Bengal.
  - H3 (*Primary*) – Andaman and Nicobar, Arunachal Pradesh, Assam, Bihar, Dadra and Nagar Haveli, Daman and Diu, Himachal Pradesh, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Puducherry, Sikkim and Tripura.
- States/UTs classified as 'advanced' have in general, perform well in terms of all the five indicators listed above. Notable states not figuring in the 'advanced' hierarchy are Maharashtra where e-Governance activities, reportedly, do not have a separate coordinating institutional mechanism or budget commitment, and Haryana where, web presence for the designated e-Governance Centre could not be found. These, in combination with the absence of a task force, prevented them from figuring in the highest category. Similarly, Delhi which has undertaken

many e-Governance initiatives, missed figuring in the top bracket as it did not have separate institutional mechanisms to promote e-Governance activities.

- After establishing the broad hierarchy of states/UTs, PCA was used to rank states/UTs within each hierarchical category. The variables used in the two analyses are different – while HA measures levels, PCA measures magnitude.
- e-Readiness is an important factor in promoting e-Governance. The former provides capabilities, while the latter is an indicator of implementation. However, one of the important differences is that while e-Readiness has three actors, i.e. government, business and individuals, the responsibility of effective implementation of e-Governance projects and services is the sole responsibility of the government. However, the effectiveness of e-Governance increases if the citizens are more e-Literate and aware, as this enables them to take benefits of e-Governance.
- Comparing the e-Readiness and e-Governance rankings, the report finds that not all states/UTs in a leading position of e-Readiness perform well in terms of e-Governance. On the other hand, many states/UTs that are less e-Ready are still using their ICT capabilities much efficiently for providing e-Governance.
- The states/UTs with e-Governance ranks greater than their e-Readiness ranks are leveraging their ICT capabilities relatively better for providing e-Governance to their citizens and businesses, as well as for coordination within their respective departments. These include Arunachal Pradesh Sikkim, Tamil Nadu, Gujarat, Uttarakhand Kerala, Andhra Pradesh, Meghalaya, Manipur, Punjab, Madhya Pradesh and Rajasthan.
- The states/UTs with e-Governance position lower than their e-Readiness rankings have scope for leveraging their existing ICT capacity more efficiently for delivery of e-Governance services. These include Jammu and Kashmir, Mizoram Tripura, Uttar Pradesh, Haryana, Orissa, Delhi, West Bengal, Bihar, Maharashtra, Himachal Pradesh, Assam and Nagaland.
- Facilitating factors for improvement in e-Readiness and e-Governance of states are elaborated in a separate chapter entitled State wise factors for improvement of e-Governance level and State wise factors for improvement of e-Readiness level.



Introduction



Introduction

1.1 ICT measurement – e-Readiness indicators

Given Government of India's proactive policies in promoting investment in ICT for economic development, the need for assessing and tracking the progress of ICT adoption in different states/UTs is critical. Collaboration between DIT and NCAER has resulted in the annual publication of reports based on e-Readiness assessments of states/UTs since 2003. The present report is the fifth in the series. These assess the progress in ICT adoption by different states/UTs as reflected in the presence of an enabling environment and the readiness of and usage by the stakeholders relating to such adoption.

1.2 ICT sector's GDP share

The dynamic performance of India's Services exports has brought computer-related services and communication services to the forefront. Both have gained in terms in their shares in national GDP as shown in Table 1.1.

Table 1.1: Percentage share of computer-related services and communication services sector in overall GDP

	(at constant 1999-2000 prices)								
	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Computer-related Services	1.0%	1.4%	1.6%	1.8%	2.1%	2.4%	2.7%	3.0%	3.3%
Communication	1.6%	1.9%	2.2%	2.6%	3.1%	3.6%	4.2%	4.9%	5.7%
Total Share of Computer-related Services and Communication	2.6%	3.3%	3.8%	4.4%	5.2%	6.1%	6.9%	7.9%	8.9%

Note: Total may not match due to rounding off.
Source: CSO

The dominant share of the ICT sector in the Indian economy is borne out by its size, which is about 60 per cent that of all registered manufacturing activities and exceeds the combined size of the banking and insurance sectors. The size of the ICT sector also exceeds the size of all construction activities and the combined size of all transportation activities.

1.3 Computer-related services' sector growth rate

India has been one of the fastest growing economies of the world in the last two decades. Not only has the growth been relatively stable, it has also been accompanied bz poverty decline – the proportion of population below the

poverty line declined from about 44 per cent in 1983 to 27 per cent in 2004. All in all, it has been a stellar growth performance. The Services sector has grown faster than other sectors and is the dominant sector of the economy. Within Services, computer-related services has been growing at a compounded annual rate of growth (CARG) of 23.9 per cent; communication services at 25.7 per cent; banking at 9 per cent and insurance at 15.3 per cent between 1999-2000 and 2007-08 (NAS, 2009).

1.4 Business services sector breakup

The Central Statistical Organisation (CSO) recently split the business services composite sector into its components; this has shed light on the share trends of GDP pertaining to "computer-related services" in the overall GDP (Table 1.2). During 1999-2000, business services accounted for about 2 per cent of overall GDP with the combined share of legal services, research and development, accounting and renting of machinery accounting for 1 per cent of overall GDP. During 2007-08, the business services sector accounted for 4 per cent of overall GDP, the combined share of all Services other than computer-related services accounting for a mere 0.7 per cent, while computer-related services accounted for 3.3 per cent share of overall GDP. Thus, the evolution of the business services sector has been largely fashioned by remarkable growth of computer-related services.

Table 1.2: Percentage share of computer-related services in business services sector 1999-2000 through 2007-08

Business services sector	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Renting of Machinery	4.1%	3.3%	3.0%	2.7%	2.3%	2.0%	1.7%	1.5%	1.3%
Computer-related services	50.3	59.8	63.6	66.6	71.2	75.0	77.9	80.9	82.9
Legal services	9.0%	7.3%	6.7%	6.2%	5.4%	4.7%	4.2%	3.7%	3.3%
Accounting	5.0%	4.2%	4.0%	3.8%	3.4%	3.1%	2.8%	2.5%	2.4%
Research and development	31.6	25.4	22.8	20.7	17.7	15.3	13.3	11.4	10.2
Total business services	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Total may not match due to rounding off.

Source: CSO

1.5 IT Revenues: sector-wise breakup – IT sector dominated by Services exports

Table 1.3 represents sector-wise IT revenues. Export of software and services account for 80 per cent of total software and services revenue. Table 1.3 also shows that the bulk of IT exports are accounted for by software exports and services exports and is emerging as the key factor in development.

1.6 Services exports and economic development – the Indian policy planners' perspective

Services exports are of two kinds; one embedded technology such as software and the other includes Services that use ICT technology as backbone. Services, particularly finance (including insurance) and transportation of goods, are traditional complements to goods trade. With the spread of telecommunications

Table 1.3: Indian IT sector-wise breakup

USD billion	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008
IT Software	**10.4**	**13.5**	**17.8**	**23.6**	**31.0**
Exports	7.3	10.0	13.3	18.0	23.1
Domestic	3.1	3.5	4.5	5.6	7.9
Eng services and R&D, S/W Prods	**3.4**	**5.2**	**5.3**	**6.5**	**8.6**
Exports	3.1	4.6	4.0	4.9	6.4
Domestic	0.3	0.6	1.3	1.6	2.2
ITES-BPO	**2.9**	**3.9**	**7.2**	**9.5**	**12.5**
Exports	2.5	3.1	6.3	8.4	10.9
Domestic	0.4	0.7	0.9	1.1	1.6
Total Software and services revenues	**16.7**	**22.6**	**30.3**	**39.6**	**52.0**
of which, Exports	**12.9**	**17.7**	**23.6**	**31.4**	**40.4**
Domestic	**3.8**	**4.9**	**6.7**	**8.2**	**11.6**
Hardware	5.0	5.9	7.0	8.2	12.0
Total IT Industry (including hardware)	**21.6**	**28.4**	**37.4**	**47.8**	**64.0**

Note: Total may not match due to rounding off.
Source: NASSCOM

and computer technologies, virtually all commercial services have become tradable across borders. The trend of globalisation, reinforced by liberalisation policies, and the removal of regulatory obstacles has fuelled steady growth of international investment and trade in Services.

Services exports, in the Indian policy planners' perception, is a key factor in economic development due to its positive impact on (a) employment (b) skill stocks that enable us to capture opportunities, and (c) the demographic dividend.

International trade in Services is worth $3.7 trillion. India's share in this is $90 billion (Economic Survey 2008-09). Though India's share in the international services trade is not significant at present, her share of Services exports in total exports is the highest among developing countries. India and China were among the top 10 exporters of commercial services in 2008, the rest being developed countries. India is considered a dynamic exporter and thus Services export is likely to be an enabler of economic development. Software services account for about 46 per cent of overall Services exports. Non-software services in India's export basket are: Other business services (17%), financial services (5%), communication services (2%), travel (11%), transportation (11%), insurance services (2%) and miscellaneous non-software services (6%).

The spillover effects of the dynamism of Services over Manufacturing have also been documented by researchers in the Indian context. This is mainly due to technology leapfrogging in communications, finance, and to an extent, transportation segments. Firms in the Manufacturing sector that are e-Ready (firms that adopt ICT-enabled governance) are showing improved productivity. This is also being reflected as tangible improvement in the performance of the Manufacturing sector.

1.7 Technology's innate ability to enable participation of marginalised aids economic development

Some economists consider ICT's catalytic role in bringing the unserved and marginalised into the mainstream and technology's innate ability to enable participation of the poor and marginalsed as the main elements of "development".

1.8 Output and employment multiplier effects of computer-related services

The "multiplier effects" of the growth in computer-related services on the national economy has been brought out by CSO through its Input-Output Table for reference year 2003-04, where computer-related services has been included as a separate row item. The Output Multiplier for computer-related services is 1.52. This means that for every one unit of output in the sector, the domestic economy would be stimulated by additional 0.52 units. In other words, export of one unit by the IT sector may stimulate the domestic sector's output by little more than half a unit. Since IT is clubbed with communication services, the forward linkage of the IT sector is also very significant.

1.9 Pervasive role of ICT sector in various economies

The world today is characterised by revolutionary changes in the way in which we communicate as well as in the way in which the information is stored, processed, transferred and accessed. This transformation has largely been enabled by innovations in 'networking technologies' and 'convergence technologies', among others. The increasingly pervasive role of ICT in different aspects of modern life has been recognised in the common metaphors being used for present-day society as 'information society', 'digital society', 'knowledge economy', etc0

1.10 Pertinent methodology selection – best practices survey

To develop a pertinent methodology to capture e-Readiness in the Indian context, several previous studies on the subject were analysed in the first e-Readiness Assessment Report in 2003. These studies included McConnell International's *"Risk e-Business: Seizing the Opportunity of Global e-Readiness"*; CSPP's *"Readiness Guide for Living in the Networked World"*; APEC's *"e-Commerce Readiness Assessment"*; CID's *"Readiness for the Networked World: A Guide for Developing Countries"*, and Economist Intelligent Unit's *"e-Readiness rankings of 2002"*. In all the methodologies reviewed, we found a common perspective on e-Readiness and its effect on a given region or country. The common thread is the realisation that e-Readiness made inclusion into the global digital economy possible and provided a high-speed constant access to information in a competitive world.

1.11 e-Readiness in the Indian context: key differences

In the Indian context, however, when assessing and then ranking states and UTs according to an e-Readiness index, the emphasis was to capture capacity to provide Services that enabled (a) participation in the provincial and national-level digital economies, (b) equitable and cost-effective governance, and, (c) a better integration of the deprived segments of society and remote regions.

As a result, the Networked Readiness Index (NRI)[1] framework was utilised and adapted to the Indian context in which the e-Readiness index was based on the following broad parameters:

- The ICT **environment** of a given state or community.
- The **readiness** of the community's key stakeholders to use ICT.
- The actual **usage** of ICT among these stakeholders

These parameters were then further classified into three sub-indicators each:

1.1 The market environment of ICT.

1.2 The policy or regulatory environment.

1.3 The ICT infrastructure environment.

2.1 Individual readiness to use ICT.

2.2 Business readiness to use ICT.

2.3 Government readiness to use ICT.

3.1 Individual usage of ICT.

3.2 Business usage of ICT.

3.3 Government usage of ICT.

This framework has been maintained for all e-Readiness Reports since 2003, though each year

[1] World Economic Forum (2002-03). The Global Information Technology report: Readiness for a Networked world.

improvements are made based on our experiences, the responses from the states/UTs and feedback from the government of India. Feedback based on interactions and discussions with the various stakeholders in this exercise reveal that the methodology is acceptable to them.

The role of ICT in promoting economic growth and technology's innate ability to include marginalised sections into the mainstream were the main reasons for development of the e-Readiness index. Therefore, the roles of all stakeholders, government, business and individuals were important in achieving a high e-Readiness score.

1.12 e-Governance

One of the most important applications of ICT is in transforming the governance process by acting as a tool for improving the public services delivery mechanism. Against such a background, it becomes important to keep track of the progress in ICT adoption in the governance and to benchmark this progress with the leaders and those upholding best practices. While this aspect was studied as a part of the overall e-Readiness indicator, the need to assess e-Governance state-wise has become very important now because of the gigantic e-Governance projects (Box 1.1) on the anvil which, inter alia, would cover more than 105 million farming households for distribution of farm inputs, cash transfers to millions of identified BPL households, monitor programmes such as National Rural Employment Guarantee Act, financial inclusion programmes such as Bhamashah, etc. Given the massive scope of these projects, tracking the e-Governance ability of the states/UTs becomes important.

Waves of e-Governance in Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh states have given us the confidence that ICT's major involvement in inclusive development is not far off. We review some major ones below.

Box 1.1: Priority national e-Governance projects

Issuance of Unique Identification Numbers (UIN) to all the citizens – A Unique Identification Authority of India has been established recently with statutory powers for creating a database of all the citizens and for issuance of UIN to them. This would help, *inter alia*, in avoiding duplication of identification.

National e-Governance Plan (NeGP) – ambitious programme of Government of India with three pillars: State Data Centres (SDCs) as a central repository of state-level data; State-Wide Area Networks (SWANs) for integration of different layers of state government and Common Services Centres (CSCs) as one-stop front-end delivery points for a variety of citizen-centric services (application forms, payment of utility bills etc). Apart from this there are many central and state Mission Mode Projects (MMPs) which are sought to be implemented in a time-bound, mission-mode manner.

National Knowledge Network/Grid (Garuda Project) – interlinking of educational and research institutes across India electronically for sharing of intellectual resources on one common platform.

Smart card for inclusion of disadvantaged sections For e.g., Bhamashah Financial Inclusion Project of Government of Rajasthan which aims at opening no frills bank account for 50 lakh BPL families through biometric ID cards.

Janani Suraksha Yojana Call Centre (Guna district of Madhya Pradesh): The Janani Suraksha Yojana Call Centre, a dedicated 'round-the-clock health call centre in Guna district, is the first of its kind in the country that coordinates vehicles to transport pregnant women to the nearest health facility for delivery, and severely sick children to hospitals. Started in September 2007 under the National Maternity Benefit Scheme of the National Rural Health Mission, the objective is to reduce the maternal mortality ratio and the infant mortality rate besides increasing institutional deliveries among the below poverty line families in Guna where health indicators have remained stagnant despite many efforts.

The call centre is headquartered at the District Health Centre and has a network of 24 vehicles with each driver having a mobile phone. When an *anganwadi* worker, auxiliary nurse midwife or accredited social health activist calls up in case of an imminent delivery, people at the centre reach out to the vehicle nearest to the place where the call came from. The driver gets in touch with the caller and

brings the woman or a severely sick child to the hospital. Being run by the state government with help from the United Nations Children's Fund (UNICEF), the centre has made quantifiable change in less than two years with institutional deliveries in the district crossing 90 per cent. The beneficiaries have been mostly those living in rural areas. Of the 35,891 institutional deliveries from September 2007 to March 2009, 13,606 used this transport facility.[2]

- **Jankari scheme of Government of Bihar**: This scheme enables people living in the remotest areas of the state to apply for information under the Right to Information Act (RTI) through just a phone call. The scheme has a provision of first and second appeal through same method. These call centres are easy access complaint cells opened under the RTI Act. BELTRON, under Department of Information Technology of Government of Bihar, is the implementing agency of this simple and universally accessible facility. This project received a gold icon award for its information call centre project under e-Governance best practices for inclusive governance at National e-Governance Conference 2009 held in Goa.

- **Bhamashah Financial Inclusion project of Government of Rajasthan**: This ambitious project of Government of Rajasthan aims at opening no-frills' bank accounts for fifty lakh BPL households through an innovative mobile-banking in which Government of Rajasthan contributes initially Rs1,500 into each account. IL&FS is the major infrastructure provider entrusted with overseeing the successful execution of the project and issuing smart cards. Punjab National Bank is the partner bank with the responsibility of opening 50 lakh 'no-frills' account. This project while initially targeted at financial inclusion also serves the purpose of digital inclusion.

- **e-District project in Uttar Pradesh**: Uttar Pradesh earned the distinction of being the pioneer state in successfully implementing e-District project (one of the state MMPs under NeGP) when the first e-District centre in the country was inaugurated in Sitapur district. The project envisages the backend computerisation of government departments and the district administration to provide Services at the doorstep of citizens. The project seeks to automate the workflow and internal processes of the district administration with the possibility of seamless integration of various departments.

Though we are aware of the potential of ICT in the effective delivery of public services, there are also challenges/issues involved in ICT adoption. Our methodology on measurements related to ICT-enabled governance described elsewhere in the report factors in the following challenges:

1.13 Issues in successful implementation of e-Governance projects

There are many issues which need to be addressed before one could be assured of the successful adoption of ICT-enabled governance. We discuss these as under,

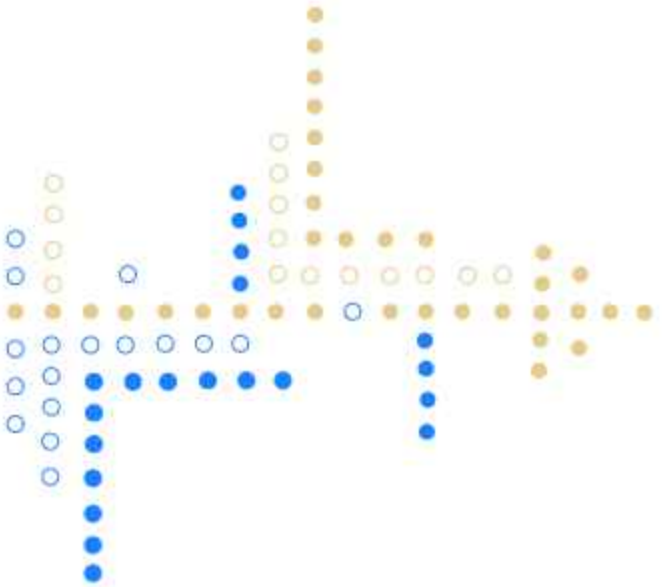
- Organisational changes in government – We at NCAER believe that the adoption of ICT-enabled governance for delivery of public services is incomplete without fundamental changes in the government processes and structures. If the aim is the transformation of delivery of public services and to ensure good governance, they cannot be achieved without re-engineering of government processes (seamless integration of different processes; removing the barriers to open the flow of information within the government) and structures (flattening of strict hierarchies in decision-making processes).
- Technology-related: On the technology front, there are the following issues:
  - Scalability of e-Governance, especially G2C projects: many of the e-Governance projects started in India are pilot projects which, if successfully implemented, would pave the way for full-scale roll out. These pilot projects should be scalable for the purpose.
  - Interoperability (especially in case of G2G projects) – the project should have an in-built system for seamless operation across different platforms. This is especially important in cases where different departments operating on different platforms are sought to be integrated to ensure seamless flow of information within the government.

2 *The Hindu*, "A call centre for pregnant women, ailing children", May 16, 2009. http://www.hindu.com/2009/05/16/stories/2009051656232000.html.

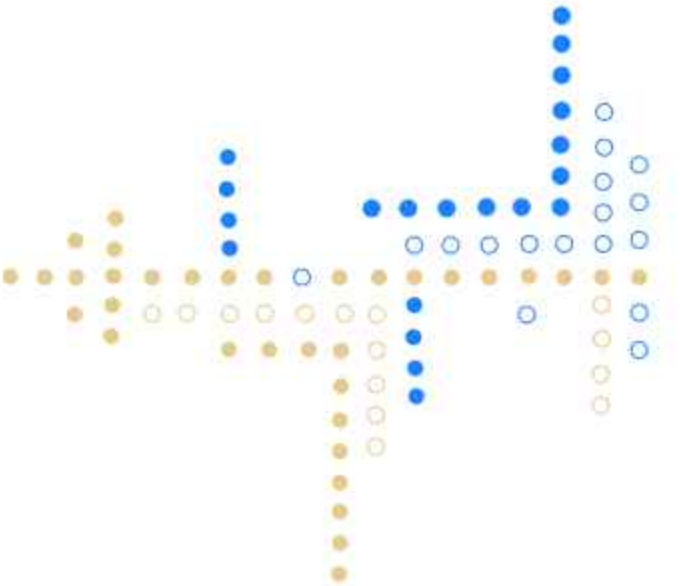
- Security aspect and risk management: One needs to take care of the following security and risk-related issues in governments moving online:
  - Security of network – require anti-virus, firewall installed in the system, apart from the use of encryption technologies and virtual private networks (VPN).
  - Disaster Data Recovery System and Business Continuity System – These systems are in place in many leading business enterprises; and as governments transform themselves into 'online' or 'connected' governments, these are of utmost importance.
- Quality and content aspects: As governance becomes increasingly interactive and participative through the adoption of ICT; the quality of e-Governance services (in terms of cost, time and citizen satisfaction) assumes great importance. Also, the content of e-Governance services would be very vital for decision making of government as well as for the public utility.
- Economic, social and cultural aspects:
  - Acceptability – many of people are culturally not comfortable with technology, especially in rural areas. This was experienced by the Akshaya project (internet kiosks) of Kerala initially, as it was believed that access to internet would have bad influence on young people. But later, the benefits of Akshaya centres was realised and opposition was withdrawn
  - Sustainability – this calls for innovative value-added services (utility payments, online birth/death certificates, etc.) to be offered through front-end delivery windows and not just routine Services like downloading of application, static information about government programmes, etc.

It could be argued that an effective e-Governance programme should aim at connected governance wherein there is no possibility of reverting to the manual option and there is a contingency programme of data recovery in case of extreme cases of system failures. We have considered this as the ultimate goal and have restricted our scope to measuring the use of ICT for effective governance in delivery of public services while moving towards the ultimate goal.

Chapter 2 looks at some macroeconomic issues on the role of the business sector in overall growth. Chapter 3 briefly discusses the sustainability issues of Services exports based on the comparative advantage framework for Indian software industry. Chapter 4 presents a comparison of international methodologies of e-Readiness measurement with NCAER's methodology. Chapter 5 contains the e-Readiness Measurement Methodology and Assessment of e-Readiness of Indian states/UTs. Chapter 6 has e-Governance Measurement Methodology and Assessment of e-Governance of Indian states/UTs as the subject matter.



Growth and Employment: A Macroeconomic Perspective



Growth and Employment: A Macroeconomic Perspective

India has been one of the fastest growing economies in the world in the last two decades. The growth rate of the GDP that had stayed around 3.5 per cent per annum for 20 years prior to 1980, shot up to about 5 per cent in the 1980s and increased further in the 1990s to 6 per cent. Over the past few years, it has reached as high as 9 per cent. Not only has the growth been relatively stable, it has also been accompanied by poverty decline – the proportion of population below the poverty line declined from about 44 per cent in 1983 to 27 per cent in 2004. All in all, it has been a stellar performance.

This raises some obvious questions – what has been the engine of Indian growth? Can the Indian model be replicated by other developing nations? More importantly, is the growth sustainable? On the face of it, the improved performance in India seems to have been achieved by following the orthodox prescription of removing the constraints on entrepreneurship. However, Indian economic growth, during 1980-2004 seems to have little in common with the so-called 'Asian Model'. Its savings rate is healthy but not at the East Asian level. Its growth so far has not been driven by manufactured exports. Nor has it attracted massive inflows of foreign investment. There is no industrial policy targeted toward developing specific industries.

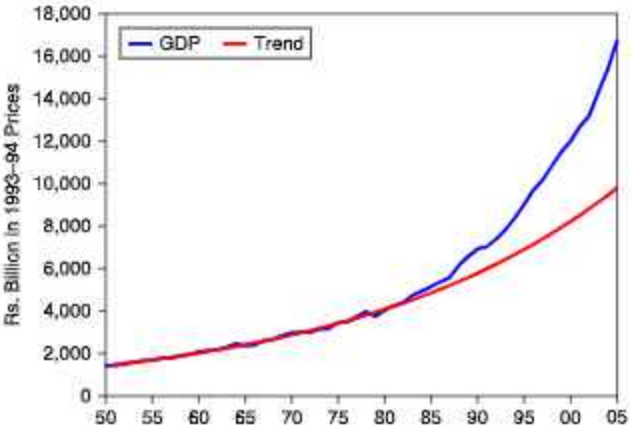
On the contrary, it is the Services sector that has led the charge in the Indian growth experience. Another aspect of the Indian experience that makes it very unique is that despite growing non-agricultural economy, the share of agriculture in the total labor force remains high as the growing non-agricultural economy did not show commensurate absorptive capacity to accommodate the labor force from the countryside. In fact, in absolute numbers, the agricultural labor force has increased since the 1980's, dampening the process of poverty decline.

2.1 Growth acceleration and the role of services

Table 2.1 presents five-year averages of annual GDP growth rates from 1951 to 2005. Except for two periods – 1956-60 and 1966-70 – when the rate of growth was in excess of 4 per cent, the 1951-79 periods saw average growth rates of less than 4 per cent. In the period since 1980, however, the economy has shifted to higher growth path. Five-year average growth rates are higher than 5 per cent in each of the sub-periods. The break in the 1980s is sharper when we look at the rates of growth of non-farm GDP.[3] Prior to 1980, the average rate of growth of non-farm GDP was below 5 per cent. This increased to close to 7 per cent in the 1980s and increased further to about 8 per cent in the 1990s.

The growth acceleration can also be seen from Figure 2.1. In this figure real GDP is plotted for the period 1951-2005 together with the trend line in this variable from the period 1951-1980. The departure from the trend is clearly visible in the early 1980s.

Figure 2.1: Acceleration in GDP-trend vs actual



[3] Non-farm GDP is the total GDP less GDP originating in the primary and mining and quarrying sectors.

Table 2.1: Rate of growth of GDP and its components

	GDP	Non-Farm GDP	Manufacturing	Services
1951-55	3.61	4.63	5.84	4.24
1956-60	4.27	5.38	6.28	5.00
1961-65	2.84	6.01	6.62	5.67
1966-70	4.66	4.27	3.96	4.24
1971-75	3.08	3.74	3.33	3.78
1976-80	3.24	4.84	4.86	4.77
1981-85	5.10	6.23	7.05	5.86
1986-90	6.18	7.40	8.18	7.02
1992-95*	6.40	7.81	9.87	7.23
1996-00	5.92	7.20	5.06	8.03
2001-05	6.93	8.19	6.80	8.78

Notes:* The year 1991-92 has been excluded from the 5-year averages since the performance was particularly bad in all sectors because of the BOP crisis.

All variables are in real 1993-94 prices.

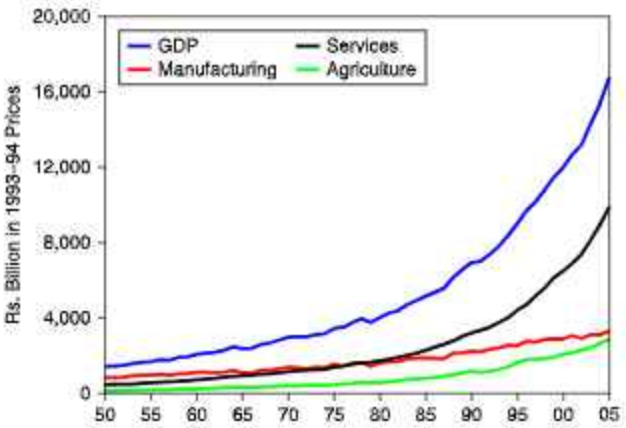
There has been a lot of research on what could have triggered growth acceleration in the 1980s.[4] Various explanations have been proposed in the literature:

- Trade liberalisation decreasesd the cost of capital equipment, which spurred growth in manufacturing in the 1980s.
- Bank nationalisation in 1969 allowed the government to mobilise savings on a large scale, leading to a rise in the savings rate.
- Huge public expenditure outlays in the 1980s.
- Diffusion of agricultural technology.
- Shift of political attitudes towards the private business sector leading to an unleashing of "animal spirits" resulting in an upward shift in private investment.

However, it is difficult to disentangle the effects of each of these. It is more likely that each of these factors played a role.

Figure 2.2 gives the sectoral composition of GDP. It can be seen that since the 1980s, it is the Services sector that has been both the dominant as well as the fastest growing sector in the economy. Between 1981 and 2005, manufacturing grew at an average annual rate of 6.9 per cent and Services at 7.3 per cent. In the 1980s manufacturing grew at a slightly higher rate 7.6 per cent compared to 6.4 per cent of Services. However, in the 1990s and up to 2005, the rate of growth of Services was higher at 8.1 per cent compared to 7.1 per cent of manufacturing. As may be seen from Table 2.1, the growth in Services overtook that of manufacturing in the mid-1990s.

Figure 2.2: Composition of GDP - 1950 - 2005



[4] Initially there was also disagreement about the timing of the shift. This was because extensive reforms were only undertaken in 1991-92. Yet, the rate of growth of GDP in the '80s is not that different from that in the '90s. However, it is now fairly well established that the break happened sometime in the early eighties or late seventies.

A much-discussed feature of the Indian growth experience is that it has not been employment creating. In 1980 India, China and Thailand had very similar proportions of their labor force engaged in agriculture – 68.7 per cent in China, 68.1 per cent in India and 70.8 per cent in Thailand. By 2000, the share of agriculture in employment had fallen drastically in China and Thailand – 47 per cent in China and 48.8 per cent in Thailand. However, in India it fell only to 59.3 per cent. Even in 2004, the share of agriculture in employment remains at high as 58.5 per cent.

