Drivers of IT Penetration in Indian States

Chapter 3

Drivers of IT Penetration in Indian States

In the chapter on ranking all Indian states according to their e-preparedness, we considered various variables, which are indicative of the e-readiness of each state. Now efforts with regard to e-readiness in general lead to certain outcomes. These outcomes in turn have been caused by some policy initiatives. The distinction between outcome variables and their drivers is blurred in our earlier analysis as we were more concerned about whether the variables indicate e-readiness or an effort in that direction. In this chapter, we distinguish between outcome variables and their causes. Two outcome variables, one showing business outcome and the other individual outcome are considered for analysis. We try to find out the main drivers of these outcomes.

Building a model, which involves a cause-effect relationship, gives rise to certain queries about the validity of the postulated relationships. Assessing causal effects require a strong theoretical framework specifying a particular causal channel in a particular context, which provides a theoretical basis for specifying determining factors, which can be credibly argued to be exogenous to the outcomes of interest. The modern formulation of the problem of causal analysis is based on the fundamental notion of counterfactual for an individual, state, country, or other unit. For example, in our case a state 'i' may witness a certain outcome (Y_{i0}) if it takes a particular policy and a different outcome (Y_{i1}) if it does not. The difference between these two outcomes gives the causal effect of the policy. But we have data for only one of these outcomes and hence the other outcome-counterfactual is missing. Thus causal effects cannot be estimated without some type of assumption or restrictions arising out of inherent unobservability of the counterfactual.

Cross-sectional data from our surveys last year and this year for thirty-five states and union territories have been used for this analysis. This has been supplemented by appropriate data from secondary sources like Statistical Abstract of India, Handbook of Statistics on Indian Economy etc. A cross-sectional regression coefficient on any policy or other variables is estimated comparing values of outcome variable for different states, which have differing values of the explanatory variables and not by comparing different values of outcome variable that would occur if the explanatory variable were to vary for a single state. So when we run a cross-sectional regression in this context, the assumption is that the counterfactual for a particular state can be accurately estimated from values of outcome variable of other states.

More than the causal nature of the relationship our endeavor is to find those policies that effect the outcome variables significantly. The framework of analysis that we use is to consider an outcome variable from this years survey and try to find out how it is affected by policy variables from last year's survey data. The assumption we are making in the process is that it takes atleast one year for policy variables to have some effect on the outcome variables. Thus this years policy variables have been excluded from the analysis. Such an assumption has more to do with non-availability of data beyond last year than any other reason. All the explanatory variables are policy dummies, which take the value of one for policy taken, or zero otherwise. The model can be understood from the following equation:

$$Y_i = \alpha_i + \beta_i D_i + \varepsilon_i$$

i = 1 to 35, various states and union territories
D_i = 1 when the answer to whether a policy is taken is 'yes'
= 0 if the answer is 'no'
Y_i = outcome variable

We have used the ratio of IT exports to Total exports across the states as the business outcome variable. The policy variables that have been considered for the analysis are presented in the Table 3.1.

Chapter 2

E-Readiness Index of the States in India 2004

2.0 Introduction

The value of the e-Readiness index at the state level reflects the capacity of a state to participate in the networked economy vis-à-vis the other states. In continuation to last year's work and in the light of new data available the states have been ranked using the same methodology, though a different framework of analysis has been used. Drawing upon last year's experience with data being made available by the states, the questionnaire was designed more comprehensively to include more relevant questions along with appropriate consistency checks. This has allowed us to include more variables (91) compared to last year's (58). In addition to a change in framework of analysis we have also refined some of last year's questions to leave little room for vague answers. There have been some notable shifts in the ranking based on this year's data compared to the previous year, though they are not strictly comparable.

2.1 Framework of Analysis 2004

The framework used in the study is based upon the following premises:

- 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;

The logical underpinning being the environment for ICT offered by the concerned state governments, the readiness of the key stakeholders (individuals, businesses and government) to use ICT and finally usage of ICT by these various stakeholders, correctly reflects a state's e-readiness.

We measure e-readiness of the states through a Factor Analytic model-Principal Component Analysis. The principal component analysis is a multivariate choice method. This approach develops a composite index by defining a real valued function over the relevant variables objectively. Given a set of explanatory variables if we have to select the most important variable or a limited number of variables from the set, principal component analysis helps. The principle of this method lies in the fact that when different characteristics are observed about a set of events, the characteristic with more variation explains more of the variation in the dependent variable compared to a variable with lesser variation in it. Therefore, the issue is one of finding weights to be given to each of the concerned variables. Weight to be given to each of the variables is found out based on the principle that the variation in the linear composite of these variables should be the maximum. Once the weight to be given to each of these variables is decided, then we can focus on constructing the composite index.