Table 2.2 gives the sectoral shares of agriculture, manufacturing and services in employment and GDP. Note that the share of manufacturing in both GDP and employment has not changed much in the last 20 years – about 17 per cent of GDP and 11 per cent of employment. On the other hand, the share of agriculture in GDP almost halved, though its share in employment fell by only about 15 per cent. The fall in the share of agriculture is reflected, almost completely, in a rise in the share of Services in GDP and employment. Whatever little reallocation there was of the labor force from agriculture, it was almost entirely to Services rather than to manufacturing. Since most of the high-end Services tend to be highly skill intensive and most of the labor in agriculture do not have the requisite skill sets, this movement is mostly to low productivity sectors like trade and construction. Therefore, the productivity gains that are usually associated with a reallocation of labor from agriculture were in most likelihood not realised in the case of India.

It is clear from Tables 2.1 and 2.2 that the Services sector has grown faster than the other sectors and is the dominant sector in the economy. However, employment in this sector has not kept pace with output growth. As a result, while the share of Services in GDP is about 60 per cent, its share in employment is barely 30 per cent. Given that the Services sector has been driving growth and reallocation of employment from agriculture, in the next section we take a look at the relative performance of different service sectors. In particular, we want to look at the role of ICT and ICT-related sectors.

2.2 The disaggregated service sector

India's growth has largely been a service driven growth in the last 20 years. Within Services, however, there is wide variation in growth rates, skill intensity and markets. For instance, sectors like software grew very fast because of booming exports. On the other hand, growth in construction is mainly due to domestic demand. Similarly, the employment creating capabilities are very different. The software sector requires mainly skilled workers and its employment multiplier is very small. On the other hand, construction can absorb large numbers of unskilled workers. Therefore, it is important to have a disaggregated analysis to understand the dynamics of the Services sector.

As is the case with most disaggregated analyses, availability of data becomes an issue. In the case of India, for value added and output, there are two main sources of data — ASI (Annual Survey of Industries) and NAS (National Accounts Statistics). The level of disaggregation is much greater in ASI than in NAS. However, ASI covers only registered manufacturing which constitutes less than 20 per cent of GDP. More importantly, it does not cover Services which are not only

Table 2.2: Sectoral shares in GDP and employment

	Share in GDP (%)			Share in employment (%)		
	Agriculture	Manufacturing	Services	Agriculture	Manufacturing	Services
1983-84	38.69	14.90	42.28	68.44	10.59	20.02
1993-94	30.97	16.06	47.97	64.87	10.44	23.60
1999-2000	24.99	16.71	53.45	62.03	10.50	26.63
2004-05	20.21	17.08	58.31	58.50	11.73	28.93

Notes: The data for GDP is from NAS (National Accounts Statistics) and is available on an annual basis. Employment data is available from NSSO (National Sample Survey Organisation) and is available on a quinquennial basis. The choice of the years is, therefore, dictated by the availability of the employment data.
GDP figures are in real 1993-94 prices.

dominant in GDP but also included some of the fastest growing sectors in the 1990s. Therefore, for output we use NAS. For employment the only source is NSS (National Sample Survey) and the recent rounds give data disaggregated up to 5-digit industry codes. However, NSS data are available only at five-year intervals. On the other hand, NAS gives a time series, but with very limited disaggregation – 41 non-farm sectors of which 17 are manufacturing, leaving only 24 service sectors. Therefore, to do a comparative analysis of growth and employment, we are restricted to 41 non-farm sectors over the NSS time periods – 1983-93, 1993-04, 1999-2000 and 2004-05. However, the time periods are convenient, from another view point, since they cover two decades, the first of which is pre-reform, and the second post reform.

Further, the NAS and NSS do not follow the same classification. The NSS gives data according to the NIC (National Industrial Classification) and different surveys use different classifications. The survey for 1983 uses the NIC 1970 classification. NSS 1993 and 1999 use NIC 1987 and NSS 2004 uses NIC 1998. First, the three classifications had to be matched to get comparable estimates of employment from NSS; and second the NIC had to be matched with NAS.

2.2.1 Composition

Table 2.3 gives the sectoral composition of the non-farm sector in terms of both value added and employment.[5] The first 14 comprise the manufacturing sector. The manufacturing sector, along with the three sectors of electricity, gas and water supply make up the industrial sector. The rest of the 24 sectors constitute the Services sector.

The reason for including the industrial sector in our analysis of the service sector is that it useful to look at the relative performance of sectors. The non-farm sector was merely 40 per cent of GDP in 1950-51. By 1980-81, its share had grown to 58 per cent and at the end of 2005-06 it constituted 78 per cent of the economy.

Within the non-farm sector, Services have a major share in value added. In 1983 and 1993, the share of Services was about 65 per cent. This increased to about 71 per cent in 2004. The dominance of Services is primarily due to two sectors – construction and trade. These two together constitute almost 30 per cent of the non-farm sector. The other major sectors are road transport, education and public administration and defense. The share of these three is approximately 18 per cent. However, between 1983 and 2004, the share of these five sectors has remained virtually unchanged. Also note that these sectors constitute the non-tradable part of the economy and, therefore, demand for their Services comes mainly from the domestic economy.

What is more interesting is the change in the structure of the non-farm sector over the past twenty years. Within industry/manufacturing there has not been much change other than the decline of the textiles industry – share of textiles fell from over 6 per cent in 1983 to under 2 per cent in 2004. In the Services sector, three sectors are of importance – communications, banking and business services.[6] In all three cases, the share of non-farm activity increased drastically. In the case of banking the growth happened in the 1980s. Its share doubled between 1983 and 1993 – from 3.5 per cent to 7 per cent – and increased marginally to 7.5 per cent in 2004. However, in the case of both communications and business services, the growth spurt happened in the 1990s. The share of communications went from under 2 per cent in 1983 and 1993 to over 6 per cent in 2004 – an increase of over 200 per cent. Similarly, business services constituted less than 1 per cent of non-farm activity in 1983 and 1993. By 2004, however, the share of business services had increased to 3.2 per cent. Though the share of both communications and business services remains small compared to, say, that of trade, the growth in these sectors nonetheless has been remarkable. Further, note that both these sectors provide Services that are tradable. This is important if they are to act as engines of growth. The possibility of trade opens up more markets. Therefore, production is not restricted by domestic demand, which may act as a binding constraint in many developing countries.

Table 2.3 also gives the employment composition of the non-farm sector. As in the case of value added the Services sector is dominant here as well. Its share in non-farm employment was about 65 per cent in 1983. This increased to just over 70 per cent in 1993 and 2004. Once again, within the non-farm sector and Services the big employers are trade and construction. In fact, since 1993, the share of these two sectors in

[5] The non-farm sector includes all sectors of industry and services, but not the primary sector (agriculture, forestry and fishing) and the mining and quarrying sector.

[6] The business services sector includes both hardware and software services, apart from services like accounting etc. NAS does not give data which has greater disaggregation. Therefore, this is the closest sector to Information technology.

Table 2.3: Sectoral composition of the non-farm sector, 1983–2004

	Sector	Share in GDP (%)			Share in Employment (%)		
		1983	1993	2004	1983	1993	2004
1	Food products	2.72	2.41	1.84	3.96	3.87	2.75
2	Beverages, tobacco etc.	1.36	0.93	0.84	3.45	3.23	2.41
3	Textiles	6.22	2.96	1.86	6.29	5.15	4.76
4	Textile products	0.31	0.98	0.91	4.79	2.63	3.45
5	Wood, furniture etc.	2.51	0.99	0.34	3.86	3.33	5.05
6	Paper printing etc.	0.98	1.02	0.73	0.81	0.74	0.81
7	Leather and fur products	0.43	0.47	0.27	0.74	0.65	0.79
8	Rubber petroleum etc.	2.69	3.34	1.63	0.38	0.69	0.47
9	Chemicals etc.	1.17	1.93	3.54	1.10	1.29	1.09
10	Non-metallic products	1.24	1.16	1.14	3.09	2.58	2.43
11	Basic metal industries	2.35	2.22	2.19	1.11	0.87	0.54
12	Metal products	1.56	1.11	-	1.41	1.46	1.44
13	Machinery	2.95	2.86	-	1.64	1.71	1.32
14	Transport equipments	1.53	1.24	1.47	0.60	0.50	0.58
15	Electricity	2.65	3.15	2.41	0.89	0.96	0.56
16	Gas	0.03	0.17	0.26	0.02	0.03	0.02
17	Water Supply	0.30	0.34	0.26	0.13	0.14	0.00
18	Construction	9.06	7.82	7.51	7.84	9.85	14.27
19	Trade	19.58	17.95	19.41	18.35	20.10	21.34
20	Hotels and Restaurants	1.16	1.19	1.40	2.92	2.68	3.15
21	Railways	2.35	1.86	1.40	1.63	1.32	0.61
22	Road Transport	4.24	4.38	4.78	5.75	6.32	7.89
23	Water Transport	0.95	1.03	0.90	0.16	0.10	0.05
24	Air Transport	0.60	0.33	0.30	0.03	0.05	0.04
25	Services Incidental to Transport	0.35	0.42	0.39	0.34	0.32	0.15
26	Storage	0.18	0.12	0.07	0.08	0.09	0.05
27	Communications	1.66	1.81	6.33	0.60	0.60	1.03
28	Banking	3.48	6.98	7.58	1.17	1.54	1.26
29	Insurance	1.01	1.04	1.23	0.15	0.25	0.33
30	Real Estate	0.08	0.06	0.05	0.46	0.15	0.25
31	Business services	0.47	0.63	3.22	0.32	0.49	1.49
32	Legal services	0.30	0.31	0.22	0.24	0.33	0.31
33	Education	4.56	4.60	4.95	5.26	5.30	5.84
34	Research and Scientific	0.33	0.32	0.38	0.11	0.07	0.02
35	Medical and Health	1.47	1.57	1.83	1.84	1.62	1.97
36	Recreation and Entertainment	0.16	0.13	0.07	0.53	0.61	0.54
37	Personal services	2.21	1.59	1.42	6.80	8.10	5.38
38	Sanitary services	0.34	0.31	0.22	0.52	0.40	0.20
39	Services/Activities nec	0.55	0.79	-	1.55	1.59	0.69
40	International and Territorial Bodies	0.89	0.33	0.24	0.02	0.01	0.00
41	Public Admin and Defense	8.85	8.40	7.05	9.08	8.30	4.68

Note: The GDP shares do not add up to a 100 because the NAS does not give a complete breakdown of the non-farm sector.

employment is greater than in value added. In 2004, trade and construction together accounted for about 27 per cent of value added and 36 per cent of non-farm employment.[7] Growth in these sectors therefore, would create employment in the non-farm sectors leading to reallocation of labor from agriculture to the non-farm sector. Indeed, whatever little labor re-allocation has happened has been to these sectors. Unfortunately, productivity in construction and trade is not much higher than in agriculture. As a result, such a movement of labor is unlikely to result in huge increases in productivity and incomes.

As noted above, the churning in the Services sector is mainly due to the three sectors of banking, communications and business services. Their share in value added increased dramatically between 1983 and 2004. However, while their share in employment increased, the growth was not as sharp. The share of banking in employment increased slightly in the 1980s and then fell. On the other hand, the share of the communications and business services was more or less stagnant in the 1980s and increased slightly in the 1990s. This is understandable since banking was growing in the 1980s and the other two in the 1990s. In all three cases, the share in employment is way less than their share in value added.

2.2.2 Contribution to growth

The growth rate of GDP/employment is nothing but a weighted average of the rates of growth of different sectors. The contribution that a particular sector makes to the overall growth rate in turn depends on how fast it is growing and its share in GDP/employment. Therefore, it is possible that a sector is growing very fast, but because its share is small, its contribution is not very large. In this section, we look at which were the fastest growing sectors in the 1980s and 1990s and their contribution to GDP and employment growth.

In Table 2.4 we present sectors sorted by their growth rate in the 1980s (1983-93). The rate of growth of GDP of the sector during 1983-92 is given in column 3.[8] Column 4 gives the rate of growth of employment[9] in the sector and columns 5 and 6 give the contribution of the sector to the growth in non-farm GDP and employment during 1983-92.[10] Thus the fastest growing sector during the 1980s was Gas with an average rate of growth of 28.3 per cent per annum. During that period, employment was growing at a mere 4.4 per cent in the sector. However, the contribution of the fastest growing sector to overall growth of GDP in the non-farm sector was only 0.16 per cent and its contribution to employment growth was even lower, at 0.04 per cent.

Table 2.5 gives the same statistics for sectors sorted by their GDP rate of growth during 1993-2004. If we look at the 12 fastest growing sectors in the 1980s and the 1990s, six of the twelve were service sectors in the 1980s. This increased to eight out of twelve in the 1990s. In the '80s the 12 fastest growing sector contributed about 30 per cent to the growth in non-farm GDP. However, they contributed less than 5 per cent to employment growth. In fact, the second-fastest growing sector, textile products, was actually shedding labor during this period. Even if we don't count this sector, the contribution to employment growth is only 13.3 per cent. When compared to the 1980s, the fast growing sectors of the 1990s were slightly better in creating employment.

The 12 fastest growing sectors of the 1990s contributed 36 per cent to non-farm GDP growth and 23 per cent to employment growth.[11] Not surprisingly, the sectors that contribute the most to employment growth continue to be trade and construction. Throughout the period, almost half the non-farm employment growth was due to these two sectors. Their contribution to GDP growth was about 28 per cent.

However, the point remains that the fastest growing sectors are not necessarily the ones creating a lot of employment. Business services and communications were the two fastest growing sectors in the 1990s. Together they contributed 7.4 per cent to GDP and 3.6 per cent to employment growth. While the contribution to GDP might seem small, it is three times their combined share of the 1993 GDP of 2.4 per cent. However, given that business services were growing at the compound growth rate of 24.3 per cent, its share is expected to rise over 7 per cent of GDP in 2007-08. This sector will then certainly start having a significant impact on GDP.

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7 The other sectors that contributed significantly more to employment than value added in 2004, were food products, beverages, tobacco, etc., textiles and products, and wood and products in manufacturing and hotels and restaurants, road transport, and personal services in the service sector. Other than road transport, however, the share in employment was relatively small (under 5%).

8 Rate of growth of GDP is the average annual rate of growth during the relevant period.

9 Since employment is available only for 1983, 1993 and 2004. The rate of growth is the point to point rate of growth annualized over the relevant period.

10 Contribution to the non-farm sector is the sectoral rate of growth weighted by the share of the sector, expressed as a percentage.

11 This is mainly due to the road transport sector which one of the twelve fastest growing sectors in the '90s. If we exclude this sector the contribution to employment growth falls to about 12 per cent.

Table 2.4: Contribution of the fastest growing sectors – 1983-93

	Sector	Rate of Growth (%)		Contribution to Growth (%)	
		VA	Emp	GDP	Emp
1	Gas	28.29	4.42	0.16	0.04
2	Textile products	15.81	-3.71	0.86	-8.53
3	Business services	14.29	6.62	1.17	1.02
4	Banking	13.11	5.17	7.89	2.90
5	Chemicals etc.	11.47	3.91	2.32	2.06
6	Rubber petroleum etc.	10.40	8.44	4.85	1.54
7	Services Incidental to Transport	8.94	1.71	0.54	0.28
8	Insurance	8.79	7.73	1.54	0.56
9	Electricity	8.74	3.09	4.01	1.32
10	Legal services	7.97	5.42	0.42	0.62
11	Medical and Health	7.58	0.97	1.93	0.85
12	Machinery	7.54	2.70	3.85	2.12
13	Paper printing etc.	7.43	1.30	1.26	0.51
14	Water Supply	7.34	2.76	0.38	0.17
15	Non-metallic products	7.00	0.45	1.50	0.66
16	Road Transport	6.90	3.24	5.07	8.94
17	Leather and fur products	6.79	0.96	0.50	0.34
18	Basic metal industries	6.57	-0.26	2.67	-0.14
19	Sanitary services	6.50	-0.25	0.38	-0.06
20	Education	6.40	2.34	5.05	5.91
21	Communications	6.24	2.16	1.80	0.62
22	Research and Scientific	6.19	-1.63	0.35	-0.09
23	Water Transport	6.03	-2.05	0.99	-0.16
24	Public Admin and Defence	6.01	1.35	9.22	5.89
25	Hotels and Restaurents	5.77	1.38	1.16	1.94
26	Services/Activities nec	5.41	2.55	0.52	1.89
27	Construction	5.40	4.63	8.48	17.42
28	Trade	5.40	3.20	18.32	28.21
29	Food products	5.01	2.04	2.36	3.87
30	Recreation, Entertainment and Radio	4.85	3.77	0.13	0.96
31	Beverages, tobacco etc.	4.79	1.58	1.13	2.62
32	Transport equipments	4.52	0.44	1.19	0.13
33	Railways	4.13	0.08	1.68	0.07
34	Textiles	4.12	0.24	4.44	0.74
35	Real Estate	3.62	-8.69	0.05	-1.92
36	Metal products	3.10	2.62	0.84	1.77
37	International, and Territorial Bodies	3.10	-4.96	0.48	-0.05
38	Personal services	2.99	4.07	1.15	13.27
39	Storage	2.65	3.80	0.08	0.15
40	Air Transport	2.08	8.62	0.22	0.12
41	Wood, furniture etc.	-2.19	0.78	-0.95	1.44

Table 2.5: Contribution of the fastest growing sectors – 1993-2004

	Sector	Rate of Growth (%)		Contribution to Growth (%)	
		VA	Emp	GDP	Emp
1	Business services	24.26	15.18	2.14	2.09
2	Communications	20.69	9.41	5.25	1.58
3	Chemicals etc.	16.51	2.48	4.45	0.90
4	Gas	12.94	-0.89	0.30	-0.01
5	Insurance	11.87	6.55	1.73	0.46
6	Services/Activities nec	10.69	-3.54	1.19	-1.58
7	Transport equipments	10.58	5.47	1.83	0.77
8	Research and Scientific	10.41	-9.03	0.46	-0.18
9	Hotels and Restaurants	9.68	5.62	1.61	4.22
10	Banking	9.63	2.20	9.40	0.95
11	Medical and Health	9.32	5.93	2.05	2.69
12	Road Transport	8.58	6.19	5.25	10.97
13	Trade	8.51	4.64	21.36	26.13
14	Education	8.31	4.99	5.34	7.42
15	Non-metallic products	7.74	3.51	1.26	2.54
16	Basic metal industries	7.68	-0.35	2.39	-0.09
17	Recreation, Entertainment and Radio	7.60	3.02	0.14	0.52
18	Textile products	7.31	6.68	1.00	4.93
19	Beverages, tobacco etc.	7.20	1.32	0.94	1.20
20	Water Transport	6.97	-2.24	1.01	-0.06
21	Services Incidental to Transport	6.94	-3.12	0.41	-0.28
22	Construction	6.93	7.64	7.58	21.10
23	Machinery	6.87	1.66	2.75	0.80
24	Food products	6.52	0.88	2.20	0.96
25	Air Transport	6.40	1.51	0.30	0.02
26	Metal products	6.31	3.92	0.98	1.60
27	Personal services	6.30	0.28	1.41	0.63
28	Real Estate	6.12	9.37	0.05	0.39
29	Public Admin and Defence	5.94	-1.20	6.98	-2.79
30	Paper printing etc.	5.75	4.95	0.82	1.03
31	Water Supply	5.54	-27.52	0.26	-1.08
32	Electricity	5.08	-1.00	2.24	-0.27
33	Legal services	4.90	3.57	0.21	0.33
34	Railways	4.56	-3.01	1.19	-1.12
35	Sanitary services	4.50	-2.36	0.20	-0.27
36	Leather and fur products	4.35	6.00	0.29	1.09
37	Textiles	3.81	3.33	1.58	4.81
38	Rubber petroleum etc.	3.37	0.58	1.57	0.11
39	Storage	2.83	-0.81	0.05	-0.02
40	International and Territorial Bodies	0.38	-11.84	0.02	-0.03
41	Wood, furniture etc.	-1.31	8.07	-0.18	7.54

The remarkable growth in the business services sector has been to a large extent driven by foreign demand. Between 1995 and 2000, India's Services exports grew nearly six times faster than world exports of Services. In 2001-02, software accounted for about a third of all Services exports. Even though the software sector is only a small part of the GDP and a negligible part of the total employment, it has been the most dynamic sector in India and has facilitated continuing growth by generating foreign exchange. From a macroeconomic perspective, however, the problem is that the fast growing sectors which are not absorbing labor fast enough. In a labor surplus economy this leads to the growth process itself becoming lopsided. The gains from growth accrue to a small fraction of the economy, creating a dichotomous society. The problem is compounded by the fact that the fast growing non-farm sectors are all skill intensive sectors and a big mass of labor in agriculture is unskilled. The shortage of skills is already evident in the economy. In a survey done by the World Bank on "Investment Climate in India", the biggest obstacle to growth identified by the software and ITES sectors was shortage of talent followed by shortage of power and prevalence of corruption.

From a longer term perspective, therefore, for growth to be sustained, certain challenges need to be overcome:

Creating employment growth in the formal sector

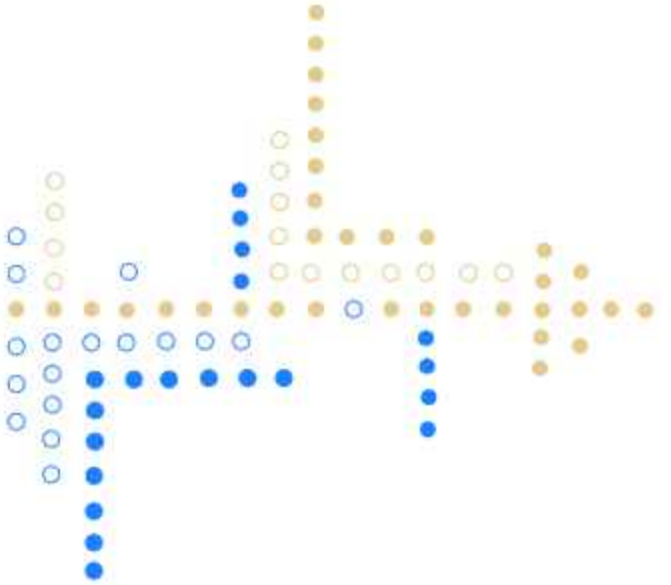
Accelerating productivity growth

Increasing literacy and improving the quality of education

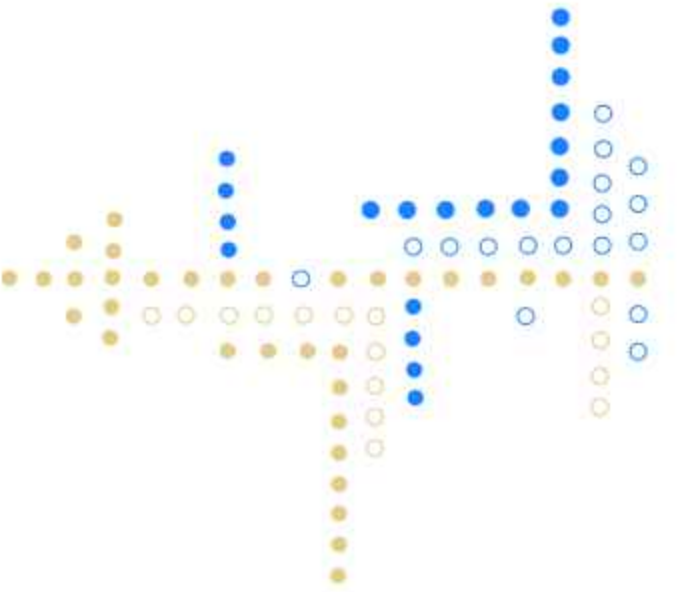
2.3 Conclusion

It is quite apparent that the Services sector has grown faster than other sectors and is the dominant sector io the economy. Within Services, the business services sector (which includes software and IT-enabled services), banking and communications have grown on average at more than 10 per cent per year in the 1990s. The fastest growing sectors, however, have not been creating employment at the same rate. This has resulted in two things. First, a limited reallocation of labor from agriculture to the more productive non-farm sector; and second, a dichotomous economy where relatively low productivity sectors like trade and construction are responsible for most of the employment growth.

Further, because the fast growing sectors are completely dependent on skilled manpower, growth may get choked if they run into a serious bottleneck. Therefore, one possible bottleneck for the Indian pattern of growth is an 'educated workforce'. A related question is that of quality. According to a report by the McKinsey Global Institute (2005), "India's vast supply of graduates is smaller than it seems once their suitability for employment by multinational companies is considered." The report stresses that the government must "adjust the country's educational policy to ward off the looming squeeze on talent". McKinsey estimates that India has 14 million young university graduates (those with seven years or less of work experience). This pool is 1.5 times the size of China's and almost twice that of the United States. Every year 2.5 million new graduates are added to this pool. However, according to the report, while the numbers seem encouraging at first glance, a closer look reveals that India is likely to face a talent crunch io the coming years.



The Indian Computer-Related Services (Software) Industry and its Prospects



The Indian Computer-Related Services (Software) Industry and its Prospects

Indian IT industry, which was at $1.09 billion in 1990-91, increased by leaps and bounds over the past decade. During 1997-98 it was estimated at $5.03 billion. In 2007-08 it touched $48 billion, a ten-fold increase. In terms of segments, hardware accounted for 50 per cent in 1990-91, its share in total turnover continuously declining to 28 per cent in 1997-98 and further to 16 per cent in 2007-08. The share of software and services was a whopping 84 per cent during 2007-08. Moreover, of the 2007-08 software and services revenue of $39.6 billion, the export market share was $31.6 billion (80%). The progress of the IT industry has therefore been synonymous with the progress of its software segment and more specifically with software and services exports. Consequently, the emphasis in this chapter is on aspects which facilitated the quantum jump in the growth of the software segment of the IT industry and examining whether its future growth is sustainable. India needs to remain a dynamic exporter of software and services if the dominant share of the ICT segment in national economy is to be maintained in future.

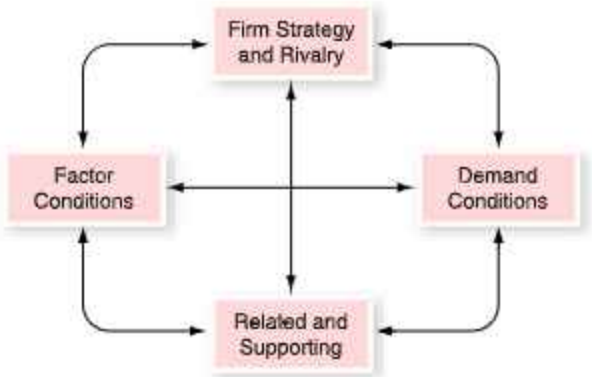
India's emergence as a major exporter of software services in the last decade and a half and the subsequent growth of exports of other business services have been analysed in great depth by Prof. Ashish Arora of Canegie Mellon University in the recently published book, *Sustaining India's growth miracle* (Jagdish N Bhagwati, *et al*). Earlier, R. Venkatesan and Chia Siow Yue, *et al* (2001), had studied the growth and development of the IT Industry in Bangalore. Venkatesan regarded Bangalore as the microcosm of the Indian IT industry for understanding the development of the segment in India. Another useful reference is Prof. S. Krishna, *et al* (1999)'s working paper, *Competitive Advantage in the Software Industry: an Analysis of the Indian Experience*. The present chapter draws heavily from the above references in analysing the factors that were responsible for the success of the software industry and for revisiting the prospects of the Indian IT industry. Of the references cited, Prof. Arora's analysis is the most comprehensive and current, and thus has been discussed in greater detail.

3.1 Michael Porter's *"National Competitive Advantage"*

Prof. Krishna tried to assess the National Competitive Advantage of the software industry based on Prof Michael Porter's framework.

The framework of National Competitive Advantage developed by Michael Porter can be advantageously employed to gauge attractiveness/competitiveness of an industry segment. Porter argued that a nation's competitiveness in any industry is dependent on good factor conditions, strong domestic rivals, aggressive home-based suppliers, and demands of local customers as shown in Figure 3.1.

Figure 3.1: Determinants of National Competitiveness- Michael Porter Model



Porter suggested that the four constituents are self-reinforcing and constitute a system. His hypothesis was that weakness in any one determinant would constrain an industry's advantage and upgradation. In the Indian context, demand factors and competition amongst firms were considered vital for the cluster to become viable. In the Indian software industry context, India cannot be

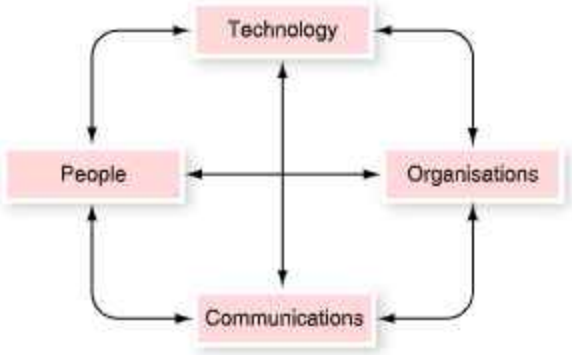
said to have excellent domestic demand conditions. However, export demand conditions are significant. Indian firms do not compete in the manner envisaged in Porter's Diamond of Determinants of National Competitive Advantage. India is not endowed adequately with the related and supporting industry (hardware) or the factor conditions (skilled manpower is in short supply) for the industry to succeed.

3.2 Prof. Krishna's Software Diamond

Krishna, *et al.* (1999) modified Porter's Diamond by focusing on the type of activity predominant in the Indian software industry to understand the software development system. Prof. Krishna argues that India has a predominant share of the world market, especially in the outsourced software and services segment. He asserts that the Indian software industry has demonstrated its competitive strength by transcending from a low value vendor relationship at the client site to a high value company site relationship in the 1990s. According to the study, the software industry is not limited by national boundaries thanks to the true globalisation that has occurred. Modern communication technology enables one to develop "off-site" production/service facilities effectively. If the "society" encourages people to adopt creative/intellectual pursuits and if the organisational environment nurtures this skill (such as non-hierarchical organisations), then the Software Development Diamond system explains Bangalore's and thus India's success in the software industry. They examine Bangalore as the "microcosm of the macrocosm India".

Elements that together determine the development system in the software industry, as conceived by Krishna, *et al* (1999), are shown in Figure 3.2. With the onset of economic reforms in 1991, the organisational aspects of the IT industry witnessed a seachange. The "livability" factor in major metros and major cities ensure their attractiveness to skilled professionals.

Figure 3.2: The Software development diamond



"People" in Figure 3.2 refer to the emerging middle class and the supply of skilled labour from predominantly private sector-funded engineering institutes. "Organisations" refer to the flat organisation structure set by the modern IT industry which is in contrast to the earlier paternalistic organisation structure prevalent in family owned businesses. "Communications" refer to the advancement in this segment. "Technology" refers to the advancements in networking and other features that have strengthened the "software diamond".

The third approach in the literature compares Silicon Valley with Bangalore (McKinsey-NASSCOM Approach). The McKinsey-NASSCOM study used the framework of critical ingredients, viz., idea generation, anchor companies, research centers and universities to compare Bangalore and the Silicon Valley (California). Table 3.1 summarises the comparison between Silicon Valley (California) and Bangalore.

Table 3.1: Comparsion of Silicon Valley and Bangalore

	Silicon Valley (California)	IT Cluster of Bangalore
Anchor Companies	HP, Fair Child, Sun Micro Systems	Wipro, Infosys, Microland, I-Flex, TCS, Motorola, Texas Instruments
Research Centres	XEROX, Palo Alto Research centre	ISRO, NAL, LRDE, GTRE, CSIR, CAIR
University	Stanford	Indian Institute of Science, Indian Institute of Management, Indian Institute of Information Technology
Venture Financing	Draper, Walden NICCO, Kleiner Perkins	Draper, KITVEN, ICICI Ventures, IL&FS Ventures, Indus ventures, CAN Bank, ICF Ventures.

Table 3.1 clearly indicates the marked similarities between Silicon Valley and Bangalore. The presence of establishment in form of anchor companies, prestigious research and academic institutions, coupled with the availability of venture financing, has attracted increasing numbers of IT companies to Bangalore. This, in conjunction with other city-related factors, has led to the success of the IT cluster in Bangalore.

3.3 Sustainability of software industry competitiveness

City-related factors that allow Bangalore and other Indian cities to sustain their competitiveness are (Srinivas, 1995):

- Availability of high technology professionals
- Availability of research institutes and laboratories in major cities
- Major centre for high technology production dispersed in major cities
- Favourable infrastructure in major cities
- Cheaper cost of living than Mumbai/Delhi

Finally, new theories have emerged to explain the competitiveness of Indian software industry that are multidisciplinary in nature such as the Krishna (1999) study and include insights from human geographers and other social scientists to explain the occurrence/sustainability of the IT clusters. Such an approach indicates that "cultural" factors contributed to Bangalore earning the status of "hot-spot" (the ability of a city/state to train, retain and attract new talents).

3.4 Research analysts' viewpoints

Researchers' analyses fall under four possible explanations that can be broadly grouped under the following approaches:

- Alternative to neo-classical trade theories
- Alternatives to Porter's model – "Software Diamond"
- International comparison with a similar successful clusters
- Urban economics based approach.

Availability of a variety of skilled labour inputs, dynamic economies of scale and the technical progress in Indian cities, endowed with research institutions and a significant middle class population, could be a partial explanation for the emergence of the metros/major cities-based IT clusters as an alternative to the neo-classical trade theory. Porter's national competitiveness model fails in the context of knowledge-based industries where offshore production is possible. The development of new communication technologies that allows off-shore development of software and the emergence of professional and more flat organisations in the post-liberalisation scenario, partly explains Indian software industry's success. A modification of Porter's model into the Software Diamond incorporating societal, communication, technical and organisational factor, is useful in gaining an understanding of the development of the Indian IT cluster. The fact that there are marked similarities between Silicon Valley and Bangalore (existence of anchor companies) also provides insights. The transformation of Bangalore and other major Indian cities over a period of time and the accompanying "livability" factors (congenial climate, moderate cost of living, etc.) may be the catalytic factors according to urban economists.

3.5 Indian software: positioning in the international market *vis-à-vis* its competitors- Ashish Arora's analysis

Ashish Arora's analysis of major factors that contributed to the software sector's amazing success is the most comprehensive analysis on the industry till date. He argues that India's software services have only a modest technology content and there is little evidence of successful product development for the international market. The infrastructure hasn't improved significantly and there is a shortage of workers. But IT revenues has increased some a decade in less than 10 years between 1997-98 and 2007-08. The Indian software and services sector, which was of the same size as Brazil in 2001, grew to $23 billion in 2005, while Brazil's industry size hovered around only $10-12 billion. Software and services revenue during 2008-09 is expected to reach $50 billion, double its year 2005 size. The impact of the global financial crisis was minimal on the Services sector export growth. The software services grew by 26 per cent while the financial services sector's performance in the shrinking world market registered 45 per cent growth rate.

Ashish Arora argues that the astounding success story can be understood only by understanding the composition of the Indian software sector. Contrary to popular belief, software products such as word processing software, accounting software, etc. are not the dominant part of the industry. Rather, the bulk of the value added and the employment in software sector are generated by customising these products, maintaining them, adding functionality and making these products work with the existing products. Most of these are carried out by software-using firms and not software firms.

In other words, he argues that there are three market segments; first of them being the design and development activities including traditional products such as word processing, spread sheets, operating systems, Enterprise Resource Planning etc., The second market segment involves custom programming and software analysis and design for clients including development of custom software products. The third category of market segment is the users of software. Bulk of the value addition in software goes in firms not classified as software firms such as banks, insurance, other financial institutions and telecommunications. India has focused on this untapped segment while its main competitors, Ireland and Israel, have focused on other market segments. Israel and Ireland's growth was affected in the post-2000 dotcom bubble while the Indian IT industry has jogged along (growth rate of 26 per cent during the financial crisis) even when market segments in advanced economies were affected badly. Arora argues Ireland and Israel have targeted a different segment than that targeted in India. Ireland is host to multinationals localising their products, plus a few innovative companies with globally competitive products and a host of tiny companies focusing on local demand. Israel hosts a number of technology start-ups and a few that have grown into large firms with headquarters in the US and R&D operations in Israel. Both Israel and Ireland were affected in the post-2000 dotcom bust, unlike India which has managed to grow at the same speed even when its main market segments were affected".

3.6 Explaining India's software success

3.6.1 Human capital and comparative advantage

Most of the software developers are freshly hired engineering graduates from the best institutes. As the CEO of a leading Indian software development firm admits, their training was not relevant but such recruitments signalled quality to foreign firms and in the context of the US, the engineering degree was valuable in getting temporary work permits.

Table 3.2 shows that in 1985, when software exports began, Indian colleges had about 45,000 graduate engineers. By 2004, the capacity had grown ten times to 440,000. Almost all engineering colleges had subjects relevant to the IT fields and the capacities were created by private engineering colleges which did not require governmental subsidies. The emerging middle class was able to fund education in these institutes.

There was a direct policy competition among Indian states to attract private investments in education. Gone were the days when the engineering colleges were under government control. Inter-state variations in college capacities has been bridged. The sanctioned intake capacity is distributed across 14 states in proportion to their respective population.

Panagariya (2007) mentions that in 1990, only six states permitted private engineering colleges. Rising inter-state competition pushed nine more states to allow private engineering colleges by 1999. There is anecdotal evidence that suggests that these governments were responding to middle class demands. The broader point is that competition between states for talent and for firms, is important and must be allowed free reign. This will enable market forces to drive improvements in quality in education and will have broader benefits as well.

- **Talent crunch is a myth created by economists**

The fact is that skilled workers can also be filled up from non-engineering colleges as the engineering college training is not a prerequisite for software development. Besides, the capacity utilisation in other disciplines is hardly 60 per cent. Obviously the surplus capacity can become handy in increasing engineering graduates supply in the immediate future.

Table 3.2: Sanctioned engineering baccalaureate capacity in India 1951-2004

Year	Population in Million	Engineering College capacity	Engineering college capacity per million of population
1951	361	4788	13
1985	765	45136	59
1995	928	105000	113
2004	1086	439689	405

Source: AICTE (Ministry of Human Resources Development).

3.6.2 The role of public policy

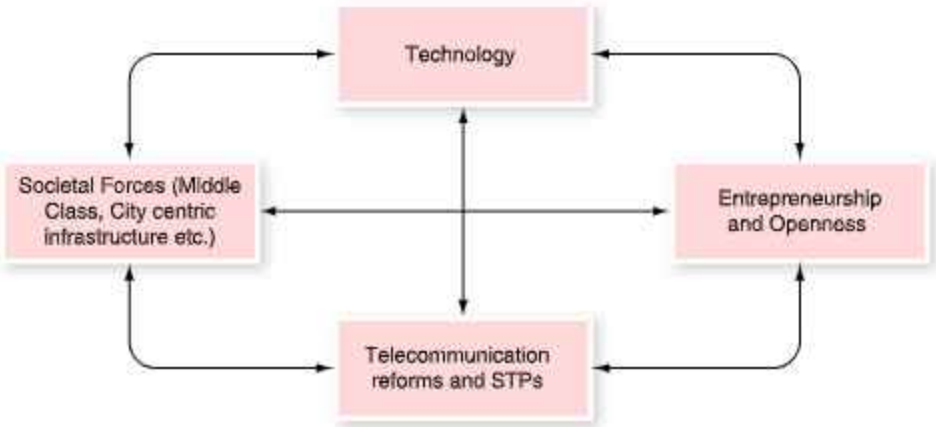
The second main reason cited for the success is the role of public policy. The direct policy competition among states to attain better e-Readiness score, to have the adequate technical training institutes, more attention being paid to improve e-Governance capability, etc. is paying off in the medium term. It is difficult to analyse affirmative, positive sector-specific policies as these were developed after the IT industry had demonstrated its international competitiveness in the respective state/region. However, it can be stated that the provision of export enabling infrastructure and long-term investments by the state in technical education and state-level science and technology policies have provided the enabling environment for software production. T.N. Srinivasan (2006) singles out telecommunication reforms and the creation of software technology parks as key steps that seemed to have helped the software sector.

3.6.3 Entrepreneurship and openness

The third important facilitating factor was Indian entrepreneurship and openness encouraged by the flat organisational structure of the entrepreneurs that made the development of software industry feasible. The role of NRIs, especially from the US, is also acknowledged by analysts in the development of the Indian software industry.

Based on the analyses of T.N. Srinivasan and Ashish Arora, one may redraw the software development diamond as in Figure 3.3. The aspiring middle class, city-centric infrastructure being developed, technical education facilities being provided by the private sector etc. could be categorised as societal forces in the diamond. The telecommunications reforms and STPs form the other arm reinforcing this diamond, entrepreneurship and openness encouraged by the flat organisational structure is the third reinforcing arm while the core

Figure 3.3: The software development diamond (modified)



strengths of technology developed by Indian software companies form the fourth reinforcing arm of the software diamond.

3.7 The Prospects of the Industry

The Prospects of industry as it moves up the value chain are highlighted in the next two paragraphs.

3.7.1 Moving up the value chain: R&D and engineering services

India can host technology intensive software development that is not dependent on proximity to customers or Indian firms could do contract research. Exports of R&D and engineering services exceeded $ 5 billion in 2006. Table 3.3 shows that leading Indian software companies are also involved in R&D and engineering services exports. They are posting healthy growth in this segment.

3.7.2 Moving up the value chain – more valuable business expertise

Supplying technology-intensive products and Services is not the only way of moving up the value chain; providing organisation capability – intensive services is another, and this is the route the leading Indian

Table 3.3: Leading Indian engineering and R&D services companies

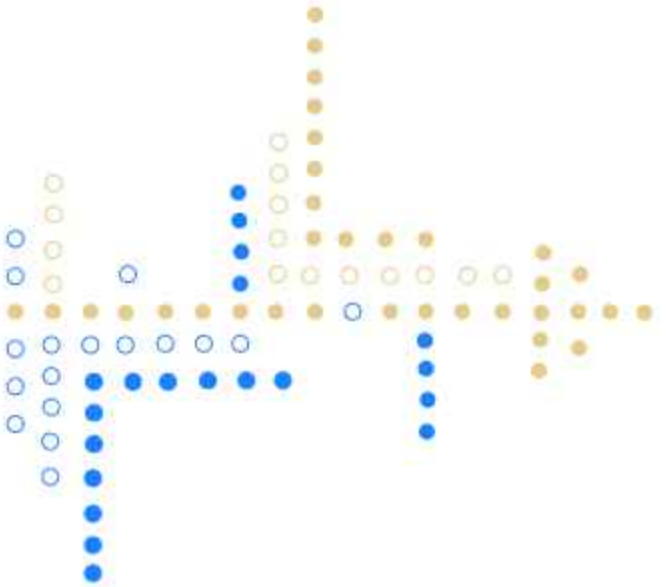
Company	Revenue (2005-06) $ million	Growth (%)
HCL Technologies	222	40
TCS	196	62
Satyam	82	53
Rolta India	31	30
Quest	15	40
Neilsoft	8	40

Source: Dataquest estimates, covered from rupee value at $1=Rs. 48.

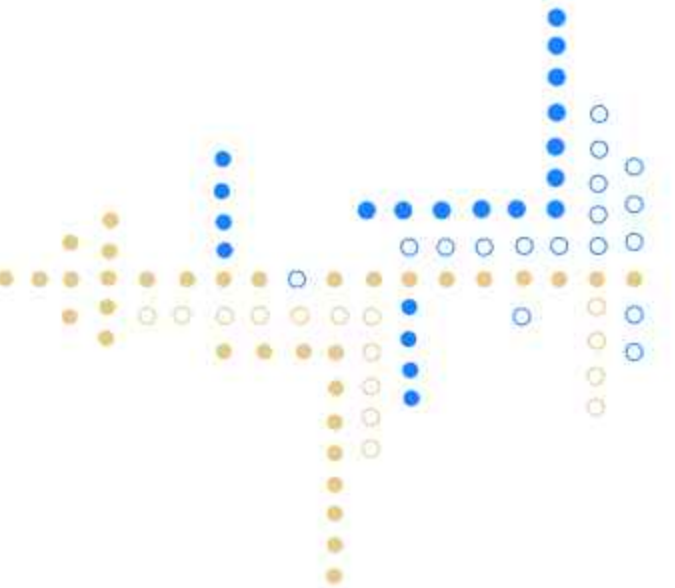
software firms are more likely to follow. They may try to diversify into emerging niches without entrenched incumbents. For e.g. for instance the TCS's forays into bio-informatics. A select few may attempt to acquire the required hardware capability to become systems integrators, though that remains to be seen.

Apart from moving up the value chain operations, diversifying the customer base geographically for customised software is another option open to Indian firms. The Economic Survey 2008-09 indicates that this diversification process is already on.

While all these prospects may not support long-run projections, such as those from a study by the AIMA and BCG, cited by Srinivasan (2005) which projects that by 2020, remote service exports and in situ Services to foreigners could lead to export revenues between $139 billion (if IT service exports grow by 10 per cent between 2010 and 2020) and $365 billion (if exports grow by 20 per cent), they do indicate that the role of ICT in economic development is likely to be significant for time to come even if not as rosy as painted by BCG.



Comparison of e-Readiness Methodologies — NCAER and International



Comparison of e-Readiness Methodologies — NCAER and International

In this chapter, we compare our e-Readiness methodology with those adopted in selected international studies. The three important e-Readiness studies chosen are:

1. United Nations' *e-Government Readiness Index 2008.*
2. Economist Intelligence Unit's *e-Readiness rankings 2009.*
3. World Economic Forum's *Network Readiness Index 2008-09.*

These studies can be compared on the basis of the following parameters:

- Framework of analysis and methodology used
- Variables used
- Weighting criteria for aggregating the index

We now discuss the methodologies and findings of the three aforementioned studies individually before performing a comparative analysis.

4.1 UN e-Government Readiness index 2008

This forms the core of the United Nations e-Government Survey 2008 which presents a comparative assessment of 192 member States' response to the ever-pressing demands of citizens and businesses for quality government services and products. The survey evaluates the application of ICT by governments with a citizen-centric approach. Further, it emphasises the need to move from e-Government (providing online Services) to more participative, citizen-centric and inclusive 'i-Government' or 'connected government'. To this end, apart from assessing the available online Services, it also looks at the methods of delivery (such as the internet and cellular phones, as well as access to Personal Computers) and the capacity of the country to absorb the content and Services. Similarly, the survey also assesses government's readiness to take into account different needs of various categories of citizens (wireless internet for youth, one-stop centres for senior citizens, etc). To sum up, the objectives of the survey are to provide:

1. Comparative assessment of the member States' ability to transform their governments by using ICT effectively to deliver online Services and products to their citizens
2. Benchmarking tool to monitor the advancement of governments in implementing e-Government services

The e-Government Readiness Index is a composite index comprising three sub-indices of (a) Web Measure Index; (b) Telecommunications Infrastructure Index, and (c) Human Capital Index. The overall index is a simple average of the three sub-indices.

4.1.1 Web measure index

This is based on a five-stage model which builds upon the previous level of sophistication of a member State's online presence. As a country move upwards through the various stages, it gets a higher value on the web measure index. The five stages of e-Government evolution in terms of web presence are as follows:

Stage I – Emerging: Online presence mainly in the form of a web page and/or official website; links to ministries/departments may or may not exist; static information

Stage II – Enhanced: Governments provide more information online on public policy and governance; links to archived information (documents, laws, reports etc) easily accessible to citizens

Stage III – Interactive: Delivery of online Services such as downloadable forms for tax payments and applications for license renewals; beginning of an interactive portal or website for citizen centric services

Stage IV – Transactional: Two-way interactions between citizen and government; full-fledged G2C interactions online 24X7 (paying taxes, applying for ID cards, license renewals etc.)

Stage V – Connected: Transformation of government into a connected entity that responds to the needs of its citizens by developing an integrated back office infrastructure; most sophisticated level of online e-Government initiatives and is characterised by horizontal and vertical connections among government agencies, seamless networking infrastructure (interoperability issues taken care of) and integration of government and other stakeholders (citizens, private sector, NGOs)

All 192 member States were assessed in 2007. The web measure assessment was based on a questionnaire which allocated a binary value to the indicator based on the presence/absence of specific electronic facilities/services available. The primary site wat the national portal or the official government home page of the member States. In addition, five ministerial/department websites (Health, Education, Social Welfare, Labour and Finance) were also assessed to reach the final web measure index. The window period for assessment of online Services was October - November of 2007.

4.1.2 Telecommunications infrastructure index

This is a composite index of five primary indices (each with an equal weight of 20%) relating to a country's infrastructure capacity which impinges on the delivery of e-government services. These are,

1. Internet users per 100 persons
2. PCs per 100 persons
3. Main telephone lines per 100 persons
4. Cellular telephones per 100 persons
5. Broad banding per 100 persons

The source of the data is the International Telecommunication Union (ITU). Data are standardised to the primary indices which are weighted to get an aggregate Telecommunications Infrastructure Index.

4.1.3 Human capital index

This is a composite of the adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio, with two third weight given to the former and one third to the latter. These data were drawn primarily from UNESCO and supplemented with data from the UNDP Human Development Report.

India's performance in terms of rankings and scores on e-Government Readiness Index and three constituent primary indices along with that of the world leader is presented in Table 4.1. Despite a good online presence for e-Governance services, India's overall score is pulled down significantly due to a very low level of ICT infrastructure penetration (PCs, Internet, broadband, etc) and poor performance in terms of Human Capital Index.

4.2 EIU e-Readiness Rankings 2009

According to EIU's e-Readiness study (in collaboration with IBM), e-Readiness is a measure of the quality of a country's ICT infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit. When a country uses ICT to conduct more of its activities, the economy can become more transparent and efficient. The ranking given in this report allows governments to gauge the success of their technology initiatives against those of other countries.

Table 4.1: e-Government Readiness index and sub-indices scores

	Web Measure Index	Telecommunications Infrastructure	Human Capital Index	e-Government readiness index
India	0.4783 (55)	0.0435 (138)	0.6195 (146)	0.3814 (113)
World Leader	1 (Denmark)	0.7842 (Sweden)	0.9933 (Australia, Denmark, Finland, New Zealand)	0.9157 (Sweden)

Note: Number in parentheses for row starting 'India' refers to India's rank out of 192 member countries while that for row starting 'World Leader' states the name of the leading countries per index scores in respective categories.

Over 100 separate criteria, both qualitative and quantitative, are evaluated for each country by EIU's team of analysts. These criteria are scored on their relative presence (or lack thereof) in a country's economic, political or social landscape. The categories, and the individual criteria within them, are weighted according to researchers' assumptions of their relative importance in fostering a country's information economy.

Table 4.2: Categories of e-Readiness: weights, description and criteria

Category	Category description	Category criteria
Connectivity and technology infrastructure (Weight: 20%)	Measures the extent to which individuals and businesses can access mobile networks and the Internet, and their ability to access digital services through means such as digital ID cards. Effective access uses two primary metrics: penetration and affordability.	Broadband penetration; Broadband affordability; mobile-phone penetration; Internet user penetration; international Internet bandwidth; Internet security
Business environment (Weight: 15%)	General business climate; 74 sub-indicators (grouped into 9 indicators) screened to evaluate each country's attractiveness as a trading economy and as a destination for business investment from 2009 to 2013.	Overall political environment; macroeconomic environment; market opportunities; policy towards private enterprise; foreign investment policy; foreign trade and exchange regimes; tax regime; financing; the labour market.
Social and cultural environment (Weight: 15%)	Considers basic education of general populace along with its web-literacy and technical skills of the workforce. Also evaluates degree of innovation	Educational level; internet literacy; degree of entrepreneurship; technical skills of workforce; degree of Innovation (measured by the generation of patents and trademarks, as well as R&D spending).
Legal environment (Weight: 10%)	e-Business development depends on a country's overall legal framework and its specific laws governing Internet use. This category reflects those legal frameworks that have a direct impact on the use of digital technology to inform, communicate and transact business.	Effectiveness of traditional legal framework; laws covering the Internet; level of censorship; ease of registering a new business; electronic ID.
Government policy and vision (Weight: 15%)	Availability of a clear roadmap for technology adoption and their efficient use. Analyses, in each country, the availability of digital channels for different stakeholders for accessing public services, consultation on political process as well as for obtaining citizen's views on pressing civic issues	Government spend on ICT per head; digital development strategy; e-government strategy; online procurement; availability of online public services for citizens and businesses; e-Participation (based on the UN e-Participation index).
Consumer and business vision (Weight: 25%)	Actual utilisation of digital channels by people and companies is a measure of successful implementation of e-Readiness platforms in the form of enabling infrastructure and environment platforms.	Consumer spending on ICT per head; level of e-Business development; use of Internet by consumers (assessing both the range of Internet features used by individuals and their online purchasing activity); use of online public services by citizens and businesses.

4.2.1 Methodology

The e-Readiness rankings model consists of over 100 separate quantitative and qualitative criteria, all but one (e-Participation Index of UN) are scored by the EIU's regional analysts and editors and are organised into six primary categories. The 38 indicators and 81 sub-indicators are, in turn, weighted according to their assumed importance as influencing factors. The rankings methodology has undergone significant change in 2009 to better reflect the use of digital technology in countries, in addition to its availability and the environmental factors which affect it.

4.2.2 Category (weights and criteria)

The six categories with their respective weights and criteria are given in Table 4.2.

Category-wise and overall score and position of India in terms of e-Readiness rankings 2009 along with that of leading country's scores are given in Table 4.3.

The fact that India has China for company at the bottom of the ladder in e-Readiness rankings 2009 is hardly comforting. Once again the low level of ICT infrastructure, as reflected in penetration of cellular phones, internet, broadband, etc. grouped under the category 'Connectivity' may be identified as one of the chief contributing factors for the low rank of 58th among 70 countries.

4.3 World Economic Forum's Network Readiness Index (NRI), 2008-09

The *Global Information Technology Report 2008-09* of WEF, the eighth in the series, presents the latest findings of Network Readiness Index (NRI), and is an updated picture of the state of networked readiness in the world. The coverage of NRI 2008-09 has extended to 134 countries, accounting for 98 per cent of world GDP. The report emphasises the role of mobility and ubiquity of communications and information as represented by increasing usage of mobile communications and wireless broadband services. These two technologies, among other ICTs, have been identified as key factors for economic growth which is also inclusive. NRI rankings for 2008-09 feature Denmark as the most networked economy in the world for the third consecutive year.

4.3.1 Framework

The Networked Readiness Framework assesses the extent to which different economies benefit from the latest ICT advances, based on three main principles:

- ICT-conducive environment is a crucial enabler of networked readiness
- A multi-stakeholder effort is required to achieve the ICT prowess
- ICT readiness facilitates ICT usage

Table 4.3: EIU's e-Readiness rankings 2009 scores

	e-Readiness 2009 score	Connectivity	Business Environment	Social and Cultural Environment	Legal Environment	Government and Policy Vision	Consumer and Business Adoption
Category weight		20%	15%	15%	10%	15%	25%
India	4.17 (58)	2.45 (69)	5.89 (55)	4.90 (59)	5.60 (52)	5.25 (51)	2.88 (60)
China	4.33 (56)	2.95	6.32	5.47	5.10	4.75	2.99
World Leader	8.87 (Denmark)	9.50 (Denmark)	8.20 (Hong Kong)	9.03 (USA)	9.00 (Hong Kong)	9.65 (Denmark)	9.15 (Norway)

Note: Parentheses for row starting 'India' refer to India's rank out of 70 countries while that for row starting 'World Leader' state the name of the leading countries per respective index scores. China's scores are given for the sake of comparison of India's scores with a similar size (population) country.

The NRI framework consists of 9 pillars and 68 variables grouped under 3 sub-indexes (components) of Environment, Readiness and Usage. These 3 sub-indexes consist of the following pillars:

1. Environment sub-index: market environment; political and regulatory environment and infrastructure environment
2. Readiness sub-index: individual readiness; business readiness and government readiness
3. Usage sub-index: individual usage, business usage and government usage

4.3.2 Methodology and Data sources

In the calculation of the global NRI score, all three sub-indexes are given the same weight, while each sub-index itself is a simple average of the composing pillars. This reflects the assumption that all index components provide similar contributions to the overall networked readiness of a country. Data for 68 variables that enter NRI calculation can be classified under two groups:

(a) Hard data – provide an objective measure of quantity (e.g. no. of PCs): available for 27 variables from sources like ITU, World Bank and UN. These data are standardised and converted to a 1-7 scale to facilitate aggregation.

(b) Survey data – for the remaining 41 variables comes from Executive Opinion Survey conducted annually by the World Economic Forum with the help of a network of 150 partner institutes. The aim of the survey was to capture the qualitative dimension of specific aspects of competitiveness and networked readiness. This highly specialised survey was administered to over 12,000 business leaders across 134 economies in 2008. Business leaders were asked to assess specific aspects of the business environment in the country in which they operate. The responses to individual questions in the survey are on a 1 to 7 scale with 7 corresponding to the best possible outcome and 1 to the worst possible outcome. Individual responses to each question are aggregated at the country level and combined with results of the previous year following a weighted moving average approach.

Table 4.4 gives a synoptic view of India's performance along with that of the world leader in terms of the overall NRI, three sub-indexes and the constituent nine pillars.

Table 4.4: Networked Readiness index, 2008-09

	No. of Variables	World Leader	Leader's Score	India's Score	India's Rank (out of 134)
NRI 2008-09	68	Denmark	5.85	4.03	54
Environment	30	Iceland	5.64	3.67	60
ME	14	Hong Kong	5.61	4.12	50
PRE	9	Singapore	6.30	4.19	57
IE	7	Iceland	6.02	2.70	76
Readiness	23	Singapore	6.01	4.91	40
IR	9	Finland	6.54	5.57	45
BR	10	Switzerland	6.00	5.05	27
GR	4	Singapore	5.92	4.12	57
Usage	15	Denmark	6.07	3.51	59
IU	5	Netherlands	6.39	1.26	114
BU	5	Sweden	6.15	5.09	30
GU	5	Denmark	6.09	4.19	47

Note: ME-Market Environment; PRE-Political and Regulatory Environment; IE-Infrastructure Environment; IR-Individual Readiness; BR-Business Readiness; GR-Government Readiness; IU-Individual Usage; BU-Business Usage; GU-Government Usage

Table 4.5: Comparison of e-Readiness studies

	UN's e-Government Readiness Index 2008	EIU's e-Readiness Rankings 2009	WEF's Network Readiness Index (NRI) 2008-09	NCAER's e-Readiness Assessment of Indian states/UTs
Measures What?	Readiness of government to use ICT effectively for providing governance services with a citizen-centric approach	e-Readiness is a measure of the quality of a country's ICT infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit	Propensity for countries to exploit the opportunities offered by ICTs; more specifically NRI seeks to comprehend the impact of ICT on the competitiveness of nations	e-Readiness of a State/UT measures its ability to participate in the increasingly networked world as a composite of ICT environment, readiness and usage within the state/UT
Sample Units	Nation	Nation	Nation	states/UTs (sub-national units)
Sample Size	192	70	134	35
Framework of the study: Sub-indexes/ Category	3 Web Measure Index (WMI), Technology Infrastructure Index (TII), Human Capital Index (HCI)	6 categories (as detailed in Table 4.2) CTI BE SCE LE GPV GBV	3 sub-indexes further divided into 9 pillars as follows: Environment (ME, PRE, IE); Readiness (IR, BR, GR) and Usage (IU, BU, GU)	Same as NRI
No. of Variables	WMI – 6 websites for each country on various parameters, TII – 5 HCI - 4	Over 100 quantitative and qualitative variables	Total 68 variables comprising of 27 hard data (quantitative variables) and 41 survey data (qualitative variables)	A large no. of variables go into PCA but the final weights given only to selected variables by PCA*
Data Sources	ITU, UNESCO, UNDP Human Development Report, UN's Web Assessment Survey	EIU, Pyramid Research, WB, UN, WIPO	Hard data – UN, WB, ITU Survey Data – WEF's annual Executive Opinion Survey	Primary (Survey) Data – state/UT Governments Hard Data – DoT, TRAI, Ministry of HRD, RBI etc
Weighting Criteria	Subjective	Subjective	Subjective	Objective (derived from PCA)
Weights Assigned to sub-indexes / categories	Equal (1/3) weights to 3 sub-indices	Differential weights to categories as follows: CTI - 20% BE - 15 SCE - 15% LE - 10 GPV - 15% CBV – 25	Successive aggregation at each level with equal (1/3) weights	Weights are factor loadings derived from Principal Component Analysis (PCA)

Note: * see details of PCA in Chapter 5.

India's NRI 2008-09 rank is 54th out of 134 countries; buoyed mainly by business readiness (27th) and business usage (30th). On the other hand, India performed badly on the two pillars of infrastructure environment (76th) and individual usage (114th). Annex A4.1 contains the list of 68 variables that went into the calculation of NRI 2008-09 along with the score/value and rank of India for these variables. These will help policy makers in identifying the areas that require improvement for moving India up on the e-Readiness ladder.

4.4 Comparative analysis of international and NCAER's e-Readiness studies

In this section, we provide a comparative assessment of the international studies in terms of framework, methodology, variables, etc. Further, we compare NCAER's methodology including weighting criteria with those of these international studies. Table 4.5 puts these comparisons in perspective.

All the three international studies are unanimous in proclaiming mobile phone penetration/affordability as a key factor in the e-Readiness of a society, but there is difference of opinion on the importance of personal computer (PC) penetration. While both UN's e-Readiness Index and World Economic Forum's NRI consider penetration of PCs (along with penetration of internet, broadband, mobile phones etc) to be an important indicator for gauging e-Readiness EIU's e-Readiness Rankings 2009 has dropped PCs penetration due to doubt about its relevance to e-Readiness. Interestingly in India, more attention is now given to access to computers and networking technologies (like internet) rather than the penetration of PCs and internet. One of the pillars of National e-Governance Programme (NeGP) is the target of establishing 100,000 Common Services Centres (CSCs) all over India, i.e. approx. 1 per 6 villages, as a front-end interface for the common public to access e-Governance services.

4.5 NCAER's e-Readiness and e-Governance study 2008

Some salient points of NCAER's study (which is India specific) in comparison to international e-Readiness studies are as follows:

- Emphasis on application of ICT-enabled services to unserved and underserved (section of people as well as geographical areas) – 'e-Inclusion' aspect
- Emphasis on access rather than the ownership/penetration (especially in case of PCs and network technologies) in 'Infrastructure' component of e-Readiness.
- Use of robust methodologies: Principal Component Analysis for e-Readiness assessment and a mix of Analytical Hierarchy Approach and PCA for e-Governance assessment.
- Data on human capital: For measuring human capital while international studies use gross enrolment ratios and adult literacy, NCAER's study considers more technical aspects of human capital like number of information technology qualified teachers, intake of students in engineering degree/MCA, etc within the states/UTs.
- Comprehensive assessment of various aspects of e-Governance projects viz., inclusiveness, type (G2C, G2G and G2B), coverage (administrative units/population), scope (full scale or pilot project) etc with due attention to citizen-centric and inclusive approach in these projects.
- e-Governance is considered broadly as an approach to provide ICT-enabled governance at the ministry/department level within the states and UTs with appropriate BPR and changes in hierarchical decision-making approach to facilitate this transformation. This is in contrast to the use of ICT for increased productivity in governance activities such as citizen-centric services, internal administration efficiency enhancement, etc.

e-Readiness Assessment of States and Union Territories (UTs)

e-Readiness Assessment of States and Union Territories (UTs)

5.1 Background

The National Council of Applied Economic Research (NCAER) has been preparing the e-Readiness reports of India since 2003, with the objective of ranking the different states of India in terms of their e-Readiness. Though the framework of measurement and methodology adopted for e-Readiness assessment has broadly remained unchanged over the years, the variables used for measuring e-Readiness have been modified and improved over time. The e-Readiness assessment for 2008 is no exception and consequently we have strived to improve upon the data sets used last year in a manner that makes the composite index of e-Readiness more accurate and robust. This also means that the rankings of the different years are not strictly comparable with the previous years.

5.2 Debate regarding composite indices

The construction of a composite index is the primary task in an exercise of measuring e-Readiness. There is a lot of debate about the desirability of compressing or aggregating a large number of variables into one single indicator that best represents the original data-set. Examples of opposing views of the 'aggregators' and 'non-aggregators' are

> *"Composite indicators are a way of distilling reality into a manageable form."*
>
> *"Composite indicators are confusing entities whereby apples and pears are added up in the absence of a formal model or justification".*

Notwithstanding the contrasting views, composite indicators have experienced a surge of popularity, possibly because of their ability to represent complex concepts such as sustainability, welfare or technological advancement, etc. in a succinct manner. The pro-aggregation scholars believe that there are at least two major reasons that make the exercise worthwhile. First, it can capture reality and is meaningful. Second, it is important in gaining media attention. The key objection of the non-aggregators to data compression is in what they see as the arbitrary nature of the weighing process through which variables are aggregated.

Composite indicators are much easier to interpret than trying to find a common trend in many individual indicators. They have proved to be useful in ranking countries or spatial units in benchmarking exercises, provided that the variables are kept constant over time. However, if poorly constructed or interpreted they could send misleading policy signals. Also, the simple big picture results that the composite indices shows may lead the policy makers to draw simplistic prescriptions rather than more nuanced policy directions. Instead, composite indicators must be seen as a starting point for initiating discussion and attracting public interest. Their relevance should be gauged with respect to the constituencies affected by the composite index.

As per the Handbook for Constructing Composite Indicators (Nardo, et. al. 2005), the basis for criticisms of composite indices can be minimised provided that the following norms are adhered to, viz:

1. *Theoretical framework* - A theoretical framework should be developed to provide the basis for the selection and combination of single indicators into a meaningful composite indicator under a fitness-for-purpose principle.

2. *Data selection* - Indicators should be selected on the basis of their analytical soundness, measurability, coverage, and relevance to the phenomenon being measured and relationship to each other. The use of proxy variables should be considered when data are scarce.

3. *Multivariate analysis* - An exploratory analysis should investigate the overall structure of the indicators, assess the suitability of the data set and explain the methodological choices of weighting, aggregation, etc.

4. *Imputation of missing data* - Consideration should be given to different approaches for imputing missing values. Extreme values should be examined as they can become unintended benchmarks.
5. *Normalisation* - Indicators should be normalised (for unit independent values) to render them comparable.
6. *Weighting and aggregation* – Indicators should be aggregated and weighted according to the underlying theoretical framework.
6. *Robustness and sensitivity* – Analysis should be undertaken to assess the robustness of the composite indicator in terms of the mechanism for including or excluding single indicators, the normalisation scheme, the imputation of missing data and the choice of weights.
6. *Links to other variables* – Attempts should be made to correlate the composite indicator with other published indicators as well as to identify linkages through regressions.
9. *Visualisation* – Composite indicators can be presented in a number of different ways, which can influence their interpretation.
10. *Back to the real data* - Composite indicators should be transparent and be able to be decomposed into their underlying indicators or values.

We have attempted to adhere to as many of these norms as possible while constructing the e-Readiness index.

5.3 Framework of Analysis

e-Readiness can be considered as the ability to pursue value creation opportunities for inclusive economic development facilitated by ICT. Therefore, it is not simply a matter of the number of computers, websites, internet service providers, internet connections, telephones and mobiles in the state/UT, but also the ability or readiness to use technology skillfully at the level of the individual, business and government.

The broad framework of analysis has remained the same as the previous reports insofar as we consider three major components of e-Readiness for our ranking. It is our understanding that a sound environment needs to be put into place at the initial stage for effective use of ICT. This environment would include the policy environment, the market environment and the infrastructural environment. Readiness deals with those characteristics of the players that enable them to respond to a conducive environment. This includes capacity building or skill formation for the different stakeholders as well as their access to the infrastructure which have been put in place either by the public or the private sector. Usage, on the other hand, is the actual utilisation of IT given a conducive environment and positive state of readiness. In this sense, a certain level of environment and readiness is a precondition to usage of a certain level. Thus, as shown in Figure 5.1, the e-Readiness growth path would be charted out in a hierarchical manner starting from creation of conducive environment. The state then would proceed to capacity building phase for utilising the infrastructure or policy put in place. Effective usage of the technology would be possible with both an enabling environment as well as stakeholders' capacity to use it. It needs to be noted, however, that a state/UT with good environment and readiness may not necessarily have high levels of usage.

The framework used in the study is based on the NRI, published by WEF that measures "the degree of preparedness of nation or community to participate in and

Figure 5.1: e-Readiness Growth Path

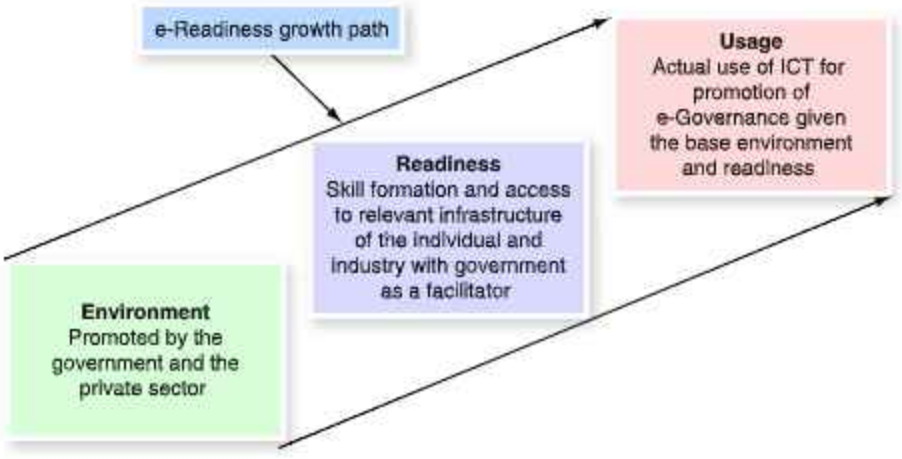
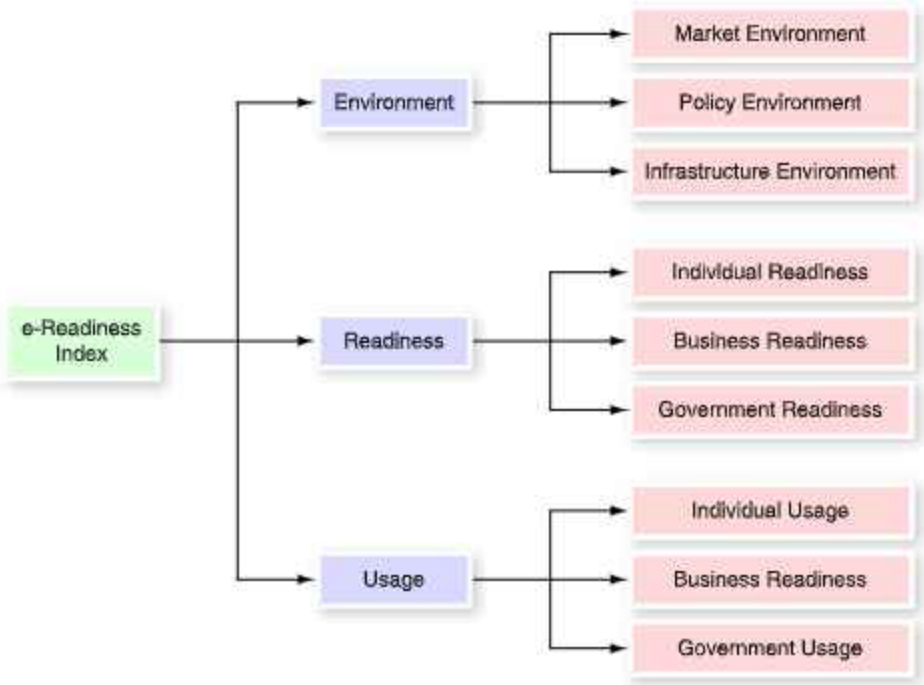


Figure 5.2: Networked Readiness Framework



benefit from ICT developments". We have modified the NRI to serve our purpose of ranking Indian states and UTs according to their e-Readiness. The networked Readiness framework has been presented in Figure 5.2.

The following premises are the foundation of our analysis:

- There are three important stakeholders to consider in the development and use of ICT: individuals, business and governments
- The degree of usage of ICT by (and hence the impact of ICT on) the three stakeholders is linked to their degrees of readiness (or capability) to use and benefit from ICT
- There is a general macroeconomic and regulatory environment for ICT in which the stakeholders play out their respective roles.

It is worthwhile to mention here that there is some change in the framework in comparison to the last year's framework. Business usage has been dropped from the analysis this year due to lack of data availability and inaccuracies. It is our understanding that the variations across states/UTs in business has less to do with the respective states/UTs than with business groups which may operate across several states/UTs. Thus, exclusion of this sub-component is not expected to have a significant bearing on our composite index.

5.4 Methodology

Over the past few decades, there has been an increase in the number of composite indicators developed by various national and international agencies. Unfortunately, individual indicators are sometimes selected in an arbitrary manner with little attention paid to the interrelationships between them. This can lead to indices, which overwhelm, confuse and mislead decision-makers and the general public. Some analysts characterise this environment as 'indicator rich but information poor'. The underlying nature of the data needs to be carefully analysed before the construction of a composite indicator. This preliminary step is helpful in assessing the suitability of the data set and would provide an understanding of the implications of the methodological choices, (e.g., weighting and aggregation) during the construction phase of the composite indicator. Information may be grouped and analysed along at least two dimensions of the dataset: sub-indicators and spatial units.

There are a number of techniques for data reduction or ordination, Principal Component Analysis (PCA) is one of the simplest techniques that is wholly objective, in contrast to techniques that use subjective choices (like the Bray Curtis ordination). Since the main criticism of composite indicators is that weights for the constituent variables are many times selected in an ad hoc manner, PCA has been chosen as the method to

aggregate the data set. Table 5.1 provides some advantages and disadvantages of the various multivariate techniques that exist for data reduction.

It is clear from Table 5.1 that the advantages are more numerous for PCA as a method of aggregation.

5.5 The Model

Measuring the e-Readiness at the state/UT level requires a three-step procedure:

i. Identification of the most important characteristics that represent e-Readiness.

ii. Identification of appropriate indicators (both quantitative and qualitative) of those characteristics.

iii. A ranking of states/UTs based on a composite index, which reflects the position of a particular state, developed on the basis of the indicators identified in step (ii).

5.5.1 Methodology

To evolve the e-Readiness index, we have used multistage PCA. We have organised the identified indicators into three main categories – environment, readiness and usage, which in turn consist of well-defined sub-groups depending on the nature of the indicators, as shown in Tables 5.2 through 5.4. Within a sub-group, they have a high degree of inter-correlation, while the canonical correlation between pairs of sub-groups is low on the average. The PCA was individually applied to each of these sub-groups of variables. The first principal component obtained from each of the different sub-groups has been treated as a set of new variables and combined at the second stage to obtain the final composite index i.e. e-Readiness Index. It has been argued that this method overcomes the necessity of taking more than one principal component in the analysis, since the correlation among the variables in a sub-group are generally high, and, consequently, the first principal component explains an adequate proportion of the variation in the data matrix.

Table 5.1: Advantages and disadvantages of selected aggregation methods

Technique	Advantages	Disadvantages
Principal Component/ Factor Analysis	Can summarise a set of sub-indicators while preserving the maximum possible proportion of the total variation in the original data set. Largest factor loadings are assigned to the sub-indicators that have the largest variation across spatial units, a desirable property for cross-country/or across state comparisons, as sub-indicators that are similar across spatial units are of little interest and cannot possibly explain differences in performance	Correlations do not necessarily represent the real influence of the sub-indicators on the phenomenon being measured. Sensitive to modifications in the basic data: data revisions and updates, *e.g.*, new countries. Sensitive to the presence of outliers, which may introduce a spurious variability in the data. Sensitive to small-sample problems, which are particularly relevant when the focus is on a limited set of countries. Minimisation of the contribution of sub-indicators which do not move with other sub-indicators.
Cronbach Coefficient Alpha	Measures the internal consistency in the set of sub-indicators, i.e., how well they describe a unidimensional construct. Thus, it is useful to cluster similar objects	Correlations do not necessarily represent the real influence of the sub-indicators on the phenomenon expressed by the composite indicator. Meaningful only when the composite indicator is computed as a 'scale' (i.e. as the sum of the sub-indicators).
Cluster Analysis	Offers a different way to group countries; gives some insight into the structure of the data set.	Purely a descriptive tool; may not be transparent if the methodological choices made during the analysis are not motivated and clearly explained.

Table 5.2: Indicators for environment

Major category	Minor category	Minor category: Indicators of significance
1. Environment	1.1. Market environment	1.1.1. Competition in the cellular market *Number of players* *Growth of no. of players*
		1.1.2. Competition in the wireless including WLL(F) market *Number of players* *Market share other than top player's share*
		1.1.3. Competition in the ISP market *Number of players*
	1.2. Political and regulatory environment	1.2.1. Policy Documentation Enabling/Facilitating the ICT Policy *Legal ICT Policy* *Security ICT Policy* *Is the issue of IPR addressed in the ICT policy?* *Does a state level ICT Action Plan exist?*
		1.2.2. Policy implementation *Institutional mechanism to implement and review progress of the ICT policy* *Effective legal mechanism to tackle the problem of piracy of ICT products* *Have you adopted the IT Amendment Act 2008 which is applicable to all states?* *Does your State/UT have separate cyber laws that confer legal status to electronic transactions and documents?* *Do you have a legal provision for digital signatures and encryption?*
		1.2.3. Structural policy/government promotion of ICT activity in private sector *Is there a provision for encouraging ICT activities in private sector industries/companies through concessions?* *Are subsidised utilities available to ICT firms in your state/UT?* *Is there a provision for a Value Addee Tax concession for ICT companies?* *Has a single window policy been adopted for the clearance of ICT businesses?* *How much time does it take to get clearance for starting an ICT business from the nodal agency/authority?*
		1.2.4. Futuristic approach of government *Are there any initiatives taken under the public-private partnership mode for the development of ICT infrastructure?* *Do you feel the need to store tacit knowledge, i.e. the experience/know-how gained by the government departments over the years?* *Do you have a mechanism to store tacit knowledge?* *Do you have a backup contingency plan in case of IT communication system failure?*
		1.2.5 Duration of implementation of ICT policy in state
		1.2.6. How often is the ICT policy amended?
	1.3. Infrastructure Environment	1.3.1. Rural-urban disparity in teledensity
		1.3.2. School infrastructure
		1.3.3. ICT infrastructure in State
		1.3.4. VPN equipment
		1.3.5. Network availability
		1.3.6. IT security

Table 5.3: Indicators for readiness

Major category	Minor category	Minor category: Indicators of significance
2 Readiness	2.1 Individual Readiness	2.1.1 Percentage households with PCs
		2.1.2 Percentage of household with internet connection
		2.1.3 Percentage of household with cell phone
		2.1.4 Percentage of household with telephone
	2.2 Business Readiness	2.2.1 IT Park density
		2.2.2 Employment per IT park
		2.2.3 IT jobs per million population
	2.3 Government Readiness	2.3.1 Officials trained in ICT • *Percentage of top government officials trained in ICT* • *Percentage of total government Officials trained in ICT*
		2.3.2 Website • *Whether website available in local language* *Website content* o *Information about the government, its mandate, its structure* o *Information about government activities, schemes, projects etc.* o *Information about all government departments* o *A site meter* • *Website portal* o *Citizen portal* o *Private firm portal* o *Government official portals* o *Non-profit organisation portal*
		2.3.3 ICT use by Panchayati Raj institutions (PRIs) • *Are PRIs equipped with intranet?* • *Plans to install the intranet application for PRIs in the next year?* • *Training programmes for the PRI members*

In our case we have an unobservable dependent variable case. The state/UT's e-Readiness is an unobserved variable, which cannot be concretely measured through a single available indicator. There are several indicators, which indicate e-Readiness collectively. To compare the states/UTs in terms of e-Readiness, we have to reduce the relevant factors or variables into one single measure or a composite index. A composite index can be defined as a linear combination of variables assigning equal or different weights to the variables. These weights may be determined subjectively or based on some statistical or econometric technique. In many cases, equal weights are used to form the composite index where it is assumed that each and every variable is equally important in explaining the phenomenon. Sometimes, subjective weights are used when the importance of the variables is known a priori and imposed externally.

We have used a multi-stage PCA to construct the e- Readiness Index of the states/UTs. In case of multi-stage PCA, the composite index formed at a lower level is used as a variable in the next step for computing the composite index and so on. Therefore, in this approach, important variables are identified at successive stages. We have used the first principal component to form the composite index that is characterised by the property of having the largest sum of squared correlations. This process is applied to each sub-group of the identified components of e-Readiness. The first principal factors obtained from the different sub-groups were treated as a set of new variables and combined at the second stage to obtain the index of the components. Similarly, the first principal component of the broad indicators of e-Readiness was used to obtain the composite e-Readiness Index/

5.5.2 Variables used

The robustness of an index depends to a large extent on the variables that have been included to construct it. In this section, we will first look at the categorisation of the indicators of e-Readiness Index we have selected for the modeling purposes (Tables 5.2 through 5.4). In the next section, we discuss the steps involved in the construction of final composite index i.e. e-Readiness Index.

Table 5.4: Indicators for Usage

Major category	Minor category	Minor category: Indicators of significance
3 Usage	3.1 Individual usage	3.1.1 Monthly expenditure incurred by households (Rs) on the following • *Internet access* • *Cellphone* • *Telephone (landline)* • *Cable TV connection*
	3.2 Government Usage	3.2.1 Has ICT been applied to any of the following fields? • *Agriculture* • *Health services* • *Transportation* • *Energy* • *Trade* • *Others*
		3.2.2 Computerisation and its penetration • *Have government employee records been computerised?* • *Does your state/UT government have a system for communication via internet/network with any of the following?* o *Government departments* o *Top government officials* o *Middle government officials* o *All government officials* o *Citizens*
		3.2.3 No. of e-Governance projects successfully running for more than one year in the state/UT
		3.2.4 Use of ICT • *Proportion of persons employed in government routinely used a computer at work* • *Proportion of persons employed in your government have access to the Internet* • *Is intranet used within your state/UT government offices?*

5.5.3 Steps

The following steps have been used in constructing the e-Readiness Index:

- First, we have used PCA to compress the minor category indicators under each sub–major category like Market environment, Political and regulatory environment, Infrastructure environment, Individual readiness, Business readiness, Government readiness, Individual usage and Government usage (for indicators under these heads, refer Tables 5.2 through 5.4).
- In the second step, we have used PCA to combine the sub–major categories and construct indices for the indictors of major categories (Environment index, Readiness index and Usage index).
- Finally, applying PCA once again we constructed the aggregate e-Readiness Index by combining the environment, readiness and usage indices.

This method removes the necessity of taking more than one principal factor, since the correlations among the variables in a sub-group are generally high. Consequently, the first principal component explains an adequate proportion of variation in the data matrix.

As mentioned earlier, we have improved the variables used to measure the various components of e-Readiness in 2008. The comparative list of variables is given in Annex A5.3. Since there are substantial differences in the variables used, relative comparison of ranks of the different states/UTs with the previous year rank would not be meaningful this year.

5.6 Construction of Index: factor loadings and percentage of variation explained

As explained in our framework of analysis, the three major components considered for measurement of the e-Readiness index are environment, readiness and usage.

5.6.1 Environment Index

The three sub-components of environment are market environment, political and regulatory environment and infrastructure environment. Market environment captures the competition and size of the IT market with respect to cellular, telecom, internet service providers.

The second sub-component, i.e. political and regulatory environment, attempts to capture the responsiveness of the respective state governments in promoting the IT sector. The areas that this sub-index captures are policy documentation, policy implementation, sectoral policy, i.e. promotion of the private sector in ICT by the state and futuristic outlook of the state. Table 5.2 reveals that the last component captures the state's attitude towards public-private partnership, storage of tacit knowledge and a back-up or contingency plan in the event of system failure. This is the first time that these aspects are being covered. Most of the variables in the infrastructure environment have been retained from 2006, with minor variations. We present the results of PCA for environment sub-index in Table 5.5a and 5.5b.

Table 5.5a: PCA Result of Environment index – Stage I

Environment	Variables	Factor Loadings	Percentage of variation explained by first principal component
Market Environment	Competition in cellular market	0.539*	50.47
	Competition in wireless market	0.826**	
	Competition in Internet Service Provider market	0.736**	
Political and Regulatory Environment	Policy documentation	0.879**	50.98
	Policy implementation	0.811**	
	Sectoral policy	0.076	
	Futuristic outlook	0.852**	
	Age of ICT policy	0.833**	
	Frequency of policy amendment	0.452*	
Infrastructure Environment	Rural-urban disparity in teledensity	0.416*	28.96
	School infrastructure	0.397*	
	ICT infrastructure in state	0.720**	
	VPN equipment	0.674**	
	Network availability	0.855**	
	IT security	0.623**	

Notes: *Significant at 5 per cent level of significance.
**Significant at 1 per cent level of significance.

Table 5.5b: PCA Result of Environment index – Stage II

Environment index	Factor loadings	Percentage of variation explained by first principal component
Market environment	0.788**	69.70
Political and regulatory environment	0.913**	
Infrastructure environment	0.797**	

Notes: **Significant at 1 per cent level of significance

The factor loadings are the correlation coefficients between the respective variable and the composite index derived at that stage. Factor loadings are also indicative of the weights that have been used to construct the composite index. Table 5.5a reveals that though only two sub-components of Market environment are significant at the 1 per cent level, competition in the wireless market has got a somewhat higher weight compared to the other two sets of indicators. Sectoral policy has an insignificant relationship with Policy and regulatory environment, while all other variables are significant. This indicates that the set of variables determining sectoral policies in terms of promotion of private sector have little or no association with the other sub-components that have been used to construct the composite indicator of political and regulatory environment. All the variables that have been used to construct the composite indicator of infrastructure environment have a significant relationship with it, though rural-urban disparity and ICT infrastructure in school has got comparatively lower weights compared to the other four indicators.

The construction of the Environment index has been done in the next step by aggregating Market environment, Policy and regulatory environment and Infrastructure environment. Table 5.5b show that Policy environment is more important than the other two; this means that a promotion of Policy environment is likely to have a salutary effect on the Business and Infrastructure environment. The composite indicator for Environment i.e. the first principal component, explains about 70 per cent of the variation of its three sub-components.

5.6.2 Readiness index

The Readiness index has been constructed from three sub-components, Individual readiness, Business readiness and Government readiness. While Individual readiness captures access to ICT technology of households in different states/UTs, Business readiness measures relate to IT parks and IT employment. Government readiness focuses on capacity building of government officials, quality of website information and

Table 5.6a: PCA Result of Readiness index – Stage I

Readiness	Variables	Factor Loadings	Percentage of variation explained by first principal component
Individual readiness	Percentage households with PCs	0.875**	75.02
	Percentage of household with internet connection	0.903**	
	Percentage of household with cell phone	0.951**	
	Percentage of household with telephone	0.718**	
Business readiness	IT Park density	0.988**	97.56
	Employment per IT park	0.988**	
	IT Jobs per million population		
Government readiness	Officials trained in ICT	0.770**	64.87
	Website	0.911**	
	ICT use by PRIs	0.724**	

Note: # Recombined with IT park density and employment due to restrictions in measures in sampling adequacy and Kaiser-Meyer-Olkin Measure of Sampling Adequacy.

Table 5.6b: PCA Result of Readiness index – Stage II

Readiness Index	Factor Loadings	Percentage of variation explained by first principal component
Individual readiness	0.853**	62.27
Business readiness	0.766**	
Government readiness	0.745**	

Note: **Significant at 1 per cent level of significance.

nature of ICT use by PRIs at the grassroots levels. All the three variables are new and, as per our understanding, better represent government readiness. In particular, they provide some insight into the use of ICT by the village governance institutions. Tables 5.6a and 5.6b presents results of multistage PCA for the Readiness index.

In contrast to the Environment index, in which policy or government component got a significantly higher weight; for Readiness, Individual readiness is somewhat more important compared to Business and Government components.

5.6.3 Usage index

As mentioned earlier, the business component of Usage has been dropped due to data non-availability and data inconsistencies. Thus, we have only the government and the individual usage sub-components. Nonetheless, we do not expect this to have a significant impact on the value of our composite index for the reasons already explained. The only disadvantage of having two sub-components is that by default they get the same weights, as there is only one correlation coefficient between these two variables.

Table 5.7 reveals that both composite indices of Individual usage and Government usage explain 55 to 65 per cent of the variations of the variables that were used to construct these indices. Monthly expenditure on cell phones seem to be more important compared to use of other ICT infrastructure. Within government usage, computerisation and its penetration among government officials and regularity of use of ICT infrastructure have got higher weights compared to the other two variables.

5.6.4 e-Readiness index

The composite e-Readiness index was constructed by aggregating the three sub-components of Environment, Readiness and Usage. While Environment and Usage got similar weights, Readiness has a slightly higher weight (Table 5.8).

5.7 States/UTs' Position in terms of the index value

The composite index derived thorough the PCA has a mean of 0 and a standard deviation of 1. This being the case, the states have been divided in 6 levels.

The states have been classified in terms of their e-Readiness on the basis of index value as follows:

- Leaders (L1): Index value above 1.0
- Aspiring leaders (L2): 0.5 to 1.0
- Expectants (L3): 0 to 0.5
- Average achievers (L4): -0.5 to 0
- Below-average achievers (L5): -1.0 to –0.5
- Least achievers (L6): below –1.0

Table 5.7: PCA Result of Usage index

Usage	Variables	Factor Loadings	Percentage of variation explained by the composite sub-index
Individual usage	Monthly expenditure incurred by households on internet access	0.670**	63.28
	Monthly expenditure incurred by households on cell phone	0.948**	
	Monthly expenditure incurred by households on telephone	0.760**	
	Monthly expenditure incurred by households on cable TV	0.780**	
Government usage	ICT Application in difference sectors	0.674**	56.66
	Computerisation and its penetration	0.848**	
	No. of e-governance projects successfully running for more than one year in the state	0.606**	
	Use of ICT by government officials	0.852**	

Note: **Significant at 1 per cent level of significance

Table 5.8: PCA Results for construction of e-Readiness index

Final composite index	Major group indicators	Factor loadings	Percentage of variation explained by the composite sub-index
e-Readiness	Environment	0.885**	81.37
	Readiness	0.933**	
	Usage	0.888**	

Note: **Significant at 1 per cent level of significance.

Figure 5.3 depicts the hierarchical pyramid. Among the leaders and aspiring leaders, three major blocks emerge. The one that performs the best is the South, where out of four states, three are among the leaders, and one, i.e., Kerala, an aspiring leader. The second block is in the west, where one, i.e. Maharastra, is a leader, and the other, Gujarat is among the aspiring leaders. The third group is in the north-west, where Chandigarh and Delhi are among the leaders, whereas Haryana and Punjab are aspiring leaders. West-Bengal is the only state from the eastern part of the country to feature in the category of the aspiring leaders.

On the other end of the spectrum are categories of under-achievers and least achievers; consisting primarily of the north-eastern states, and some of the UTs. Figure 5.3 presents category pyramid of Indian states/UTs on the basis of e-Readiness 2008 scores.

All the new states, i.e. Chhattisgarh, Uttarakhand and Jharkhand, are in the average achievers level. The new states would have some advantages as they can begin with the latest technology and may introduce pro-active policies right from the start. However, they would take time in terms of capacity building of the local populace in general and the government officials in particular since most of the regions under them were relatively less developed before they split from their respective mother states. This is visible in the ranking of Madhya Pradesh, Uttar Pradesh and Bihar, which are all only one category above the newly formed states.

Andaman and Nicobar Islands has performed surprisingly well on e-Readiness index and finds itself in the category of 'expectants'. The performance of Andaman and Nicobar is commendable because it is completely cut off from the rest of India and does not have the benefit of the 'neighbourhood' effect. Due to its remoteness, it is probably not in a position to maximise the 'interaction effect' through tourism.

Table 5.9 gives the ranking of states by the aggregate as well as sub-indices. Some observations that clearly emerge from the examination of the trend in the

Figure 5.3: Ranking of states in terms of different levels

Table 5.9: Distribution of states by Environment, Readiness, Usage and e-Readiness

Levels	Environment	Readiness	Usage	e-Readiness
L1	Maharashtra Chandigarh Karnataka Andhra Pradesh	Karnataka Tamil Nadu Chandigarh Maharashtra	Chandigarh Delhi Andaman and Nicobar Karnataka	Karnataka Chandigarh Maharashtra Tamil Nadu Delhi Andhra Pradesh
L2	Gujarat Tamil Nadu Haryana West Bengal Punjab Assam Delhi Kerala Madhya Pradesh Uttar Pradesh	Haryana Andhra Pradesh Delhi Kerala Punjab West Bengal Bihar	Kerala Gujarat Andhra Pradesh West Bengal Jharkhand Tamil Nadu Uttarakhand	West Bengal Kerala Haryana Gujarat Punjab
L3	Orissa Goa Nagaland Tripura Puducherry	Gujarat Andaman and Nicobar Himachal Pradesh Goa Madhya Pradesh Orissa	Maharashtra Assam Punjab Haryana Himachal Pradesh Madhya Pradesh Sikkim Chhattisgarh Rajasthan	Andaman and Nicobar Madhya Pradesh Goa Orissa Assam Himachal Pradesh Uttar Pradesh Bihar
L4	Himachal Pradesh Chhattisgarh Sikkim Rajasthan	Chhattisgarh Uttar Pradesh Sikkim Uttarakhand Jharkhand Rajasthan	Orissa Bihar Goa Uttar Pradesh Meghalaya	Chhattisgarh Uttarakhand Jharkhand Sikkim Rajasthan
L5	Manipur Bihar Uttarakhand Jharkhand Andaman and Nicobar Jammu and Kashmir	Puducherry Jammu and Kashmir Assam Meghalaya Tripura	Nagaland Mizoram	Tripura Nagaland Puducherry Meghalaya
L6	Meghalaya Mizoram Arunachal Pradesh Lakshadweep Dadra and Nagar Haveli Daman and Diu	Manipur Lakshadweep Mizoram Arunachal Pradesh Daman and Diu Nagaland Dadra and Nagar Haveli	Tripura Lakshadweep Manipur Puducherry Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu Jammu and Kashmir	Manipur Mizoram Jammu and Kashmir Arunachal Pradesh Lakshadweep Dadra and Nagar Haveli Daman and Diu

sub-components of e-Readiness with that of the final composite index of e-Readiness,

- Among the leaders, only Karnataka and Chandigarh figure in the 'leaders' category in all three sub-components. It is notable that Maharashtra is ranked much lower in terms of usage compared to the other two subcomponents of Environment and Readiness where it has performed extremely well. This suggests that Maharashtra needs to more effectively leverage the enabling environment and high readiness for greater actual ICT usage within the state.
- All the 'least achievers' are placed in the bottom of the ladder in the overall index as well as the three subcomponents. Thus, all three components need to be improved to make their performance better, which would require not only investment from the central government and concerned state/UT governments, but also effective implementation of policies.
- A few north-eastern states like Tripura and Nagaland, and the UT of Puducherry, in spite of above-average environmental scores, have performed relatively poorly in Readiness and Usage. This indicates the need to improve effectiveness of policy implementation within the respective states.
- At the other end of the spectrum are the states/UTs like Andaman and Nicobar, Uttarakhand, Jharkhand and Chattisgarh who performed extremely well on the usage component with respect to their e-Readiness rank, while lagging behind on the Environment and Readiness indices. This means that with additional funds for infrastructure and capacity building, they could perform much better than their current levels of performance.

5.8 Regional comparison of e-Readiness and Component index scores

The regional construct has been presented in Table 5.10. The idea of analysing within a regional framework is to look at the spatial interaction effect of ICT. In other words, we aim to analyse the importance of physical contiguity in promotion of information and communication technology.

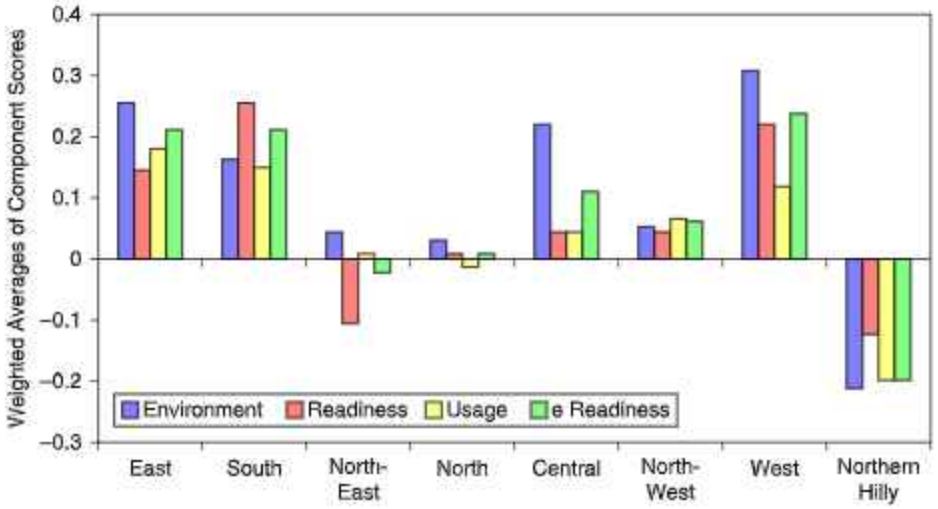
The major states in the South are the clear leaders, but have islands or pockets of underdeveloped ICT regime in Puducherry and Lakshadweep. Lakshadweep probably cannot be easily brought under the 'neighbourhood effect' due to its island status. However, Puducherry is not characterised by any such problem and should have done better. The eastern region consisting of West Bengal, Orissa and Andaman and Nicobar have had consistent performance, with all the states being under the category of either 'aspiring leaders' or 'expectants'. In the north-west region, Rajasthan lags significantly behind others. Within the north-east, Assam is significantly better-off than its sister states, being at least two notches above all of them. The other states, except Sikkim, are in the bottom two categories. The Western region demonstrates a highly disparate performance, with clear pockets that require a lot of attention being the two union territories of Dadra and Nagar Haveli and Daman and Diu.

Figure 5.4 depicts the respective positions of the different regions. Since the states within the different regions are not of equal size, the representative index value for a particular region cannot be derived by simply averaging the values for the different states. Thus, each state was weighted by the ratio of its population to the

Table 5.10: Regional construction for analysis

Region	States
North	Uttar Pradesh, Jharkhand, Bihar
North-West	Chandigarh, Haryana, Delhi, Rajasthan, Punjab
North-East	Tripura, Manipur, Mizoram, Meghalaya, Assam, Nagaland, Arunachal Pradesh, Sikkim
Central	Chhatisgarh, Madhya Pradesh
East	Orissa, West Bengal, Andaman and Nicobar Island
West	Maharashtra, Gujarat, Dadra and Nagar Haveli, Daman and Diu, Goa
South	Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Puducherry, Lakshadweep
Northern Hilly	Himachal Pradesh, Jammu and Kashmir, Uttarakhand

Figure 5.4 e-Readiness and its components: regional patterns



region's population, such that the smaller states get lower weights compared to the larger ones. Thus, Dadra Nagar Haveli and Daman and Diu would get a far lower weight compared to Maharastra, the population of which occupies about 65 per cent of the western region. It needs to be noted that the new values generated at the regional level would be substantially compressed compared to the original index values. The weighted values show the western region is ahead of the south, which is almost at par with the east. However, as per the weighted average, the leading position of the Western region is due to its leading position in Environment; both in terms of Readiness and Usage. The northern hilly states (Jammu and Kashmir, Himachal Pradesh and Uttarakhand) are the worst off; pulled down by bottom-of-the-ladder performance by Jammu and Kashmir. The north-eastern states occupy the second last slot; with only Assam putting up good performance while other states in the region did not fare well in terms of their e-Readiness scores. Table A5.4 in the annex presents the population weighted scores of e-Readiness and its components.

5.9 Modified (weighted) e-Readiness index

The purpose of this chapter is to rank the states/UTs in terms of their e-Readiness status. The states/UTs, however, are not comparable in terms of their characteristics. Two of the major characteristics that are likely to make a significant difference to the capability of any region in adoption of ICT are:

1. *Percentage of rural population to total population:* ICT depends on basic infrastructure like power and education. A rural area in India is far less likely to be at par with the urban areas in terms of access to such infrastructure. Thus, if a state/UT with a large share of rural population performs as well as a state/UT that is mostly urban in terms of e-Readiness, the performance of the former can be taken to be better than the latter, as there was no level playing field in terms of the basic infrastructure, which creates an enabling starting point.
2. *Total population:* ICT ultimately aims to serve the people living within an administrative unit. For a state with larger population, the level of difficulty in administering ICT-enabled services would be higher compared with a state/UT with a smaller population.

A modified index was computed keeping the above two factors in mind, with 10 per cent weights assigned to both the ratio of rural to total population and total population, while the e-Readiness score was given a weight of 80 per cent. The comparison of the two indices has been shown in Table 5.11. There is no substantial difference in the two indices except for the positions of a few states. There has been a noticeable fall in the ranking of Delhi, which has moved from the category of *'Leaders (L1)'* to *'Aspiring Leaders (L2)'*, and Goa, which remained in the rank of *'Expectants (L3)'*, but experiences a fall of five ranks. The reason for the downward movement of these two states is similar. Both states have lower than average rural population ratio and total population; however, for Delhi, the share of rural to total population is the major cause for the downward movement, while for Goa, it is because of its total population. Notably, Chandigarh, which has got a low weight with respect to both the factors has shown no movement in its ranking per modified e-Readiness index, as the difference between its e-Readiness score and that of the succeeding state in the ranking, i.e., Maharashtra, is very high.

Two of the north-eastern states, Tripura and Manipur, have shown an upward movement, albeit by only one rank point. This, however, has enabled them to climb up to the next category; in case of Tripura, from the category of *'Below Average Achievers (L5)'* to *'Average Achievers (L4)'*, and in case of Manipur, from *'Least Achievers (L6)'* to *'Below Average Achievers (L5)'*.

5.10 Trend comparison of ranking of states/UTs

It needs to be noted that though the broad methodology of the e-Readiness index has not changed over the past four years, the variables that have been used to construct indices have changed over a period of time. This year, not only has a lot of variables changed, some states were not

Table 5.11: Comparison of e-Readiness index and modified e-Readiness index

Levels	e-Readiness index	Modified (weighted) e-Readiness index
L1	Karnataka Chandigarh Maharashtra Tamil Nadu Delhi *Andhra Pradesh*	Karnataka Chandigarh Maharashtra Tamil Nadu
L2	West Bengal Kerala Haryana Gujarat Punjab	Andhra Pradesh West Bengal Kerala Haryana Delhi Gujarat Punjab
L3	Andaman and Nicobar Madhya Pradesh Goa Orissa Assam Himachal Pradesh Uttar Pradesh Bihar	Madhya Pradesh Andaman and Nicobar Orissa Assam Himachal Pradesh Bihar Uttar Pradesh Goa
L4	Chhattisgarh Uttarakhand Jharkhand Sikkim Rajasthan	Chhattisgarh Sikkim Uttarakhand Jharkhand Rajasthan Tripura
L5	Tripura Nagaland Puducherry Meghalaya	Nagaland Meghalaya Puducherry Manipur
L6	Manipur Mizoram Jammu and Kashmir Arunachal Pradesh Lakshadweep Dadra and Nagar Haveli Daman and Diu	Mizoram Jammu and Kashmir Arunachal Pradesh Lakshadweep Dadra and Nagar Haveli Daman and Diu

* e-Readiness score of 0.99 has been rounded off to 1.0.

in a position to vouch for continuity in data provided last year. Therefore, in this year's report, we have not attempted a trend comparison in ranks as such a comparison would not have been robust. However, what we have attempted is a measurement of mobility across categories since the last e-Readiness assessment.

There could be three reasons for the movement of states/UTs across categories:

1. Because of their actual relative growth in ICT vis-à-vis the rest of the states/UTs.
2. Because of the change in variables in the two years.
3. Because of difference in clarity and comparability of the data provided by the respective states

Table 5.12 provides the movements of the states/UTs across categories of the e-Readiness index, while tables A5.5 to A5.7, in the annexure, present the movements in the three different sub-components. It needs to be mentioned here that since the distribution of the data is different in the two years under reviews, the movement from one category to a lower or higher category should be interpreted cautiously.

The states/UTs that show significant relative upward movement are Andaman and Nicobar, Assam and Bihar, all of who climbed up two notches from the category of Below-average achievers (L5) to Expectants (L3). The states that have shown less significant upward movements are Maharastra, West Bengal, Madhya Pradesh, Orissa and Tripura. What is notable here is that all the three states in the eastern zone have experienced an upward movement and hence the performance of the eastern states has gone up significantly.

Mizoram is the only state that has shown significant downward movement and has moved downwards by two categories, from that of an average achiever (L4) to a least achiever (L6). The states that have shown some downward mobility are, Kerala, Puducherry and Lakshadweep within the southern region; Punjab, Haryana, Rajasthan and Uttar Pradesh within the north-western and the northern region; Meghalaya within the north eastern region and finally Goa within the western region.

Thus, in terms of regions, while the eastern region has experienced upward movement, the north-west, except Delhi and Chandigarh, has shown downward movement. The North-eastern region too to some extent has shown a tendency towards downward mobility.

5.11 Summing up

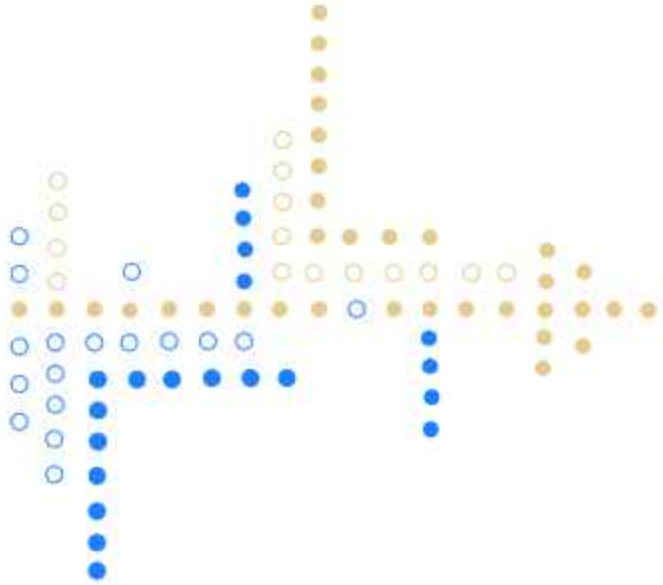
- In 2006, all three sub-components of Environment, Readiness and Usage had nearly the same weights in construction of the e-Readiness index. In other words, all three sub-components had similar associations with each other. In 2008, however, Readiness shows a greater association with the e-Readiness index compared to Environment and Usage. This implies that Capacity building for ICT use among stakeholders has become more important than before. Investments in ICT-related education, both at the school and higher education levels, needs to be stepped up among all states, along with effective training and workshops for government officials.
- The Southern and Western states maintain their position of dominance. The population-weighted regional indices actually show that the latter region is a shade above the former region due to their very high scores in environment index, driven primarily by the state of Maharashtra.
- The Eastern region, overall, has shown a relative upward mobility, whereas the North-western states, except Delhi and Chandigarh, have shown downward mobility. Though the reason for these movements is not very clear, it appears that at least for the eastern region, it is due to more effective usage compared to 2006.
- The remote hilly and island states/UTs have not shown much improvement compared to 2006, and still remains at the bottom of the e-Readiness spectrum in the country. In fact two of the north-eastern states have shown a downward mobility. The only exception is Andaman and Nicobar, which has achieved a relatively high e-Readiness rank despite a poor performance in terms of ICT environment, driven primarily by efficient usage of ICT infrastructure. On the other hand, some of the north-eastern states, in spite of relatively high infrastructure score, have done poorly in Readiness and Usage. While the objective of providing connectivity to the remote areas through ICT is yet to be achieved in its entirety, Andaman and Nicobars's performance is a case in point, which in spite of its remoteness, has done exceedingly well. Its usage score, in fact, is at par with that of the leaders.
- An overall low weight in Environment, of policy implications, indicates the need for a more effective state policy regime and higher central and state investments in ICT related infrastructure.. Upgrading a low readiness score again would be a joint responsibility of both the central and the state government as it necessitates revamping the educational infrastructure. A low usage score, on the other hand, could only be improved with effective changes in mode of functioning within the respective states or union territories, and this is

Table 5.12: Movements of states/UTs across categories between 2008 and 2006 in terms of e-Readiness Index

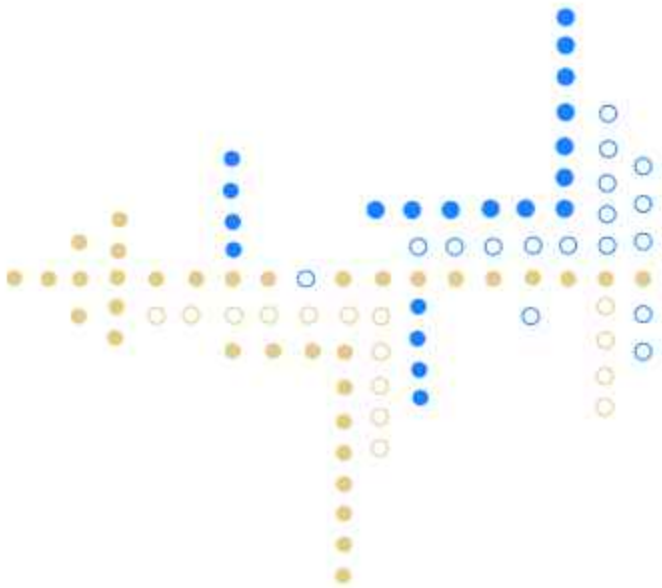
Levels	e-Readiness		
	2008	2006	Movement (2008 with respect to 2006)
L1	Karnataka Chandigarh Maharashtra Tamil Nadu Delhi Andhra Pradesh	Karnataka Chandigarh Tamil Nadu Delhi Andhra Pradesh Kerala Haryana Punjab	Kerala Haryana Punjab
L2	West Bengal Kerala Haryana Gujarat Punjab	Maharashtra Gujarat Goa Uttar Pradesh	Maharashtra Goa Uttar Pradesh
L3	Andaman and Nicobar Madhya Pradesh Goa Orissa Assam Himachal Pradesh Uttar Pradesh Bihar	West Bengal Himachal Pradesh Chhattisgarh Jharkhand Rajasthan	West Bengal Rajasthan Chhattisgarh Jharkhand
L4	Chhattisgarh Uttarakhand Jharkhand Sikkim Rajasthan	Madhya Pradesh Orissa Uttarakhand Sikkim Puducherry Meghalaya Mizoram	Madhya Pradesh Orissa Puducherry Meghalaya Mizoram
L5	Tripura Nagaland Puducherry Meghalaya	Andaman and Nicobar Assam Nagaland Lakshadweep Bihar	Andaman and Nicobar Assam Bihar Lakshadweep
L6	Manipur Mizoram Jammu and Kashmir Arunachal Pradesh Lakshadweep Dadra and Nagar Haveli Daman and Diu	Tripura Manipur Jammu and Kashmir Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu	Tripura

upward movement | downward movement

dependent upon both the state government and bureaucratic functioning within the states. In this respect, Andaman and Nicobar and the three newly formed states of Jharkhand, Chattisgarh and Uttarakhand require the attention and investment from the central and state governments in the latter three cases, as their relative usage scores are far better compared to their relative environment scores, indicating their potential to perform much better.



e-Governance Assessment of Indian States/UTs



e-Governance Assessment of Indian States/UTs

In the previous chapter, we had given state/UT level assessment of e-Readiness, measured as a composite of different stakeholders' readiness and usage of ICT along with the presence of facilitating environment (market, political and regulatory and infrastructure). This chapter evaluates specifically the e-Readiness of different states/UTs' governments, i.e. a comparative assessment of the status of ICT-enabled governance. To this end it considers, among other factors, the institutional mechanism and documented policy for e-Governance initiatives together with progress and outreach of various e-Governance projects within these states/UTs.

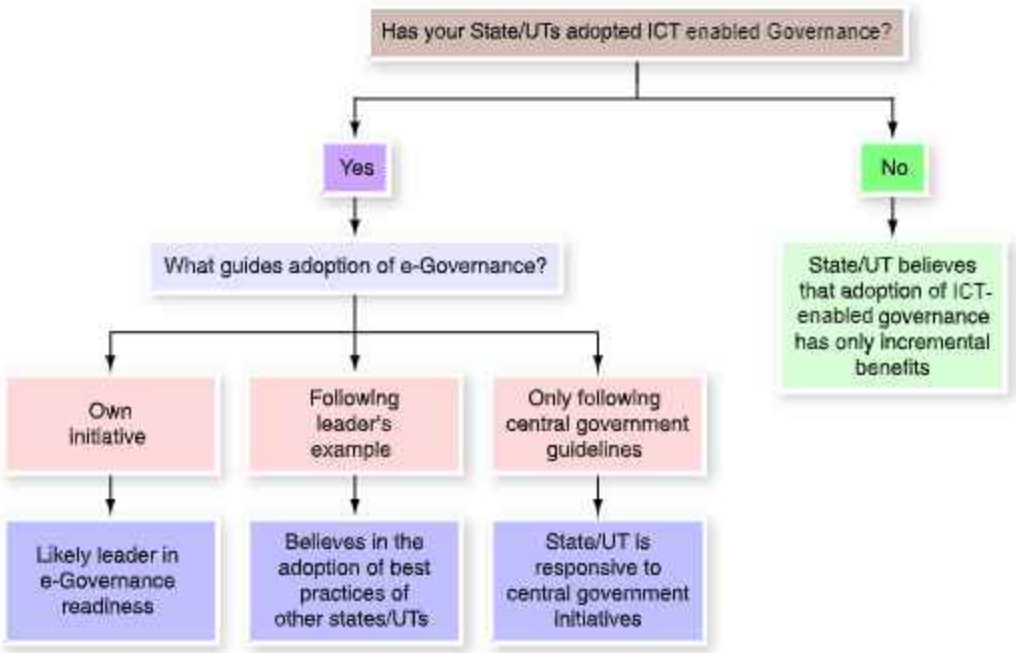
6.1 Methodology

For e-Governance assessment, we have used a combination of Hierarchic Analysis and Principal Component Analysis (PCA). The e-Governance part of the questionnaire administered in all the states/UTs by NCAER contained certain questions as basic filters for capturing hierarchy in e-Governance. This hierarchy is brought out on the basis of the institutional set-up for undertaking e-Governance initiatives and commitment towards moving to a connected government. Once we capture the implicit hierarchy, we carry out an assessment of e-Governance on various parameters such as the number, outreach and inclusiveness of e-Governance projects using PCA.

6.2 Hierarchy in e-Governance – Filtering Criteria

The first basic filter that has been applied is concerned with the adoption of ICT-enabled governance by states/UTs. ICT-enabled governance, in the true sense, refers to the adoption of ICT for governance processes in a manner that there is no manual alternative. To

Figure 6.1: Basic filter chart



facilitate such transition what are required are, among others, a disaster data recovery system and a back-up contingency plan for tackling emergencies such as failure in the IT communication system. Moreover, governments feel the need to store such knowledge (know-how of things gained from experience; valuable knowledge) and have a mechanism to store tacit knowledge. Nonetheless, in the initial stages of e-Governance adoption, states/UTs may have neither the capacity nor the willingness to undergo such a complete transformation of governance mechanism. Thus, for our present purpose, as a filtering question we restrict the meaning of e-Governance to application of ICTs for providing G2C and G2B services and for increasing efficiency in administration through G2G services. Figure 6.1 depicts the first basic filter and the Table 6.1 gives the results based on the responses of the states/UTs to these filtering questions.

Figure 6.1 is self-explanatory as it shows that among the states/UTs adopting ICT-based governance, the one who has taken its own initiatives in implementing e-Governance is likely to figure in the 'leader' category. Our a priori expectation was that many states/UTs would be figuring in the non-adopters category and among those who have adopted ICT-based governance; many would be only following the central government initiatives like implementing NeGP (SWAN, SDC, CSCs, etc). Table 6.1 that documents the responses of states/UTs to the filtering questions brings out some surprises.

Table 6.1: Adoption of e-Governance

Filtering Criteria	No. of states/UTs
1. Adoption of ICT-enabled governance	35
2. Guiding force behind adoption of e-Governance	
Own initiatives	30
Following leader's example	25
Only following central government guidelines	5

Thus, almost all the responding states/UTs have reported to have adopted ICT-enabled governance. This is quite surprising and may be due to the fact that adoption of e-Governance in different states/UTs may be referring to different level of adoption i.e. in some it may be referring to ICT investments and usage of ICTs in the governance process, while in others these ICT investments may have been accompanied by facilitating environments in form of Business Process Re-engineering (BPR) and organisational changes. To account for such differences in the degree of ICT enablement of governance process, we apply our next filtering question 'Has BPR been done to facilitate ICT adoption in governance?'

Only 7 of the 35 responding states/UTs answered in the negative (Table 6.2). Once again, the extent of BPR in these states/UTs varies, with Chandigarh reporting implementation in as many as 35 departments, which resulted in the reduction of the process time. Hence, these filtering questions could not establish any hierarchy in the e-Governance. Nonetheless, they provide us with some interesting insights as follows:

- Positive perception about ICT adoption in governance - Almost all the states perceive that adoption of ICT-enabled governance would lead to significant benefits in the form of increased efficiency in the governance process. They differ in

Table 6.2: Business Process Re-engineering in states/UTs

Filtering question	No. of states/UTs
Has BPR been done to facilitate ICT adoption in governance?	
Yes	28
No	7

the extent of adoption of e-Governance and their commitment towards successful adoption of ICT-enabled governance, which may be on account of constraint of budgets or lack of administrative support (resistance to change from within) among others. This is important as it shows that even the states/UTs which are lagging presently would respond positively to central government initiatives and could benefit from learning from best practices elsewhere.

- BPR considered important for successful implementation of e-Governance – it is heartening to note that BPR has been given an important place in successful implementation of e-Governance process both in terms of the actual re-engineering of the process as well as in the policy documentation (e-Governance road map documents). This bodes well for the future of e-Governance projects in the states/UTs.

6.3 Establishing hierarchy in e-Governance – institutional set-up, documented policy/road map and budget commitment for e-Governance

We could establish the hierarchy on the basis of certain indicators, which in our view are crucial for successful implementation of e-Governance initiatives/projects. These indicators are listed as under,

1. Institutional mechanism to promote e-Governance such as separate e-Governance department, separate agency for overseeing the e-Governance initiatives etc
2. Web presence of the institutional mechanism for promoting e-Governance initiatives; interactive portal with web links to individual e-Governance projects
3. Documented policy or road map for e-Governance
4. Establishment of State e-Governance Mission Team (SeMT) or separate task force for e-Governance
5. Separate e-Governance budget

Three levels of hierarchy were finally arrived at based on these indicators and they have been presented in Table 6.3.

In our view, the presence of institutional mechanisms is very vital for the success of e-Governance initiatives. There was considerable diversity among states/UTs in the institutional mechanism for promoting e-Governance activities. While Karnataka is the only one to have a separate department of e-Governance with a Secretary heading it, other states/UTs (e.g. KSIM in Kerala, SPIC in Chandigarh and GIL in Gujarat; see Table A6.1 in annex) too have effective mechanisms for promoting e-Governance. On the other hand, while States like Bihar and Jammu and Kashmir have established separate agencies, BeST and JaKeGa (see Table A6.1 in annex) respectively, to promote e-Governance activities, they are yet to be properly institutionalised.

States/UTs classified as 'advanced' hierarchically, have in general, separate institutional mechanisms for supporting e-Governance. Most of them have web presence and an interactive portal with links to e-Governance services. As a rule, these states/UTs have documented policies and road maps. They have also set up the States e-Governance Mission Team (SeMT) and/or task force for e-Governance. Further, they have a separate e-Governance budget. All of them show high levels of government commitment for facilitating ICT-enabled governance. Notable exceptions in the 'advanced' category were Maharashtra, where e-Governance activities, do not reportedly have separate coordinating institutional mechanism or budget commitment and Haryana

Table 6.3: Hierarchy in e-Governance

Hierarchy Level	No. of states/UTs	States/UTs
H1- Advanced	9	Andhra Pradesh, Chandigarh, Chattisgarh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Punjab and Tamil Nadu
H2 – Middle	11	Delhi, Goa, Haryana, Jharkhand, Lakshadweep, Maharashtra, Orissa, Rajasthan, Uttar Pradesh, Uttarakhand and West Bengal
H3 - Primary	15	Andaman and Nicobar, Arunachal Pradesh, Assam, Bihar, Dadra and Nagar Haveli, Daman and Diu, Himachal Pradesh, Jammu and Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Puducherry, Sikkim, Tripura

where web presence for the designated e-Governance Centre could not be found, which in combination with absence of Task Force prevented them from figuring in the highest hierarchy. Similarly, Delhi, which has undertaken many e-Governance initiatives, missed figuring in the top bracket as it did not have any separate institutional mechanism to promote e-Governance activities. However, states like Goa, Uttar Pradesh and West Bengal did not figure in the 'advanced' category despite having designated separate institutional mechanism for e-Governance as these did not have interactive web presence.

6.4 Ranking of states/UTs within the hierarchies through use of PCA

In the preceding section, Hierarchic Analysis (HA) enabled us to arrive at three different categories of states using some basic criteria of e-governance. However, to rank these states within the categories we use some other aspects of e-governance using PCA. It is worth mentioning here that while the variables used for the HA are binary, or at best categorical, the indicators used for the PCA are continuous. We believe that the criteria that were adopted to arrive at the three levels of hierarchy are basic to the status of e-Governance among the states/UTs. Consequently, we take these hierarchy categories as given and PCA is used for ranking within these categories. Theoretically, however, it is possible that a state/UT ranked in the top hierarchy (through HA) may get a lower rank than a state/UT categorised in the second hierarchy in terms of PCA rankings due to two reasons.

- The variables used in the two analyses are different.
- While the HA measures levels, the PCA measures magnitude.

6.5 PCA Indicators for measuring e-Governance

- *Number of e-Governance projects:* At initial stages, the number of e-Governance projects undertaken by various states reflects the level of initiatives that a particular state has taken. The number across states is comparable, as most of the states have to perform similar kinds of functions.
- *Age of the oldest e-Governance project:* The maturity of e-Governance in the respective states could be ascertained from this variable. The earlier the first initiative, the more time the state would have had to improve upon its experience.
- *Percentage of e-Governance projects with BPR:* The importance of BPR has been explained earlier. However, this variable provides the spread of BPR across e-Governance projects, thus gives us an idea about the magnitude of the variable.
- *Spread of e-Governance projects:* While the number of projects is important, the quality in terms of their penetration, stage of implementation and coverage of marginalised groups are equally important. One of the major objectives of ICT in general and e-Governance in particular is to use technology to address the concerns of people in remote areas and those who are economically or socially deprived. Table 6.4 provides the four variables that have been included under this head, which has been clubbed using PCA. The composite index explains around 45 per cent of the variations in the four variables (Table 6.5). The percentage of projects having infrastructure set up in entire state to total projects has got the highest weight among all the four variables used to construct the index.
- *Applications in Services:* e-Governance projects are undertaken with the primary objective of providing Services to citizens in an efficient and transparent manner. This broad variable is a composite of four indicators, which, taken together, not only measures the spread of e-Governance in Services, but also their level of operation, its dissemination to the users, as well as their effectiveness in terms of reducing the requirements of making physical visits to the dealing office. Again these four indicators have been compressed into a composite index through PCA at the first stage. This index explains about 68 per cent of the variations of the four indicators used to construct the index.
- *Policy and Institutional Environment:* This includes three broad components, i.e. spread of e-Governance projects across existing government departments, policies promoting e-Governance in the state (refer to Table 6.4 for the exact variables) and use of various dissemination instruments to popularise e-Governance. These three variables have been clubbed through PCA. About 65 per cent of the variations of the three variables is explained by the composite index.

The factor loadings of the final PCA index of e-Governance have been presented in Table 6.6. The composite index explains about 41 per cent of the variations of the six variables. The two variables that have got the highest weights in the process of the

Table 6.4: Indicators of e-Governance ranking used for PCA

Major category	Minor category	Minor category Indicators of significance
e-Governance	e-Governance projects	No. of e-Governance projects
	Age	Age of the oldest e-Governance project in the state
	BPR	Percentage of e-Governance projects with BPR
	Spread of e-Governance projects	Percentage of programs having entire state coverage as per plan
		Percentage of projects having infrastructure set up in entire state to total projects having entire state coverage as per plan
		Percentage of projects active in entire state to total projects having infrastructure set up in entire state
		Percentage of projects focusing on marginalised target groups
	Application in Services	Percentage of Services where changes have been implemented
		Percentage of Services which are transforming and transaction based
		No. of Services for which citizen charter provided
		Percentage of Services for which trips to the dealing office by user's availing the service has been completely eliminated
	Policy and Institutional Environment	Separate institutional mechanism to promote e-Governance
		Documented policy for e-Governance activities
		e-Governance road map document
		State e-Governance mission team (SeMT) set up for e-Governance projects
		Separate task force been set up for e-Governance projects
		Separate ICT budget
		Separate e-Governance budget
		Percentage of e-Governance projects to total number of departments
		Dissemination Instruments 1. *Radio* 2. *Print* 3. *Television* 4. *Street Shows* 5. *Any Other*

index construction are composite index of application of Services and composite e-Governance institutional environment. These two indicators of e-Governance are somewhat more important than the other four by virtue of their higher association with the other indicators.

e-Readiness is an important factor in promoting e-Governance, as the former provides capabilities, while the latter is an indicator of implementation. However, one of the important differences is that while e-Readiness has three actors, i.e. government, business and individuals; the responsibility of effective

Table 6.5: PCA result of e-Governance index

	Variables	Factor loadings	Percentage of variation explained by the composite sub-index
Spread of project	Percentage of progams having entire state coverage as per plan	0.783	44.47
	Percentage of projects having infrastructure set up in entire state to total projects having entire state coverage as per plan	0.890	
	Percentage of projects active in entire state to total projects having infrastructure set up in entire state	0.691	
	Percentage of projects focusing on marginalized target groups	0.586	
Application in Services	Percentage of Services where changes have been implemented	0.872	68.48
	Percentage of Services which are transforming and transaction based	0.833	
	No. of Services for which Citizen Charter provided	0.905	
	Percentage of Services for which trips to the dealing office by user's availing the service has been completely eliminated	0.683	
Policy and institutional environment	Percentage of e-Governance projects to total number of departments	0.850	64.63
	Separate mechanism to promote e-Governance	0.821	
	Dissemination instruments	0.736	

Table 6.6: PCA results for construction of e-Governance index

Final composite index	Major group indicators	Factor loadings	Percentage of variation explained by the composite sub-index
e-Governance	No. of e-Governance projects	0.726	41.03
	Age of the oldest e-Governance project	0.510	
	Percentage of e-Governance projects with BPR	0.732	
	Composite index for spread of project	0.581	
	Composite index for application in Services	0.881	
	Composite index for institutional environment	0.814	

implementation of e-Governance projects and Services is the sole responsibility of the Government. However, the effectiveness of e-Governance increases if the citizens are more e-Literate which help them to be informed and empowered. A e-Governance project can hardly be interactive or transforming if the users do not take advantage of the e-Services that is being offered to them. It is thus useful to present a comparison between the ranks of e-Readiness and e-Governance as this could provide important policy directions.

Table 6.7: e-Governance ranking within established hierarchies

Hierarchy level	Ranking within hierarchies
H1	Andhra Pradesh Karnataka Tamil Nadu Punjab Madhya Pradesh Kerala Chhattisgarh Chandigarh Gujarat
H2	Jharkhand Delhi Haryana Maharashtra Goa Rajasthan West Bengal Lakshadweep Orissa Uttar Pradesh Uttarakhand
H3	Andaman and Nicobar Sikkim Meghalaya Assam Manipur Himachal Pradesh Daman and Diu Tripura Bihar Dadar and Nagar Haveli Arunachal Pradesh Mizoram Jammu and Kashmir Puducherry Nagaland

Table 6.7 presents the ranking within the established hierarchies, while Table 6.8 provides the comparison between the e-Governance and e-Readiness rankings. It may be observed from Table 6.7 that not all states/UTs in a leading position in terms of e-Readiness rankings perform that well in terms of e-Governance. On the other hand, many states/UTs that are less e-Ready are using their capabilities relatively better to serve their population. About twelve states/UTs out of the 35 are more or less at par in terms of both rankings (Table 6.8). Seven states/UTs have a deviation that is moderate, whereas the rest, i.e. 16 states/UTs have a positive or negative deviation above 5. The states/UTs in italics have a higher e-Governance ranking, which indicate that they are utilising their e-Readiness relatively better to serve its citizens and businesses, as well as for coordination within various government departments. Some of the states/UTs, which not only have very low ranks in e-Readiness but are also categorised as relatively less developed states/UTs in terms of their per capita net state domestic product, are efficient performers in a relative scale in terms of e-Governance. These include Lakshadweep, Chhattisgarh, Jharkhand, Madhya Pradesh, Daman and Diu and Rajasthan. On the other hand, the states/UTs marked in bold in Table 6.8 are the ones with scope for improving the e-Governance further by leveraging existing e-Readiness.

6.6 Summing Up

- A higher e-Readiness capability may not necessarily be leveraged into a better e-Governance performance. One factor that is important for an effective e-Governance performance is political will to use ICT effectively for governance process, an aspect that is difficult to factor into any model of measurement.

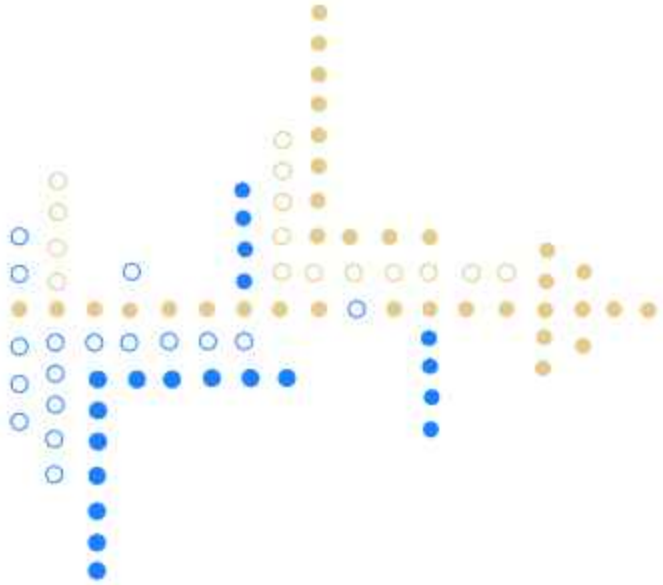
- Our analysis shows that some less developed states with relatively poor ICT infrastructure and readiness leverage their existing e-Readiness much better than the leaders for providing e-Governance services. It is expected that promoting ICT investments in these states would give high returns.

Table 6.8: Deviations in e-Governance and e-Readiness ranks

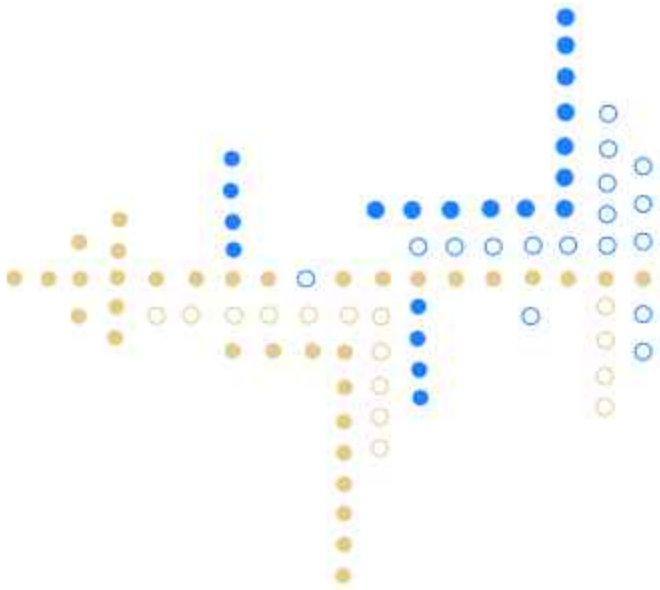
Absolute deviations in ranks of e-Governance and e-Readiness	States/UTs	Number of States
0 to 2	*Arunachal Pradesh, Sikkim, Tamil Nadu, Gujarat, Uttarakhand, Kerala,* Goa, **Jammu and Kashmir, Karnataka, Mizoram, Uttar Pradesh**	11
3 to 5	*Andhra Pradesh, Dadra and Nagar Haveli, Meghalaya, Manipur,* **Haryana, Orissa, Tripura**	7
6 to 10	*Punjab, Madhya Pradesh, Daman and Diu, Rajasthan* **Chandigarh, Delhi, Puducherry, Assam, Andaman and Nicobar, Himachal Pradesh, Nagaland, West Bengal, Bihar, Maharashtra**	14
Above 10	**Lakshadweep, Chattisgarh, Jharkhand**	**3**

Note: The states/UTs in italics have a higher e-Governance ranking compared to their e-Readiness ranking while the states/UTs in bold have a higher e-Readiness ranking compared to their e-Governance ranking.

- On the other hand, some developed states with relative high e-Readiness capabilities are not able to translate this into equally high performances in e-Governance services. Some re-engineering within the government set-up is probably necessary in these states to make full use of their existing e-Readiness capabilities.



State-wise Factors for Improvement of e-Readiness and e-Governance level



State-wise Factors for Improvement of e-Readiness and e-Governance level

7.1 State-wise factors – e-Readiness level

The levels obtained by PCA methodology are not, strictly speaking, amenable to inter temporal comparison as the variables that constitute the construction of the index are different in any two years.

Nonetheless, we have drawn insights by looking at 2008 performance, relative to those of 2006 with the view og identifying factors/variables which states can develop upon to improve their readiness.

States which have moved up in level from the 2006 levels are as follows:

- Maharashtra has moved up from the 2006 level of L2 to L1 in 2008. However its weakness factors lay in the area individual usage, specifically in monthly expenditure incurred by households on internet access, cell phone, telephone, cable TV. Under individual readiness percentage households with PCs, percentage of household with internet connection, percentage of household with cell phone need to be spruced up.
- West Bengal has moved up from the 2006 level og L3 to L2 in 2008. Its weakness factors lie in the area of Business readiness, specifically in density of employment in IT parks and number of IT jobs per million in the population.
- Andaman and Nicobar have moved up from the 2006 level of L5 to L3 in 2008. Their weakness factors lie in the area of Market Environment specifically in competition in the WLL market i.e. in terms of number players in the market and percentage market share other than top players market share.
- Madhya Pradesh has moved up in level from L4 to L3 in 2008 from the 2006 level. This states weakness factors include individual usage, individual readiness and business readiness. Therefore monthly expenditure incurred by households on Internet access, cell phone, telephone, cable TV connection is not up to the mark. Apart from this for individual readiness: percentage households with PCs, percentage of household with internet connection, percentage of household with cell phone is lower than expected and for business readiness IT park density, IT jobs per million population and employment per IT park needs to be spruced up.
- Orissa has moved up to L3 in 2008 from the 2006 levels of L4. The state lacks in the areas of policy documentation & implementation and Government usage. Under government usage it particularly lacks in the use of ICT by government officials. The state also lacks a section in the ICT policy document on legal and security aspects. Further the state has not adopted the IT Amendment Act 2008, does not have separate cyber laws that confer legal status to electronic transactions and documents and no legal provision for digital signatures and encryption.
- Bihar has moved up two levels from the 2006 level of L5 to 2008 level of L3. However it lacks in the areas of Policy documentation, in particular in legal ICT policy and Policy implementation. It also does not have state level ICT Action Plan and has not adopted the IT Amendment Act 2008. Further it does not have separate cyber laws that confer legal status to electronic transactions and documents and no legal provision for digital signatures and encryption.
- Tripura has moved up to L5 from its previous 2006 level of L6. It lacks in government usage. This implies lack of application of ICT to the following areas: agriculture, health services, transportation, energy and trade.
- Assam has moved up to L3 in 2008 from the 2006 level of L5 and need to improve in the area of individual readiness i.e. percentage households with PCs, percentage of household with internet connection, percentage of household with cell phone need to be augmented.

States which have moved down in level from the 2006 levels are as follows:

- Kerala has moved down to L2 since 2006 level of L1. Kerala's weakness factors lay in the area of Business readiness i.e. in density of employment in IT parks and jobs per million in the population.
- Haryana has moved down to L2 from the previous level of L1 in 2006. Haryana's weakness factors lay in the area of Individual usage and Government readiness. Specifically for Haryana, the percentage of officials trained in ICT is only 20% while the percentage of government officials using ICT is about 40%. Further monthly expenditure incurred by households on Internet access, cell phone, telephone (landline), cable TV connection need to be enhanced for Individual usage. For government readiness percentage of top government officials trained in ICT and percentage of total government officials trained in ICT need to be enhanced.
- Punjab has moved down to L2 from the previous level of L1 in 2006. Punjab lacks in government usages in the sense that the proportion of officials employed by the government who have access to the internet is about 25%.
- Goa and UP have moved down to L3 in 2008 from the 2006 level of L2. Goa's weakness factors lay in the area of government readiness, particularly in percent rage of officially trained in ICT and ICT use by PRI's. UP lacks in the areas of individual readiness and usage. Thus UP lacks in the areas of percentage households with PCs, percentage of household with internet connection, percentage of household with cell phone and monthly expenditure incurred by households on Internet access, cell phone, telephone (landline), and cable TV connection need to be spruced up.
- Chattisgarh and Jharkhand have both moved down to L4 from 2006 level of L3. Both lack in the area of market environment i.e. Competition in the cellular market: number of players and growth of no. of players, competition in the wireless including WLL(F) market, number of players, market share other than top player's share and competition in ISP market in terms of number of players. Chattisgarh in particular lacks in competition in the Cellular market and competition in the Wireless including WLL (F) market.
- Rajasthan has moved down to L4 from the 2006 level of L3. It lacks in policy environment and infrastructure environment. Under policy environment it specifically lacks in Legal ICT Policy and an effective legal mechanism to tackle the problem of piracy of ICT products. Further it does not have state level ICT Action Plan and has not adopted the IT Amendment Act 2008. It also does not have separate cyber laws that confer legal status to electronictransactions and documents and does not have legal provision for digital signatures and encryption.
- Puducherry has moved down to L5 from the 2006 level of L4. Its weakness areas lie in government Usage specifically in Computerization and its penetration. The percentage of officials trained in ICT is 25% and there is no effective legal mechanism to tackle the problem of piracy of ICT products. The state further does not have separate cyber laws that confer legal status to electronic transactions and documents and no legal provision for digital signatures.
- Meghalaya has moved down to L5 from the 2006 level of L4. Its weakness factors lie in the area of policy environment, specifically security ICT Policy, legal ICT Policy, and policy implementation.
- Mizoram has moved down to L6 from the 2006 level of L4 and is lacking in policy environment. It does not have security ICT policy or legal ICT policy. It lacks an institutional mechanism to implement and review progress of the ICT policy and effective legal mechanism to tackle the problem of piracy of ICT products, It does not have state level ICT Action Plan, separate cyber laws that confer legal status to electronic transactions and documents and no legal provision for digital signatures and encryption, WAN, VPN.

States which have not changed in level from the 2006 levels are as follows:

- Uttarakhand has remained at L4 from 2006. The states weakness factor lies in policy environment and has no legal ICT policy. It also does not have separate cyber laws that confer legal status to electronic transactions and documents and no legal provision for digital signatures and encryption. In terms of policy environment it lacks in policy documentation enabling/ facilitating the ICT Policy: legal ICT policy, security ICT policy, the issue of IPR may not be addressed in the ICT policy and a state level ICT action plan may not exist. Under policy implementation, the state lacks institutional mechanism to implement and review progress of the ICT policy, effective legal mechanism to tackle the problem of

piracy of ICT products, separate cyber laws that confer legal status to electronic transactions and documents may not exist and legal provision for digital signatures and encryption may not exist.

- Andhra Pradesh and Delhi have remained at L1 from 2006. Andhra Pradesh weakness factors lie in the areas of business readiness and individual usage. Under business readiness, Andhra Pradesh needs to improved in parameters of; IT park density, employment per IT park and IT jobs per million in the population. Under individual usage, monthly expenditure incurred by households on Internet access, cellphone, telephone (landline), cable TV connection needs to be improved. However Delhi's weakness factors lie in the area of market environment i.e Competition in the cellular market: number of players and growth of no. of players, competition in the wireless including WLL(F) market , number of players, market share other than top player's share and competition in ISP market in terms of number of players. Further Delhi does not have separate cyber laws that confer legal status to electronic transactions and documents and effective legal mechanism to tackle the problem of piracy of ICT products.

7.2 State-wise factors – e-Governance level

All States/UTs classified as 'Advanced' hierarchically, in general, show high levels of government commitment for facilitating ICT-enabled governance and have a separate institutional mechanism for supporting e-Governance activities. All States/UTs in this category have a documented policy. However, Karnataka, the only state to have a separate department of e-Governance with a Secretary heading it, does not have State e-Governance Mission Team (SeMT). Chattisgarh have a separate institutional mechanism for supporting e-Governance activities and web presence does not have a State e-Governance Mission Team (SeMT). Chandigarh and Gujarat do not have a separate e-Governance budget.

In the 'medium' category all States/UTs have a Road Map for e-Governance. Delhi, Maharashtra, Orissa and Rajasthan do not have a separate institutional mechanism for e-Governance. Maharashtra does not have a separate coordinating institutional mechanism or budget commitment. Haryana, where web presence for the designated e-Governance Centre could not bf found, does not have a separate Task Force. Similarly, Delhi, which has undertaken many e-Governance initiatives, missed figuring in the top hierachial bracket as it did not have any separate institutional mechanism to promote e-Governance activities.

States like Goa, Uttar Pradesh and West Bengal do not figure in the 'advanced' category despite having designated separate institutional mechanism for e-Governance, as these do not have an interactive web presence.

States like Manipur, Meghalya, Mizoram and Nagaland figuring in "Lower" category have a Road Map for e-Governance and have established a State e-Governance Mission Team (SeMT).However, they do not a separate institutional mechanism to promote e-Governance activities, such as separate e-Governance department or an overseeing agency for e-Governance initiatives etc. States/UTs in this category do not have Web presence or the institutional mechanism for promoting e-Governance initiatives; and do not have an interactive portal with web links to individual e-Governance projects (Refer Table A6.1 for details).

Within a hierachy, states all ranked using the Principal Components Analysis (Ref: Table 6.4). The e-Governance ranking within established hierarchy is given in Table 6.7. Out of the states figuring in the top two levels i.e. "advanced" and "middle" category; Karnataka, Chandigarh, Delhi, Haryana, Maharashtra, West Bengal, Orissa and Uttar Pradesh have a scope for improving the e-Governance further by leveraging existing e-Readiness, to even higher levels.

Karnataka has a low percent of e-Governance projects to total number of departments and Citizen Charter is provided only for about 55% of the services. This is an area of improvement in the context of Karnataka.

In case of Delhi and Chandigarh dissemination instruments needs to be augmented. Also percentage of e-Governance projects compared to total number of departments is forty percent. Number of services for which Citizen Charter is provided is less in Haryana and Maharashtra. Uttar Pradesh has a low percentage of e-Governance projects with BPR and needs to strengthen the policy and institutional Environment indicators. Though West Bengal has a high percentage of e-Governance projects with BPR performs poorly on the indicators capturing the spread of projects in terms of geographical area.

States like Andhra Pradesh, Tamil Nadu, Punjab, Madhya Pradesh, Kerala, Chhattisgarh, Gujarat, Rajasthan etc. have a higher e-Governance ranking, which indicate that they are utilising their e-Readiness status relatively better to serve their citizens and business-

es, as well as for coordination within various government departments. States like Jharkhand and Chattisgarh with a high percent of e-Governance projects with BPR do not perform that well on the indicators capturing the spread of projects and application in various services.

Tamil Nadu which figures in top states can improve further by providing Citizen Charters for services. Kerala has a low percent of projects focusing on marginalized target groups. In Punjab and Madhya Pradesh Citizen Charter is provided for a very low percent of services and dissemination instruments need to be strengthened.

Annexures

Networked Readiness Index Variable

Table A4.1: Networked Readiness index 2008-09: India's performance vis-à-vis leader

	Leader		India	
	Country	Score/ Value	Rank	Score/ Value
1st pillar: Market environment	**Hong Kong**	**5.61**	**50**	**4.03**
1.01 Venture capital availability Entrepreneurs with innovative but risky projects can generally find venture capital in your country (1=not true, 7=true)	USA	5.13	27	3.97
1.02 Financial market sophistication The level of sophistication of financial markets in your country is (1=lower than international norms, 7=higher than international norms)	Switzerland	6.77	33	5.32
1.03 Availability of latest technologies In your country, the latest technologies are (1=not widely available and used, 7=widely available and used)	Iceland	6.69	43	5.20
1.04 State of cluster development Strong and deep clusters are widespread throughout the economy (1=strongly disagree, 7=strongly agree)	Taiwan, China	5.59	24	4.48
1.05 Utility patents (hard data) Number of utility patents (i.e., patents for invention) granted between January 1 and December 31, 2007, per million(population | 2007	Taiwan, China	266.92	57	0.49
1.06 High-tech exports (hard data) High-technology exports as a percentage of total goods exports | 2006 or most recent year available	Philippines	59.38	54	3.44
1.07 Burden of government regulation Complying with administrative requirements (permits, regulations, reporting) issued by the government in your country is (1=burdensome, 7=not burdensome)	Singapore	5.66	90	2.93
1.08 Extent and effect of taxation The level of taxes in your country (1=significantly limits the incentives to work or invest, 7=has little impact on the incentives to work or invest)	UAE	6.22	28	4.25

	Leader		India	
	Country	Score/ Value	Rank	Score/ Value
1.09 Total tax rate (hard data) This variable is a combination of profit tax (percents of profits), labor tax and contribution (percents of profits), and other taxes (percents of profits) / 2007	Qatar	11.30	119	71.5
1.10 Number of procedures required to start a business (hard data) Number of procedures required to start a business | 2008	Canada	1	112	13
1.11 Intensity of local competition Competition in the local market is (1=limited in most industries and price-cutting is rare, 7=intense in most industries as market leadership changes over time)	Germany	6.38	11	5.86
1.12 Freedom of the press How free is the press in your country? (1=totally restricted, 7=completely free)	Denmark	6.90	23	6.25
1.13 Accessibility of digital content In your country, is digital content (text and audiovisual content, software products) widely accessible via multiple platforms (fixed-line Internet, wireless Internet, mobile network, satellite, etc.)? (1=no, digital content is not accessible, 7=yes,	Sweden	6.47	61	4.77
2nd pillar: Political and Regulatory environment	**Singapore**	**6.30**	**57**	**4.19**
2.01 Effectiveness of law-making bodies How effective is your national parliament/congress as a law-making institution? (1=very ineffective, 7=very effective, among the best in the world)	Singapore	6.35	25	4.53
2.02 Laws relating to ICT Laws relating to the use of information and communication technologies (electronic commerce, digital signatures, consumer protection) are (1=nonexistent, 7=well developed and enforced)	Denmark	6.08	38	4.58
2.03 Judicial independence Is the judiciary in your country independent from political influences of members of government, citizens, or firms? (1=no, heavily influenced, 7=yes, entirely independent)	New Zealand	6.63	43	4.91
2.04 Intellectual property protection Intellectual property protection in your country (1=is weak and not enforced; 7=is strong and enforced)	Switzerland	6.28	57	3.70
2.05 Efficiency of legal framework for disputes The legal framework in your country for private businesses to settle disputes and challenge the legality of government actions and/or regulations (1=is inefficient and subject to manipulation, 7=is efficient and follows a clear, neutral process)	Denmark	6.30	42	4.44

	Leader		India	
	Country	Score/ Value	Rank	Score/ Value
2.06 Property rights Property rights, including over financial assets (1=are poorly defined and not protected by law, 7=are clearly defined and well protected by law)	Switzerland	6.66	52	5.02
2.07 Quality of competition in the ISP sector Is there sufficient competition among Internet service providers in your country to ensure high quality, infrequent interruptions, and low prices? (1=no, 7=yes, equal to the best in the world)	Estonia	6.10	23	5.29
2.08 Number of procedures to enforce a contract (hard data) Number of procedures from the moment the plaintiff files a lawsuit in court until the moment of payment | 2008	Ireland	20	117	46
2.09 Time to enforce a contract (hard data) Number of days required to resolve a dispute | 2008	Singapore	150	126	1420
3rd pillar: Infrastructure environment	**Iceland**	**6.02**	**76**	**2.70**
3.01 Telephone lines (hard data) Main telephone lines per 100 population | 2007 or most recent year available	Switzerland	66.81	108	3.37
3.02 Secure Internet servers (hard data) Secure Internet servers per million population | 2007 or most recent year available	Iceland	1421.24	99	1
3.03 Electricity production (hard data) Electricity production (kWh) per capita | 2005 or most recent year available	Norway	29704.32	104	638.64
3.04 Availability of scientists and engineers Scientists and engineers in your country are (1=nonexistent or rare, 7=widely available)	Finland	5.93	3	5.67
3.05 Quality of scientific research institutions Scientific research institutions in your country (e.g., university laboratories, government laboratories) are (1=nonexistent, 7=the best in their fields internationally)	USA	6.30	27	4.84
3.06 Tertiary education enrollment (hard data) Gross tertiary education enrollment rate | 2006 or most recent year available	Greece	94.87	98	11.85
3.07 Education expenditure (hard data) Education expenditure as a percentage of GNI | 2006 or most recent year available	Lesotho	9.26	77	3.95
4th pillar: Individual Readiness	**Finland**	**6.54**	**45**	**5.57**
4.01 Quality of math and science education Math and science education in your country's schools (1=lag far behind most other countries' schools, 7=are among the best in the world)	Finalnd	6.48	17	5.16

	Leader		India	
	Country	Score/ Value	Rank	Score/ Value
4.02 Quality of the educational system The educational system in your country (1=does not meet the needs of a competitive economy, 7=meets the needs of a competitive economy)	Finalnd	6.24	37	4.27
4.03 Internet access in schools Internet access in schools is (1=very limited; 7=extensive, most children have frequent access)	Finalnd	6.44	60	3.54
4.04 Buyer sophistication Buyers in your country make purchasing decisions (1=based solely on the lowest price, 7=based on a sophisticated analysis of performance attributes)	Switzerland	5.36	38	4.19
4.05 Residential telephone connection charge (hard data) One-time residential telephone connection charge (US$) as a percentage of GDP per capita | 2007 or most recent year available	Algeria	0.00	64	0.77
4.06 Residential monthly telephone subscription (hard data) Residential monthly telephone subscription (US$) as a percentage of monthly GDP per capita | 2007 or most recent year available	UAE	0.12	99	3.70
4.07 High-speed monthly broadband subscription (hard data) High-speed monthly broadband subscription charge (US$) as a percentage of monthly GDP per capita | 2006 or most recent year available	Malta	0.12	68	27.82
4.08 Lowest cost of broadband (hard data) Lowest sampled cost (US$) per 100 kb/s as a percentage of monthly GNI | 2006 or most recent year available	Japan	0.00	85	5.93
4.09 Cost of mobile telephone call (hard data) Cost of 3-minute local call during peak hours (US$) as a percentage of monthly GDP per capita | 2006 or most recent year available	Hong Kong	0.00	74	0.19
5th pillar : Business Readiness	**Switzerland**	**6.00**	**27**	**5.05**
5.01 Extent of staff training The general approach of companies in your country to human resources is (1=to invest little in training and employee development, 7=to invest heavily to attract, train, and retain employees)	Denmark	5.85	34	4.59
5.02 Local availability of specialized research and training services In your country, specialized research and training services are (1=not available, 7=available from world-class local institutions)	USA	6.12	32	4.66

	Leader		India	
	Country	Score/ Value	Rank	Score/ Value
5.03 Quality of management schools Management or business schools in your country are (1=limited or of poor quality, 7=among the best in the world)	France	6.07	12	5.42
5.04 Company spending on R&D Companies in your country (1=do not spend money on research and development, 7=spend heavily on research and development relative to international peers)	Switzerland	6.04	29	3.91
5.05 University-industry research collaboration In its R&D activity, business collaboration with local universities is (1=minimal or nonexistent, 7=intensive and ongoing)	USB	5.85	45	3.60
5.06 Business telephone connection charge (hard data) One-time business telephone connection charge (US$) as a percentage of GDP per capita | 2007 or most recent year available	Algeria	0.00	57	0.77
5.07 Business monthly telephone subscription (hard data) Business monthly telephone subscription (US$) as a percentage of monthly GDP per capita | 2007 or most recent year available	Ghana	0.05	83	3.70
5.08 Local supplier quality The quality of local suppliers in your country is (1=poor, as they are inefficient and have little technological capability, 7=very good, as they are internationally competitive and assist in new product and process development)	Austria	6.41	37	5.19
5.09 Local supplier quantity Local suppliers in your country are (1=largely nonexistent, 7=numerous and include the most important materials, components, equipment, and services)	Japan	6.28	4	5.91
5.10 Computer, communications, and other services imports (hard data) Computer, communications, and other Services as percentage of total commercial services imports | 2007 or most recent year available	Ireland	70.60	23	42.07
6th pillar : Government Readiness	**Singapore**	**5.92**	**57**	**4.12**
6.01 Government prioritization of ICT Information and communication technologies (computers, Internet, etc.) are an overall priority for the government (1=strongly disagree, 7=strongly agree)	Singapore	6.34	24	5.38

	Leader		India	
	Country	Score/ Value	Rank	Score/ Value
6.02 Government procurement of advanced technology products Government purchase decisions for the procurement of advanced technology products are (1=based solely on price, 7=based on technical performance and innovativeness)	Singapore	5.51	88	3.36
6.03 Importance of ICT to government vision of the future The government has a clear implementation plan for utilizing information and communication technologies for improving the country's overall competitiveness (1=strongly disagree, 7=strongly agree)	Singapore	6.40	33	4.68
6.04 E-Government Readiness Index (hard data) The E-Government Readiness Index assesses e-government readiness based on website assessment, telecommunications infrastructure, and human resource endowment | 2008	Sweden	0.916	94	0.381
7th pillar: Individual Usage	**Netherlands**	**6.39**	**114**	**1.26**
7.01 Mobile telephone subscribers (hard data) Mobile telephone subscribers per 100 population | 2007 or most recent year available	UAE	173.37	120	19.96
7.02 Personal computers (hard data) Personal computers per 100 population | 2006 or most recent year available	Canada	94.58	94	2.76
7.03 Broadband Internet subscribers (hard data) Total broadband Internet subscribers per 100 population | 2007 or most recent year available	Denmark	36.33	94	0.27
7.04 Internet users (hard data) Internet users per 100 population | 2007 or most recent year available	Netherlands	91.36	99	6.93
7.05 Internet bandwidth (hard data) International Internet bandwidth (mB/s) per 10,000 population | 2007 or most recent year available	Denmark	346.02	96	0.24
8th pillar: Business Usage	**Sweden**	**6.15**	**30**	**5.09**
8.01 Prevalence of foreign technology licensing In your country, licensing of foreign technology is (1=uncommon, 7=a common means of acquiring new technology)	Denmark	6.00	30	5.38
8.02 Firm-level technology absorption Companies in your country are (1=not able to absorb new technology, 7=aggressive in absorbing new technology)	Iceland	6.56	26	5.52
8.03 Capacity for innovation Companies obtain technology (1=exclusively from licensing or imitating foreign companies, 7=by conducting formal research and pioneering their own new products and processes)	Germany	5.96	35	3.77

	Leader		India	
	Country	Score/ Value	Rank	Score/ Value
8.04 Availability of new telephone lines New telephone lines for your business are (1=scarce and difficult to obtain, 7=widely available and highly reliable)	Switzerland	6.91	38	6.20
8.05 Extent of business Internet use Companies in your country use the Internet extensively for buying and selling goods, and for interacting with customers and suppliers (1=strongly disagree, 7=strongly agree)	USA	6.22	41	4.58
9th pillar: Government Usage	**Denmark**	**6.09**	**47**	**4.19**
9.01 Government success in ICT promotion Government programs promoting the use of information and communication technologies are (1=not very successful, 7=highly successful)	Singapore	6.16	23	5.08
9.02 Availability of government online services In your country, online government services such as personal tax, car registrations, passport applications, business permits, and e-procurement are (1=not available, 7=extensively available)	Estonia	6.60	49	4.21
9.03 ICT use and government efficiency The use of information and communication technologies by the government has improved the efficiency of government services, facilitating interaction with businesses and individuals (1=strongly disagree, 7=strongly agree)	Singapore	6.27	33	4.85
9.04 Presence of ICT in government offices The presence of information and communication technologies in government offices in your country is (1=very rare, 7=commonplace and pervasive)	Singapore	6.44	67	4.29
9.05 E-Participation Index (hard data) The E-Participation Index assesses the quality, relevance, usefulness, and willingness of government websites for providing online information and participatory tools and services to the people | 2008	USA	1.00	47	0.25

e-Readiness : Principal Component Analysis

Table A5.1: Principal Component Analysis (PCA)

The objective of PCA is to explain the variance of the observed data through a few linear combinations of the original data. Even though there are Q variables, $1\ 2\ Q\ x\ ,x\ ,...x$, much of the data's variation can often be accounted for by a small number of variables – principal components, or linear relations of the original data, $1\ 2\ Q\ Z\ ,Z\ ,...Z$ that are uncorrelated. At this point there are still Q principal components, i.e., as many as there are variables. The next step is to select the first, say $P<Q$ principal components that preserve a "high" amount of the cumulative variance of the original data.

$$Z_1 = a_{11}\,x_1 + a_{12}\,x_2 + a_{1Q}\,x_Q$$
$$Z_2 = a_{21}\,x_1 + a_{22}\,x_2 + a_{2Q}\,x_Q$$
.....
$$Z_Q = a_{Q1}\,x_Q + a_{Q1}\,x_2 + a_{QQ}\,x_Q$$

The lack of correlation in the principal components is a useful property. It indicates that the principal components are measuring different "statistical dimensions" in the data. When the objective of the analysis is to present a huge dataset using a few variables, some degree of economy can be achieved by applying Principal Components Analysis (PCA), if the variation in the Q original x variables can be accounted for by a small number of Z variables. It must be stressed that PCA cannot always reduce a large number of original variables to a small number of transformed variables. Indeed, if the original variables are uncorrelated, then the analysis is of no value. On the other hand, a significant reduction is obtained when the original variables are highly correlated—positively or negatively.

The weights aij (also called component or factor loadings) applied to the variables j x in Equation (1) are chosen so that the principal components i Z satisfy the following conditions:

i. They are uncorrelated (orthogonal),
ii. The first principal component accounts for the maximum possible proportion of the variance of the set of x s, the second principal component accounts for the maximum of the remaining variance and so on until the last of the principal component absorbs all the remaining variance not accounted for by the preceding components.

PCA involves finding the eigenvalues λj , j=1,…,Q, of the sample covariance matrix CM. The eigenvalues of the matrix CM are the variances of the principal components and can be found by solving the characteristic equation. $CM - \lambda I = 0$ where I is the identity matrix with the same order as CM, and λ is the vector of eigenvalues. This is possible, however, only if Q is small. There are Q eigenvalues, some of which may be negligible.

Negative eigenvalues are not possible for a covariance matrix. An important property of the eigenvalues is that they add up to the sum of the diagonal elements of CM. That is, the sum of the variances of the principal components is equal to the sum of the variances of the original variables:

$$\lambda 1 + \lambda 2 + ... + \lambda Q = cm11 + cm22 + ... + cmQQ$$

A drawback of the conventional PCA is that it does not allow for inference on the properties of the general population. Traditionally, drawing such inferences requires certain distributional assumptions to be made regarding the population characteristics, which the PCA techniques are not based upon.

Table A5.2: Assumptions in Principal Component Analysis

1. **Enough number of cases.** The question of how many cases (or countries) are necessary to do PCA/FA has no scientific answer and methodologists' opinions differ. Alternatively, arbitrary rules of thumb in decreasing order of popularity include,
   Rule of 10. There should be at least 10 cases for each variable.
   3:1 ratio. The cases-to-variables ratio should be no lower than 3 (Grossman et al. 1991).

2. **No bias in selecting sub-indicators.** The exclusion of relevant sub-indicators and the inclusion of irrelevant subindicators in the correlation matrix being factored will affect, often substantially, the factors which are uncovered.
   Although social scientists may be attracted to factor analysis as a way of exploring data whose structure is unknown, knowing the factorial structure in advance helps select the sub-indicators to be included and yields the best analysis of factors. This dilemma creates a chicken-and-egg problem. Note this is not just a matter of including all relevant sub-indicators. Also, if one deletes sub-indicators arbitrarily in order to have a "cleaner" factorial solution, erroneous conclusions about the factor structure will result (Kim and Mueller, 1978a).

3. **No outliers.** As with most techniques, the presence of outliers can affect interpretations arising from PCA/FA. One may use Mahalanobis distance to identify cases, which are multivariate outliers and remove them prior to the analysis. Alternatively, one can also create a dummy variable set to 1 for cases with high Mahalanobis distance, then regress this dummy on all other variables. If this regression is non-significant (or simply has a low R-squared for large samples) then the outliers are judged to be at random and there is less danger in retaining them. The ratio of the regression coefficients indicates which variables are most associated with the outlier cases.

4. **Assumption of interval data.** Kim and Mueller (1978b) note that ordinal data may be used if it is thought that the assignment of ordinal categories to the data does not seriously distort the underlying metric scaling. Likewise, the use of dichotomous data is allowed, if the underlying metric correlation between the variables are thought to be moderate (.7) or lower. The result of using ordinal data is that the factors may be much harder to interpret. Note that categorical variables with similar splits will necessarily tend to correlate with each other, regardless of their content (see Gorsuch, 1983). This is particularly apt to occur when dichotomies are used. The correlation will reflect similarity of "difficulty" for items in a testing context; hence such correlated variables are called *difficulty factors*. The researcher should examine the factor loadings of categorical variables with care to assess whether common loading reflects a difficulty factor or substantive correlation.

5. **Linearity.** Principal components factor analysis (PFA), which is the most common variant of FA, is a linear procedure. Of course, as with multiple linear regression, nonlinear transformation of selected variables may be a preprocessing step, but this is not common. The smaller the sample size, the more important it is to screen data for linearity.

6. **Multivariate normality** of data is required for related significance tests. PCA and PFA have no distributional assumptions. Note, however, that a variant of factor analysis, maximum likelihood factor analysis, does assume multivariate normality. The smaller the sample size, the more important it is to screen data for normality. Moreover, as factor analysis is based on correlation (or sometimes covariance), both correlation and covariance will be attenuated when variables come from different underlying distributions (ex., a normal vs. a bimodal variable will correlate less than 1.0 even when both series are perfectly co-ordered).

7. **Underlying dimensions** shared by clusters of sub-indicators are assumed. If this assumption is not met, the "garbage in, garbage out" principle applies. Factor analysis cannot create valid dimensions (factors) if none exist in the input data. In such cases, factors generated by the factor analysis algorithm will not be comprehensible. Likewise, the inclusion of multiple definitionally similar sub-indicators representing essentially the same data will lead to tautological results.

8. **Strong intercorrelations** are not mathematically required, but applying factor analysis to a correlation matrix with only low intercorrelations will require for solution nearly as many factors as there are original variables, thereby defeating the data reduction purposes of factor analysis. On the other hand, too high inter-correlations may indicate a multi-collinearity problem and collinear terms should be combined or otherwise eliminated prior to factor analysis.

   a. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is a statistics for comparing the magnitudes of the observed correlation coefficients to the magnitudes of the partial correlation coefficients. The concept is that the partial correlations should not be very large if one is to expect distinct factors to emerge from factor analysis (Hutcheson and Sofroniou, 1999). A KMO statistic is computed for each individual sub-indicator, and their sum is the KMO overall statistic. KMO varies from 0 to 1.0. A KMO overall should be .50 or higher to proceed with factor analysis (Kaiser and Rice, 1974), though realistically it should exceed 0.80 if the results of the principal components analysis are to be reliable. If not, it is recommended to drop the sub-indicators with the lowest individual KMO statistic values, until KMO overall rises above 50.

   b. The Bartlett's test of sphericity is used to test the null hypothesis that the sub-indicators in a correlation matrix are uncorrelated, that is to say that the correlation matrix is an identity matrix. The statistic is based on a chi-squared transformation of the determinant of the correlation matrix. However, as Bartlett's test is highly sensitive to sample size.

Table A5.3: Comparison of e-Readiness indicators used in 2008 and 2006

Indicators for Environment

Category	Indicators used in 2006	Indicators used in 2008
Market Environment	Competition in the cellular market • *Number of players* • *Market share other than top player's share* • *Growth of the number of players in the cellular market*	Competition in the cellular market • *Number of players* • *Growth of no. of players*
	Competition in the Telecom market • *Number of players* • *Market share other than top player's share* • *Growth of the number of players in the telecom market*	Competition in the Wireless including WLL(F) market • *Number of players* • *Market share other than top player's share*
	Competition in the ISP market • *Number of players in the ISP market* • *Market share other than top player's share* • *Growth of the number of players in the ISP market*	Competition in the ISP market • *Number of players*
	Proportion of software and services export to total export from the state	
Political and Regulatory Environment	Duration of implementation of ICT Policy in the State	Policy Documentation Enabling/ Facilitating the ICT Policy • *Legal ICT Policy* • *Security ICT Policy* • *Is the issue of IPR addressed in the ICT policy?* • *Does a state level ICT Action Plan exist?*
	Range of policies taken for e-Governance • *Is there a section in the IT policy document on (a) Enabling/Facilitating policy, (b) Regulatory Policy, (c) Legal Policy* • *Is there a performance matrix of the state for monitoring policies* • *Does a supplementary budget exist for state level e-Governance projects* • *Is there a Mission/Objectives/Strategies and Tactics (MOST) document for e-Governance projects* • *Is there a transparent policy for public private partnerships (PPP) for e-Governance activities* • *Have you enacted the IT Amendment Act 2008 which is applicable to all states* • *Is there a law on regulation of digital signatures and encryption*	Policy Implementation • *Institutional mechanism to implement and review progress of the ICT policy* • *Effective legal mechanism to tackle the problem of piracy of ICT products* • *Have you adopted the IT Amendment Act 2008 which is applicable to all states?* • *Does your State/UT have separate cyber laws that confer legal status to electronic transactions and documents?* • *Do you have a legal provision for digital signatures and encryption?*

Category	Indicators used in 2006	Indicators used in 2008
	Range of policies taken for ICT companies • *Have any concessions been given to industries/companies for ICT activities* • *Are subsidised utilities provided to ICT firms* • *Any sales tax concessions have been given to ICT companies* • *How much time does it take to get clearance for starting an ICT business from the nodal agency/authority*	Structural Policy/Government promotion of ICT activity in private sector • *Is there a provision for encouraging ICT activities in private sector industries/companies thru concessions?* • *Are subsidised utilities available to ICT firms in your State/UT* • *Is there a provision for a sales tax concession for ICT companies?* • *Has a single window policy been adopted for the clearance of ICT businesses?* • *How much time does it take to get clearance for starting an ICT business from the nodal agency/authority?*
	Range of security policies • *Is there a section in the IT policy document on Security Policy* • *Is the issue of IPR addressed in the ICT policy* • *Is there effective legal machinery to tackle the problem of piracy of ICT products*	Futuristic Approach of Government • *Are there any initiatives taken under the public private partnership mode for the development of ICT infrastructure?* • *Do you feel the need to store tacit knowledge, i.e. the experience/ know-how gained by the government departments over the years?* • *Do you have a mechanism to store tacit knowledge?* • *Do you have a backup contingency plan in case of IT communication system failure?*
		Duration of Implementation of ICT Policy in State
		How often is the ICT policy amended?
Infrastructure Environment	Proportion of villages with Village Public telephones (VPTs)	Rural Urban Disparity in teledensity
	Teledensity	School Infrastructure
	Rural/Urban teledensity	ICT Infrastructure in Statf
	Cellular Teledensity	VPN equipment
	Percentage of schools with computer labs	Network Availability
	Percentage of schools with Internet access	IT Security
Individual Readiness	Percentage of IT qualified teachers to total teachers	Percentage households with PCs
	Percentage of MCA to total technical students (masters)	Percentage of household with internet connection
	Percentage of households with PC	Percentage of household with cell phone
	Percentage of household with Internet connection	Percentage of household with telephone
	Percentage of household with mobilf	
	Percentage of household with telephone	

Category	Indicators used in 2006	Indicators used in 2008
Business Readiness	IT park density	IT Park density
	Percentage of IT companies to total companies in the State	Employment per IT park
	RCA of ICT export	IT jobs per million population
Government Readiness	Percentage of expenditure on technical education to total expenditure	Officials trained in ICT ● *% of top Government officials trained in ICT* ● *% of total Government Officials trained in ICT*
	Percentage of policies taken for IT readiness ● *Does ERP/online performance evaluation system packages exist* ● *Does separate ministry exist for ICT* ● *Does an intranet exist for Panchayati Raj Institutions (PRI)*	Website ● *Whether website available in local language* ● *Website content* o *Information about the government, its mandate, its structure* o *Information about government activities, schemes, projects etc.* o *Information about all government departments* o *A site meter* ● *Website portal* o *Citizen portal* o *Private firm portal* o *Government official portals* o *Non-profit organisation portal*
		ICT use by PRIs ● *Are PRIs equipped with intranet* ● *Plans to install the intranet application for PRIs in the next year?* ● *Training programmes for the PRI members*
Individual usage	Average monthly expenditure on ● *Internet access* ● *Cell phone* ● *Telephone*	Monthly expenditure incurred by households (Rs) on the following ● *Internet Access* ● *Cell phone* ● *Telephone (landline)* ● *Cable TV connection*
	Current year to year growth rate in the number of Internet users	
Business Usage	Share of companies using ● *Lease line* ● *ISDN* ● *VSAT*	

Category	Indicators used in 2006	Indicators used in 2008
Government Usage	Proportion of policies taken for ICT usage • *Agriculture* • *Health services* • *Transportation* • *Energy* • *Trade*	Has ICT been applied to any of the following fields? • *Agriculture* • *Health services* • *Transportation* • *Energy* • *Trade* • *Others*
	Have government employee records been computerised	Computerisation and its penetration • *Have government employee records been computerised* • *Does your State/UT government have a system for communication via internet/network with any of the following?* o *Government departments* o *Top government officials* o *Middle government officials* o *All government officials* o *Citizens*
	Status of accessibility of the information and services by the citizen • *Land Records* • *Movable Property* • *Land Registration* • *Stamp paper registration* • *Utilities Billing* • *Crime Registration* • *Municipality Administration* • *Death/Birth certificates* • *Documentation of policy*	Number of e-Governance projects successfully running for more than one year in the state
	Proportion of implemented e-Governance projects to the total initiated, ongoing and implemented e-Governance projects	Use of ICT • *Proportion of persons employed in government routinely used a computer at work* • *Proportion of persons employed in your government have access to the Internet?* • *Is Intranet used within your State/UT govt offices?*
	Proportion of workshops to the duration of IT policy	

Table A5.4: Population weighted e-Readiness scores for regions and states

States/Regions	PW Environment	PW e-Readiness	PW Usage	PW e-Readiness
Andaman and Nicobar	-0.003	0.001	0.005	0.001
Orissa	0.152	0.018	-0.014	0.057
West Bengal	0.611	0.424	0.544	0.582
East	**0.254**	**0.148**	**0.179**	**0.213**
Andhra Pradesh	0.337	0.298	0.275	0.336
Karnataka	0.282	0.635	0.293	0.451
Kerala	0.095	0.099	0.126	0.118
Lakshadweep	0.000	0.000	0.000	0.000
Puducherry	0.000	-0.003	-0.006	-0.003
Tamil Nadu	0.254	0.506	0.205	0.360
South	**0.161**	**0.256**	**0.149**	**0.210**
Arunachal Pradesh	-0.036	-0.035	-0.038	-0.040
Assam	0.468	-0.544	0.331	0.082
Manipur	-0.031	-0.062	-0.077	-0.063
Meghalaya	-0.065	-0.048	-0.009	-0.045
Mizoram	-0.026	-0.026	-0.020	-0.027
Nagaland	0.018	-0.067	-0.042	-0.034
Sikkim	-0.004	-0.004	0.001	-0.003
Tripura	0.019	-0.069	-0.082	-0.049
North-East	**0.043**	**-0.107**	**0.008**	**-0.022**
Bihar	-0.155	0.186	-0.015	0.009
Jharkhand	-0.080	-0.036	0.073	-0.016
UP	0.323	-0.122	-0.091	0.038
North	**0.029**	**0.009**	**-0.011**	**0.010**
Chhattisgarh	-0.044	-0.029	0.013	-0.022
Madhya Pradesh	0.480	0.120	0.074	0.247
Central	**0.218**	**0.045**	**0.044**	**0.112**
Chandigarh	0.010	0.013	0.014	0.014
Delhi	0.080	0.090	0.196	0.135
Haryana	0.163	0.179	0.038	0.141
Punjab	0.169	0.130	0.073	0.137
Rajasthan	-0.152	-0.182	0.014	-0.120
North-West	**0.054**	**0.046**	**0.067**	**0.061**

States/Regions	PW Environment	PW e-Readiness	PW Usage	PW e-Readiness
Goa	0.004	0.002	-0.001	0.002
Gujarat	0.320	0.094	0.280	0.254
D and DNH	-0.003	-0.002	-0.002	-0.003
Daman and Diu	-0.002	-0.001	-0.002	-0.002
Maharashtra	1.225	1.014	0.324	0.949
West	**0.309**	**0.221**	**0.120**	**0.240**
Himachal Pradesh	-0.022	0.044	0.041	0.024
J and K	-0.391	-0.301	-0.859	-0.569
Uttarakhane	-0.222	-0.113	0.223	-0.043
Northern Hilly	**-0.212**	**-0.123**	**-0.198**	**-0.196**

Note: The population Weights as been assigned as per the respective states shares of population in the respective region.

Table A5.5: Movements of states across categories between 2008 and 2006: Environment Index

Levels	2008	2006	Movement (to 2008 with respect to 2006)
L1	Karnataka Chandigarh Andhra Pradesh Maharashtra	Chandigarh Maharashtra Delhi Haryana Punjab Gujarat	Delhi Haryana Punjab Gujarat
L2	Tamil Nadu Delhi Kerala Haryana Punjab Gujarat Uttar Pradesh West Bengal Madhya Pradesh Assam	Karnataka Andhra Pradesh Tamil Nadu Kerala Uttar Pradesh West Bengal Goa	Karnataka Andhra Pradesh Goa
L3	Goa Orissa Puducherry Nagaland Tripura	Puducherry Himachal Pradesh Rajasthan Mizoram	Himachal Pradesh Rajasthan Mizoram
L4	Himachal Pradesh Chhattisgarh Rajasthan Sikkim	Madhya Pradesh Assam Orissa Nagaland Chhattisgarh Jharkhand	Madhya Pradesh Assam Orissa Nagaland Jharkhand
L5	Jharkhand Uttarakhand Andaman and Nicobar Bihar Manipur Jammu and Kashmir Meghalaya	Tripura Sikkim Uttarakhand Andaman and Nicobar Bihar Manipur Meghalaya	Tripura Sikkim
L6	Mizoram Lakshadweep Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu	Jammu and Kashmir Lakshadweep Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu	Jammu and Kashmir

upward movement | downward movement

Table A5.6: Movements of states across categories between 2008 and 2006: Readiness index

Levels	2008	2006	Movement (to 2008 with respect to 2006)
L1	Chandigarh Maharashtra Haryana Karnataka Tamil Nadu	Chandigarh Haryana Kerala	Kerala
L2	Delhi Punjab Andhra Pradesh Kerala West Bengal Bihar	Karnataka Tamil Nadu Delhi Andhra Pradesh	Karnataka Tamil Nadu
L3	Gujarat Goa Himachal Pradesh Madhya Pradesh Orissa Andaman and Nicobar	Maharashtra Punjab West Bengal Goa Uttar Pradesh Puducherry	Maharashtra Punjab West Bengal Uttar Pradesh Puducherry
L4	Uttar Pradesh Rajasthan Chhattisgarh Jharkhand Sikkim Uttarakhand	Gujarat Himachal Pradesh Madhya Pradesh Orissa Andaman and Nicobar Rajasthan Chhattisgarh Jharkhand Sikkim Uttarakhand Assam Meghalaya Lakshadweep	Gujarat Himachal Pradesh Madhya Pradesh Orissa Andaman and Nicobar Assam Meghalaya Lakshadweep
L5	Puducherry Assam Tripura Meghalaya Jammu and Kashmir	Bihar Jammu and Kashmir Mizoram Nagaland Manipur Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu	Bihar Mizoram Nagaland Manipur Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu
L6	Mizoram Nagaland Manipur Lakshadweep Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu	Tripura	Tripura

upward movement downward movement

Table A5.7: Movements of states across categories between 2008 and 2006: Usage index

Levels	2008	2006	Movement (to 2008 with respect to 2006)
L1	Chandigarh Karnataka Delhi Andaman and Nicobar		
L2	Kerala Tamil Nadu Andhra Pradesh West Bengal Gujarat Jharkhand Uttarakhand	Chandigarh Karnataka Delhi Chhattisgarh	Chandigarh Karnataka Delhi Chhattisgarh
L3	Haryana Maharashtra Punjab Himachal Pradesh Madhya Pradesh Rajasthan Chhattisgarh Sikkim Assam	Kerala Tamil Nadu Andhra Pradesh West Bengal Gujarat Jharkhand Haryana Maharashtra Punjab Himachal Pradesh Rajasthan Goa Mizoram Uttar Pradesh	Kerala Tamil Nadu Andhra Pradesh West Bengal Gujarat Jharkhand Goa Uttar Pradesh Mizoram
L4	Goa Uttar Pradesh Orissa Meghalaya Bihar	Andaman and Nicobar Uttarakhand Madhya Pradesh Sikkim Assam Orissa Meghalaya	Andaman and Nicobar Uttarakhand Madhya Pradesh Sikkim Assam
L5	Mizoram Nagaland	Bihar Nagaland Puducherry Lakshadweep Manipur Arunachal Pradesh Daman and Diu Tripura	Bihar Nagaland Puducherry Lakshadweep Manipur Arunachal Pradesh Daman and Diu Tripura
L6	Puducherry Lakshadweep Jammu and Kashmir Manipur Arunachal Pradesh Dadra and Nagar Haveli Daman and Diu Tripura	Jammu and Kashmir Dadra and Nagar Haveli	

upward movement | downward movement

Table A6.1: Hierarchy in e-Governance: analysis sheet

H1 – Advanced

State	Separate Institutional mechanism for e-Gov	Name	Acronym	Web presence of the concerned e-Governance Body	Documented Policy for e-gov	Road map for e-Gov	State e-Gov Mission Team (SeMT)	Separate task force for e-Gov	Separate e-Gov budget	Hierarchy Category
Andhra Pradesh	Yes	Andhra Pradesh Technology Services Limited[x]	APTS	www.apts.gov.in/	1	1	1	1	1	H1
Chandigarh	Yes	Society for Promotion of IT in Chandigarh[xx]	SPIC	http://spicindia.com	1	1	1	0	0	H1
Chhattisgarh	Yes	Chattisgarh IT and BT Promotion [xx]	CHiPS	http://www.chips.nic.in	1	1	0	1	1	H1
Gujarat	Yes	Gujarat Informatics Ltd: GoG company[x]	GIL	www.gujaratinformatics.com	1	1	1	1	0	H1
Karnataka	Yes	Department for e-Governance (also a Centre for e-Governance)		http://www.karunadu.gov.in0egovernance	1	1	0	1	1	H1
Kerala	Yes	Keral State IT Mission[xx]	KSIM	www.itmission.kerala.gov.in	1	1	1	1	1	H1
Madhya Pradesh	Yes	MP Agency for Promotion of Information Technology[xx]	MAP_IT	http://www.mapit.gov.in	1	1	1	1	1	H1
Punjab	Yes	Punjab State e-Governance Society[xx]	PSEGS	www.doitpunjab.gov.in	1	1	1	1	1	H1
Tamil Nadu	Yes	Tamil Nadu e-Governance Agency[xx]	TNeGA	http://www.tn.gov.in/tnega	1	0	1	1	1	H1

H2 – Medium

State	Separate Institutional mechanism for e-Gov	Name	Acronym	Web presence of the concerned e-Governance Body	Documented Policy for e-gov	Road map for e-Gov	State e-Gov Mission Team (SeMT)	Separate task force for e-Gov	Separate e-Gov budget	Hierarchy Category
Delhi	No				1	1	1	1	1	H2
Goa	Yes	Infotech Corp. of Goa*	Infotechgoa	www.infotechgoa.com	1	1	1	1	1	H2
Haryana	Yes	e-Governance Centre at Secretariat of IT**	———	http://haryanait.nic.in	0	1	1	0	1	H2
Jharkhand	Yes	Jharkhand Agency for Promotion of Information Technology**	JAP-IT		1	1	0	1	1	H2
Lakshadweep	Yes	Lakshadweep Information Technology Services **	LITSS	http://lakit.nic.in	0	1	1	1	1	H2
Maharashtra	No				1	1	1	1	0	H2
Orissa	No				1	1	1	1	1	H2
Rajasthan	No				1	1	1	1	1	H2
Uttar Pradesh	Yes	Centre for e-Governance**	CEG	http://ceg.up.nic.in	0	1	1	0	1	H2
Uttarakhand	Yes	Information Technology Development Agency*	ITDA	http://www.uttara.in/information_tech	0	1	0	1	0	H2
West Bengal	Yes	West Bengal Electronics Industry Development Corp Ltd**	Webel	http://www.webel-india.com	1	1	1	1	1	H2

H3 – Lower

State	Separate Institutional mechanism for e-Gov	Name	Acronym	Web presence of the concerned e-Governance Body	Documented Policy for e-gov	Road map for e-Gov	State e-Gov Mission Team (SeMT)	Separate task force for e-Gov	Separate e-Gov budget	Hierarchy Category
Andaman and Nicobar	No				1	1	1	0	1	H3
Arunachal Pradesh	No				0	1	1	0	0	H3
Assam	Yes	Assam Electronics Development Corporation Ltd*	AMTRON	www.amtron.in	0	0	0	1	0	H3
Bihar	Yes	Bihar e-Governance Services and Technologies Ltd***	BeST		0	1	1	1	0	H3
Dadra Nagar Haveli	No				0	0	1	1	0	H3
Daman and Diu	No		--------		0	1	1	1		H3
Himachal Pradesh	No				1	1	1	0	0	H3
Jammu and Kashmir	Yes	J and K e-Governance Agency**	JaKeGA		0	1	1	1		H3
Manipur	No				0	1	1	0	1	H3
Meghalaya	No				1	1	1	0	1	H3
Mizoram	No				1	1	1	0	0	H3
Nagaland	No				0	1	1	1	0	H3
Puducherry	Yes	Puducherry E-Governance Society*	PeGS		1	1	0	0	0	H3
Sikkim	Yes	Centre for Research and Training in Informatics (CRTI)*	CRTI		1	1	1	1	0	H3
Tripura	No				1	1	0	0	0	H3

Note: 1. Entries of 0 and 1 refer to 'Absence' and 'Presence' respectively.

2. * Government Company/Corporation/Agency/Body; ** Registered Society under DIT (Except Kerala where it is an autonomous body) *** JV between IL&FS and Gov of Bihar

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Department of Information Technology
Government of India

Questionnaire: e-Readiness Assessment of States and Union Territories 2008

Name of the State: _____

Name & Designation of the Respondent: _____

Responding Department of State/UT Government: _____

Address: _____

Telephone: _____ Fax: _____

Email: _____

Note: State-wise data to be collected
All information is to be given for the financial year 2007-08 unless stated otherwise

General ICT Policy for 2007-08

1 Does your State/UT government have a clearly defined ICT policy? (Yes/No) ☐

If yes, please attach the relevant document and go to Q 1.1. If no, go to Q 2.

1.1 In which year was the ICT Policy initiated? ☐

1.2 In which year was it last amended? ☐

1.3 How often is it amended? (average number of years) ☐

1.4 Is there a section in the ICT policy document on any of the following *(Please mark where relevant)*

(a) Enabling/Facilitating the ICT Policy ☐
(b) Legal ICT Policy ☐
(c) Security ICT Policy ☐

1.5 Is there an institutional mechanism to implement and review progress of the ICT policy? (Yes/No) ☐

1.6 Is the issue of IPR addressed in the ICT policy? (Yes/No) ☐

2 Does a state level ICT Action Plan exist? (Yes/No) ☐

3 Have you adopted the IT Amendment Act 2008 which is applicable to all states? (Yes/No) ☐

If **yes**, go to Q4. If **no**, pass on to the next question

3.1 Does your State/UT have separate cyber laws that confer legal status to electronic transactions and documents? (Yes/No) ☐

3.2 Does your State/UT have a legal provision for digital signatures and encryption? (Yes/No) ☐

4 Is there a provision for encouraging ICT activities in private sector industries/companies through concessions? (Yes/No) ☐

If yes, pass to Q4.1. If no, skip to Q5.

4.1 Please elaborate on the provision and/or provide the relevant document/extract.

_____

_____

_____

4.2 How often have these concessions been availed in 2007-08? ☐

5 Is there an effective legal mechanism to tackle the problem of piracy of ICT products? (Yes/No) ☐

6 Are subsidised utilities available to ICT firms in your State/UT? (Yes/No) ☐

If yes, go to Q6.1. If no, skip to Q 7

6.1 Who provides these subsidised utilities? (government/ministry/private) ☐

7 Is there a provision for a sales tax concession for ICT companies? (Yes/No) ☐

If Yes, go to Q7.1. If no, skip to Q 8.

7.1 How many ICT selling companies have availed of this subsidised rate? (Please give a percentage figure) ☐ %

8 Has a single window policy been adopted for the clearance of ICT businesses? (Yes/No) ☐

9 How much time does it take to get clearance for starting an ICT business from the nodal agency/authority? *(Please mark where relevant)*

(a) < 1 month ☐
(b) 1 –3 months ☐
(c) 3 – 6 months ☐
(d) 6 – 9 months ☐
(e) 9 – 12 months ☐
(f) > 1 year ☐

10 Are there any initiatives taken under the public private partnership mode for the development of ICT infrastructure? (Yes/No) ☐

If yes, please elaborate and give details below.

_____

_____

_____

_____

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Department of Information Technology
Government of India

FUNCTIONAL ASPECTS OF ICT IN THE STATE/UT 2007-08

11 Does a separate department exist for ICT within your State/UT government? (Yes/No) ☐

12 Is there a separate ICT department with a Secretary in your state? (Yes/No) ☐

13 Total number of ICT jobs (IT jobs in IT companies/IT Enabled Services (ITES)) *(as on December 2007).* ☐

14 Does the State/UT provide any of the following ICT infrastructures? *(Please mark where relevant)*

- IT Parks ☐
- State Wide Area Network (SWAN) ☐
- State Data Centres (SDCs) ☐
- District Data Center ☐
- Community information centers (CIC) ☐
- Community service centres (CSC) ☐

15 If provided, total number of IT Parks: ☐

16 Number of companies registered in IT parks ☐

17 Employment in IT parks (numbers) ☐

18 If provided, total number of CICs: ☐

19 If provided, total number of CSCs: ☐

20 Total number of registered Internet cafes: ☐

21 Number of registered ICT training centers: ☐

22 Total number of blocks: ☐

23 Number of blocks with optical fibres: ☐

24 Number of Wireless Local Loop (WLL) phones in rural areas: ☐

25 Total revenue in the Internet Service Provider (ISP) sector: ☐

26 Total revenue in the telecom sector: ☐

27 Range of price charged for internet connections (per 100 hours) ☐

28 Range of price charged for cellular connections ☐

29 Range of price charged for landline connections (without STD facility). ☐

30 Range of price charged for landline connection with STD facility (without ISD facility) ☐

31 Range of price charged for landline connection with ISD facility.

32 Has ICT been applied to any of the following fields? *(Please mark where relevant)*

- Agriculture ☐
- Health services ☐
- Transportation ☐
- Energy ☐
- Trade ☐
- Other (please specify) ☐

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Department of Information Technology
Government of India

33 Total number of schools:	
34 Number of schools with computer labs:	
35 Number of schools with internet access:	
36 Number of schools with websites:	
37 Total number of colleges:	
38 Number of colleges with computer labs:	
39 Number of colleges with internet access:	
40 Number of colleges with websites:	
41 Total number of universities:	
42 Number of universities offering ICT courses (minimum one year course):	
43 Number of universities/institutes with online courses:	
44 Number of universities with ICT facilities for students:	
45 Total number of teachers (schools + colleges + universities):	
46 Number of IT qualified teachers (holding an IT diploma/degree) teaching IT or another IT related subject:	

47 Intake of students in the following courses (in numbers)

Engineering graduates	_____
MCA	_____
BCA	_____
B.Sc Computers	_____
Diploma (ICT) (Minimum one year)	_____
12th pass (computer science subjects)	_____

FUNCTIONAL ASPECTS OF ICT IN THE STATE/UT GOVERNMENT 2007-08

48 Percentage of **top** government officials trained in ICT.	%
49 Percentage of **total** government officials trained in ICT.	%
50 What proportion of persons employed in your government routinely used a **computer** at work during the last **week** (please provide a percentage figure)?	%
51 Is Intranet used within your State/UT government offices? (Yes/No)	

52 Please give the proportion of use of the mediums through which your State/UT government departments connect to the Internet.

- Analog modem (dial-up via standard phone line) ____ %
- ISDN (Integrated Services Digital Network) ____ %
- DSL (ADSL, SDSL, VDSL etc.) ____ %
- Cable modem ____ %
- Other narrowband ____ %
- Other broadband ____ %
- Other (please specify)_____ ____ %
- Does not have internet ____

53 What proportion of persons employed in your government have **access** to the **Internet?** (please provide a percentage figure)? ____ %

54 Is there an official State/UT government web-site? (Yes/No) ____

54.1 If yes, please provide the Uniform Resource Locator (URL). ____

54.2 How many hits per day did your URL receive on average in 2007-08? ____

55 Is the government web-site available in the local language(s)? (Yes/No) ____

56 Does your State/UT official web-site have any of the following *(please tick all that exist)*

- Information about the government, its mandate, its structure ☐
- Information about government activities, schemes, projects etc. ☐
- Information about all government departments ☐
- A site meter ☐
- Other (please specify) _____

57 Number of departments having web-site in- a) Local languages (specify) ____

b) English ____

57.1 Is there a time-frame specified by the state government by which web-sites should be updated? (Yes/No) ____

57.2 If yes to 57.1, what is the time-frame? ____

58 What is the average time by which departments actually update their web-sites? ____

59 What proportion of official web-sites are interactive i.e. have a two way dialogue between the department and those the department provides services for? ____ %

60 Does the State/UT official web-site have portals with two way interaction for different users? *(Please mark where relevant)*

- Citizen portal ☐
- Private firm portal ☐
- Government official portals ☐
- Not-for-profit organisation portal ☐

61 Are Panchayati Raj Institutions (PRI) equipped with intranet? (Yes/No) ____

61.1 If no, are there any plans to install the intranet application for PRIs in the next year? (Yes/No) ☐

61.2 If yes, are there any training programmes for the PRI members? (Yes/No) ☐

62 Do you feel the need to store tacit knowledge, i.e. the experience/know-how gained by the government departments over the years? (Yes/No) ☐

62.1 If yes, do you have a mechanism to store tacit knowledge? (Yes/No) ☐

63 Do you have a backup contingency plan in case of IT communication system failure? (Yes/No) ☐

63.1 If yes, please state what this backup plan is?

_____

_____

_____

64 Does your State/UT utilise terrestrial links such as optical fibres? (Yes/No) ☐

65 Does your State/UT utilise LAN (Local Area Network) i.e. a network connecting computers and associated devices within a localised area such as a single building, department or site; it may be wireless? (Yes/No) ☐

66 Does your State/UT utilise WAN (Wide Area Network), a network connecting computers and associated devices within a wide geographic area such as a region or state? (Yes/No) ☐

67 Does your State/UT utilise VPN (Virtual Private Network) that creates a virtual tunnel through which the users have exclusive and secure connectivity independent of their location when using the public network? (Yes/No) ☐

67.1 If yes, is your VPN equipped with any of the following?

- A secured socket line ☐
- A voice and data communications system ☐
- All of the above ☐

68 Does your State/UT currently (not including what is planned in the future) have any of the following IT security measures? *(please tick all those that apply)*

- Virus checking or protection software which is regularly updated ☐
- Anti-spyware software which is regularly updated ☐
- Firewall ☐
- Spam filter
- Secured communication between clients and servers (e.g. SSL, SHTTP) ☐
- Authentication software or hardware for internal users (this verifies the identity of internal users through passwords, PIN codes or digital signature for example) ☐
- Authentication software or hardware for external users (this verifies the identity of external users) ☐
- Intrusion detection system ☐
- No IT security measures in place ☐

69 Does your State/UT government have a system for communication via **internet/network** with any of the following? (mark all that apply)

- Government departments ☐
- Top government officials ☐
- Middle government officials ☐
- All government officials ☐
- Citizens ☐

70 Have government employee records been computerised? (Yes/No) ☐

ICT INVESTMENTS WITHIN THE STATE/UT

71 Do you know about the annual e-Readiness report, a project of the Department of Information Technology of the Government of India, that ranks States according to their e-Readiness? (Yes/No) ☐

72 What steps have you taken in the last one-year to improve your position?

_____

_____

73 What was your investment in ICT development in the State/UT Government offices during 2007-08? (Rs. In lakhs) ☐

74 Fund allocation to ICT development within the state (Rs. in lakhs and percentage of total government expenditure) for 2007-08

State's contribution	☐	Rs.	☐	% of total budget
Centre's contribution	☐	Rs.	☐	% of total budget
Contribution by other funding agencies such as the World Bank or any other international agency	☐	Rs.	☐	% of total budget

75 How long on average does it take to see the benefits of your ICT investments once these investments have been implemented? ☐

76 Has ICT implementation empowered your government to respond more quickly to change? (Yes/No) ☐

77 Has greater ICT use improved the quality of government services? (Yes/No) ☐

78 Has greater ICT meant faster access to information? (Yes/No) ☐

Ministry of Communications & Information Technology
Department of Information Technology
Government of India

79 Were there any bottlenecks you faced while implementing ICT? (Yes/No) ☐

79.1 If yes, please elaborate briefly. *(Tick where applicable)*

a) Profit level too low to make investment in ICT

b) Quality of ICT service (lack of security, slow data communication etc.)

c) Lack of qualified personnel

d) ICT developing & maintaining cost too high

e) Any other (please specify)

80 If any, how did you get over the bottlenecks?(Please elaborate briefly)

_____

_____

_____

81 Were there any problems that arose due to the implementation of greater ICT applications that you had not foreseen? (Yes/No) ☐

81.1 If yes, please explain.

_____

_____

_____

82 In your opinion, what strategies, improvements and/or investments will help your state move up the e-Readiness ranking as placed in the NCAER e-Readiness Reports of the Department of Information Technology?

_____

_____

_____

_____

Ministry of Communications & Information Technology
Department of Information Technology
Government of India

e-Governance

NOTES AND DEFINITIONS:

e-Governance is the use of ICT in (1) the interaction between government and citizens (G2C) and the government and business (G2B), as well as (2) in internal government operations (G2G) with the aim to improve access to information and efficient delivery of public services.

Information Communication Technology (ICT) is encompassed in IT but more specifically refers to all e-enabled communication systems set up through IT such as communication networks etc. It includes any IT based communications policy.

Business Process Re-engineering (BPR) involves the fundamental rethinking and radical redesign of government processes to achieve dramatic improvements in government functioning in terms of cost, quality, service and speed.

Task Force is a team of functionaries and experts cutting across departments set up for reducing red-tapism in the government functioning.

Mission Team has a wider mandate than the task force as it has a specified time frame, project goals and generally a separate budget to achieve its mission.

Institution and Policy

1. Has your state adopted ICT based governance i.e. e-Governance? (Yes/No) ☐

1.1 If yes to Q1, what guides adoption of e-governance in your state? *(tick one or more of the following)*

a) The state is adhering to central government guidelines. ☐
b) The state is following the example set by the leading states in e-governance initiatives. ☐
c) The state is taking its own initiatives in adopting ICT enabled governance. ☐

1.2 If yes to Q1, what are the major objectives of adopting e-Governance? (list in terms of priority)

Objective	Ranking
Increasing Accountability	
Greater Inclusiveness (of disadvantaged/ marginalised groups)	
Increasing Responsiveness of Government	
Greater Transparency	
Cost Saving to Citizen	
Cost Saving to Government	
Others (specify)	

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Department of Information Technology
Government of India

2 Has business process re-engineering (BPR) been done to facilitate ICT adoption in governance? (Yes/No)

2.1 If yes to Q 2, list departments.

Departments	% reduction in process time due to BPR

3. Total number of departments under the government administration.

4. Number of departments having e-Governance projects.

5. Number of departments having computerisation of back office activities.

6. Number of departments having bio-metric smart cards i.e. financial inclusion programs through smart cards.

7. Is there a separate department for e-Governance with a secretary? (Yes/No)

7.1 If no to Q 7, is there a separate institutionalised mechanism to promote e-Governance? (Yes/No)

7.2 If yes to Q 7.1, specify.

_____

_____

8 Is there a documented policy for e-Governance activities? (Yes/No)

If yes, please attach the document.

9. Is there an e-Governance road map document? (Yes/No)

If yes, please attach the document.

10. Has a state e-Governance mission team (SeMT) been set up for e-governance projects? (Yes/No)

10.1. If yes to Q 10. is there a clearly defined mandate for the team? (Yes/No)

10.2 Is there a report that documents the activities of the SeMT? (Yes/No)

Please provide the document, if so.

11. Has a separate task force been set up for e-Governance projects? (Yes/No)

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Department of Information Technology
Government of India

Budget/ Financial Allowances

12. Is there a separate ICT budget? (Yes/No)	
12.1 If yes to Q 12, what percentage of the total budget goes to ICT?	%
13. Is there a separate e-Governance budget? (Yes/No)	
13.1 If yes to Q 13, what percentage of the total ICT budget goes to e-Governance?	%
13.2 If no to Q 13, are there any plans to invest in e-Governance in 2009-10? (Yes/No)	
13.3 If yes to Q 13.2, how much? (Rs. in lakhs)	
14. Total capital investment in ICT in last five years. (Rs. in lakhs).	
15. Total capital investment in e-Governance in last five years. (Rs. in lakhs).	

Dissemination and Capacity Building

16. Is there a structured awareness programme for promoting e-Governance activities? (Yes/No)

16.1 If yes to question 16, what is/are the medium/s? (Please tick whichever is applicable)

a) Print ☐
b) Radio ☐
c) Television ☐
d) Street shows ☐
e) Any other (please specify) ☐

17. Details of e-Governance workshops and training programmes.

Levels	Number of workshops/ training programmes (2007-08) (1)	Number of Participants (2007-08) (2)	Do you have a feedback system for the workshops/ training programmes? (Yes/No) (3)	Do you conduct workshops/training at different levels for the same set of participants (Yes/No) (4)
State-level				
District-level*				

* Please provide the number of districts in which programmes have been held in 2007-08 in bracket in column 1.

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Department of Information Technology
Government of India

Details of e-Governance projects

18. Number of e-Governance projects successfully running for more than one year in the state under various departments. [ ]
(for these projects provide details below)

Project Name (1)	Department concerned (2)	Year of initiation (3)	Budget (in Rs. Lakhs) (4)	Major service provided (5)

Ques 18 Continued

Project Name	Pilot study =1/ Full scale study =2	Type of project:		Name of Districts covered (as per plan)*	Name of Districts in which infrastructure has been put in place*	Name of Districts where it is actively being used *	Target group (if any, eg. Rural/ BPL/ SC/ ST etc.)	Population covered as per plan	No. of actual users	Is BPR done? (Yes=1, No=2)
		G2G=1 G2B=2 G2C=3	Only Public =1, Public-Private Partnership (PPP)=2							
(1)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)

* Please give the codes as provided in the attached sheet.

Ministry of Communications & Information Technology
Department of Information Technology
Government of India

19. Please list the e-Governance projects that were successfully initiated but failed to be completed or were interrupted midway and reasons for the same.

Project Name (1)	Depart-ment concerned (2)	Year of initia-tion (3)	Year of abandon-ment (4)	Scale of operation: Pilot =1/ Full scale study =2 (5)	No. of districts in which implemention was done (6)	Population covered by plan (7)	Reasons for failure (8)

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Department of Information Technology
Government of India

Nature and Quality of e-Governance Services

20. Nature of service and details about citizen charter (for details about citizen charter restrict to G2C projects).

Services (1)	Nature of service (information based=1, Interactive=2, Transaction based=3, Transforming=4) (Please see below for explanation) (2)	Is Citizen Charter provided (Yes=1, No-=0) (3)	If yes to Col. (3) is it displayed in a visible public place (Yes=1, No-=0) (4)	If yes to Col. (4) what language is it displayed in. (Only English=1, only local language=2, both=3) (5)	Deviation of time of delivery of service from Citizen Charter (6)
Land Records Registration					
Land Mutation					
Vehicle Registration					
Driving License					
Stamp paper registration					
Crime Registration					
Property Registration					
Property Tax					
Death/Birth Certificates					
Utilities Billing					
Tax Returns-Commercial Tax					
Right to Information (RTI)					
Literacy & Primary Education					
Management Information System for Agriculture					
Citizen Grievance Redressal					
Any Other*					

Q 20 Continued

(1)	(2)	(3)	(4)	(5)	(6)
Any Other*					
Any Other*					
Any Other*					

* Please add any relevant service(s) applicable for your state other than the ones mentioned above.

Code Col (2): a) Information based, i.e. a flow of information from Govt. to Citizens
b) Interactive, i.e. a two way dialogue between Govt. and Citizens
c) Transaction based, for example online application, online payment for a service etc.
d) Transforming, for example provoking a change in the organisational structure

21. Reduction in the number of trips to the dealing office by user's availing the service.

Services (1)	Codes: Completely eliminated=2; Partially Eliminated-=1; No effect=0 (2)	Under which project is the service provided (3)
Land Records Registration		
Land Mutation		
Vehicle Registration		
Driving License		
Stamp paper registration		
Crime Registration		
Property Registration		
Property Tax		
Death/Birth Certificates		
Utilities Billing		

Q 21 Continued		
Services	Codes: Completely eliminated=2; Partially Eliminated=1; No effect=0	Under which project is the service provided
Tax Returns-Commercial Tax		
Right to Information (RTI)		
Literacy & Primary Education		
Management Information System for Agriculture		
Citizen Grievance Redressal		
Any Other*		
Any Other*		
Any Other*		
Any Other*		

* Please add any relevant service(s) applicable for your state other than the ones mentioned above.

22. Penetration of computerisation. (only for G2C and G2B projects)

Services (1)	No. of users availing manual services (2)	Average waiting time for manual services (3)	No. of users availing computerised services (4)	Average waiting time for computerised services (5)
Land Records Registration				
Land Mutation				
Vehicle Registration				
Driving License				
Stamp paper registration				

Ministry of Communications & Information Technology
Department of Information Technology
Government of India

Q 22 Continued

Services (1)	No. of users availing manual services (2)	Average waiting time for manual services (3)	No. of users availing computerised services (4)	Average waiting time for computerised services (5)
Crime Registration				
Property Registration				
Property Tax				
Death/Birth Certificates				
Utilities Billing				
Tax Returns-Commercial Tax				
Right to Information (RTI)				
Literacy & Primary Education				
Management Information System for Agriculture				
Citizen Grievance Redressal				
Any Other*				
Any Other*				
Any Other*				
Any Other*				

* Please add any relevant service(s) applicable for your state other than the ones mentioned above.

23. What are the changes in terms of quality of delivery of services due to the implementation of e-governance in your State/UT government?

Services (1)	Implemented=1, Not Implemented=0 (2)	Transparent* (3)	Inclusive* (of disadvantaged/ marginalised groups) (4)	Accountable* (5)	Responsive * (6)	Cost Saving to*	
						Citizen (7)	Government (8)
Land Records Registration							
Land Mutation							
Vehicle Registration							
Driving License							
Stamp paper registration							
Crime Registration							
Property Registration							
Property Tax							
Death/Birth Certificates							
Utilities Billing							
Tax Returns-Commercial Tax							
Right to Information (RTI)							
Literacy & Primary Education							
Management Information System for Agriculture							
Citizen Grievance Redressal							

* Code: Not applicable=0; Very poor=1; Poor=2; Average=3; Good=4; Very good=5

Q 23 Continued

Services (1)	Impleme-nted=1, Not Impleme-nted=0 (2)	Transparent** (3)	Inclusive* *(of disadvantaged/ marginalised groups) (4)	Accountable** (5)	Responsive ** (6)	Cost Saving to**	
						Citizen (7)	Government (8)
Any Other**							
Any Other**							
Any Other**							
Any Other**							

* Code: Not applicable=0; Very poor=1; Poor=2; Average=3; Good=4; Very good=5

** Please add any relevant service(s) applicable for your state other than the ones mentioned above.

Constraints in adoption of e-Governance

24. Please list the government departments that have not adopted e-Governance and the reasons for the same.

Department	Reasons for lack of funds (1)	e-governance not applicable (2)	Any other (specify) (3)

References

Bhagwati, Jagdish and Charles W. Calomiris (ed), (2008), "Sustaining India's Growth Miracle", Columbia University Press

Chia Siow Yue, Nick Freeman, R. Venkatesan and S. V. Malvea, (2001), "Growth and development of the IT Industry in Bangalore and Singapore: A Comparative Study". Sterling Publishers Pvt. Ltd.

Economic Survey 2008-09, Department of Economic Affairs Economic Division, Ministry of Finance, Government of India

Economist Intelligence Unit Limited, 2009, "E-Readiness rankings 2009 – The usage imperative"

Gorsuch, R. L. (1983). "Factor Analysis". Hillsdale, NJ: Lawrence Erlbaum Associates

Hutcheson, G., and Sofroniou, N. (1999). "The multivariate social scientist: Introductory statistics using generalized linear models". Thousand Oaks, CA: Sage Publications

Impact Assessment of e-Governance Projects (2008), Department of Information Technology, Ministry of Communications and Information Technology, Government of India

Kim, J.-O., and Mueller, C. W. (1978a). "Introduction to factor analysis: What it is and how to do it". Newbury Park, CA: Sage Publications

Kim, J.-O., and Mueller, C. W. (1978b). "Factor Analysis: Statistical methods and practical issues". Newbury Park, CA: Sage Publications

Krishna, S., Ojha, A.K. and Barrett, M., 2000, "Competitive Advantage in Software Industry: An Analysis of the Indian Experience, *in Information Technology in Context*, Ashgate: Aldershot

M. Nardo, M. Saisana, A. Saltelli, S. Tarantola, A. Hoffman, E. Giovannini, (2005), "Handbook on constructing composite indicators: methodology and user guide"

NASSCOM's India ITES-BPO Strategy Summit 2006: Background and Reference Resource, 7-8 June 2006, Bangalore, India

Porter, Michael, 1990, "The Competitive Advantage of Nations", Free Press, 1990

United Nations e-Government Survey 2008, From e-government to Connected Governance Department of Economic and Social Affairs Division of Public Administration and Development Management

Unwin, Tim General Editor, (2009), "ICT4D Information Communication Technology for Development". Cambridge University Press 2009

World Economic Forum-INSEAD, 2009, "Global Information Technology Report 2008-09: Mobility in a Networked World"

List of Contributors

Department of Information Technology

1. **R Chandrasekhar IAS, Secretary, DIT**
   Prime Minister's Award for Excellence in Public Administration Winner, 2007-08

2. **SR Rao IAS, Addl. Secretary, DIT**
   Padmasree

3. **Shankar Aggarwal IAS, Joint Secretary, DIT**
   Qualification: MTech (Computer Technology) IIT-D

4. **Tulika Pandey, Addl. Director, DIT**
   Member of Institute of Electrical and Electronics Engineers

5. **Vineeta Dixit, Principal Consultant (NeGP Programme Management Unit)**
   Qualification: MBA (Marketing) The Business School, Jammu University
   MSc. (Social Policy & Development), London School of Economics

6. **Sulakshana Bhattacharya, Consultant, (NeGP Programme Management Unit)**
   Qualification: MA (International Communication and Development), London

List of Contributors

National Council of Applied Economic Research (Core Group)

1. **Mr. R. Venkatesan, Senior Consultant, Team Leader and Main Author**
   Qualification: B. Tech (IIT- Madras), PGDM (IIM Bangalore)
   Areas of Interest: Managerial Finance, Industrial Economics, ICT- Industry Study, Social Cost Benefit Analysis, Program/Project Evaluation
   email: rvenkatesan@ncaer.org, rvenkatesaniitmiimb@gmail.com

2. **Dr. Sucharita Sen, Senior Consultant, Co-Author**
   Qualifications: PhD (Regional Development), Jawaharlal Nehru University
   Area of Interest: Space and Economic Policy, Agriculture and Natural Resource Management, Globalisation and Livelihood
   email: ssen.jnu@gmail.com

3. **Dr. Wilima Wadhwa, Senior Consultant, Co-Author**
   Qualification: Ph.D (University of California - Irvine)
   Areas of Interest: Developmental & Macro Economics and Econometrics
   email: wilima@vsnl.com

4. **Mr. Siddharth Kumar, Consultant, Co-Author**
   Qualifications: MA (Economics), Delhi School of Economics
   Area of Interest: Welfare Economics, Macro Economics, International Trade
   email: siddharth@ncaer.org

5. **Ms. Diane Rai, Consultant**
   Qualifications: Masters in International Relations,
   Graduate Institute of International Studies, Geneva, Switzerland
   Areas of Interest: Development Economics, International Trade and Relations, Environment
   email: drai@ncaer.org

6. **Ms. Kiran Sheokand, Research Associate**
   Qualification: M.A (Economics), Delhi School of Economics
   Areas of Interest: Rural Housing and e-Readiness
   email: ksheokhand@ncaer.org

7. **Ms. Jaya Koti, Project Assistance**
   Qualification: M.A (Rural Development), IGNOU
   Areas of Interest: Rural Development, Composite Dataset Analysis
   email: jkoti@ncaer.org

8. **Mr. Udayan Namboodiri, Editor**

NATIONAL COUNCIL OF APPLIED ECONOMIC RESEARCH

Parisila Bhawan 11 Indraprastha Estate New Delhi 110 002 India
T +91 11 2337 8263 / 2337 9861-63 F +91 11 2337 0164
W. www.ncaer.org E infor@ncaer.org