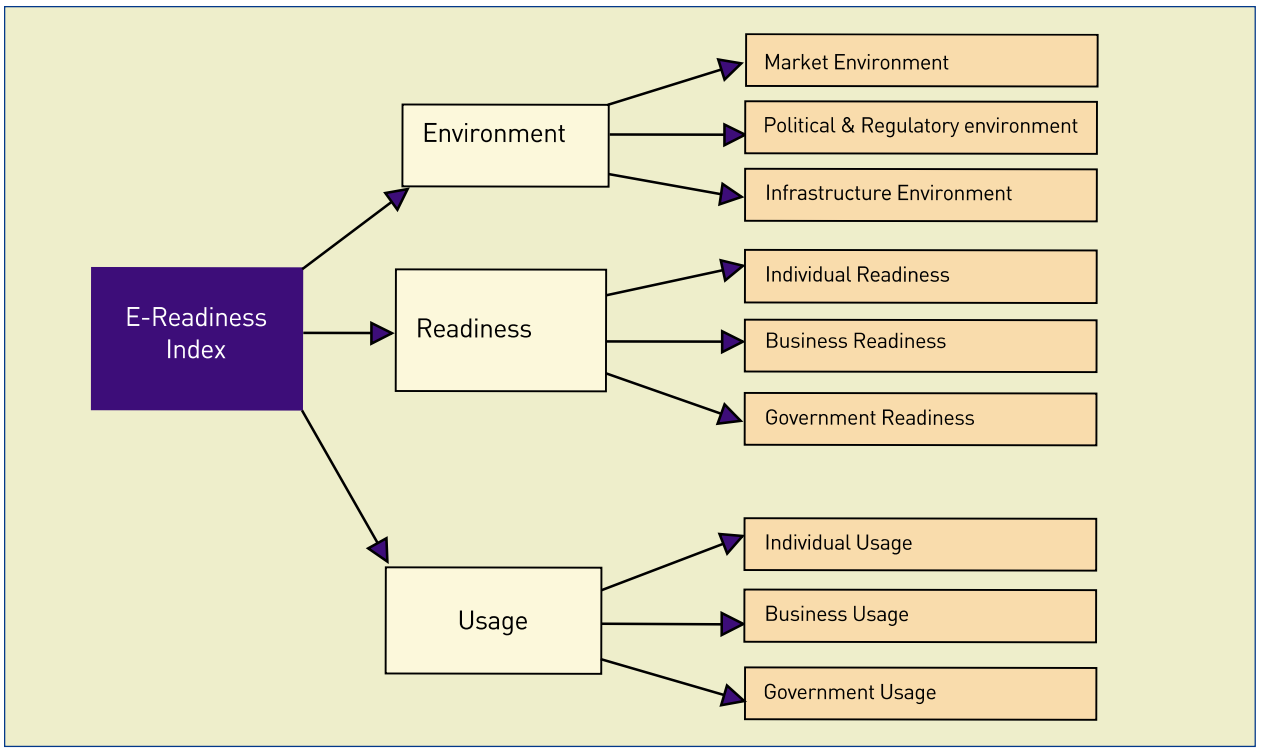
The main purpose of this modelling exercise is to quantify the levels of achievement of each state in terms of e-readiness index (composite) based on certain relevant characteristics. The logic of the exercise flows from the simple assumption that higher the levels of these characteristics, higher would be the levels of e-readiness.

Identification of the levels of e-readiness at the state level requires a three-step procedure.

1. Identification of the most important characteristics that represent e-readiness.
2. Identification of appropriate measures of those characteristics.
3. A rating of states based on composite index, which reflects the position of a particular state, as indicated by the comparative position of important characteristics identified in step 1.

The e-readiness index developed by us is based on three broad categories 'Environment', 'Readiness' and 'Usage' as shown in Figure 2.1.

Figure 2.1: The Networked Readiness Index Framework



These have been sub-divided into various user categories. The complete list of indicators and sub-indicators are presented in Annex II. Appropriate variables have then been selected which best reflects the chosen categories. Since many factors affect the level of advancement of a state in terms of information and communication technology, it is essential to form a composite index that incorporates a large number of relevant variables into it. There are different ways to form a composite index where all the selected indicators are represented by one single indicator that facilitates easier comparison of the states. The key issue in this integration process, however, is the identification of the weights that have to be assigned to each variable. As explained the Principal Component Analysis has been chosen as the best known approach for constructing a single composite index out of a large number of variables with the help of a quantitative database. The details of the approach is given in Annex I. The weighting scheme of the variables through principal component analysis allows the model to determine weights based on the data itself and thus reduces the possibility of imposition of any external subjectivity in the composite index. We have discussed the characteristics of the principal component analysis and various other methods of forming composite index and the related advantages and disadvantages in the introductory chapter.

2.2 Data Sources

As mentioned earlier, our model considers three broad parameters to construct the e-readiness index at the state level. The variables representing these parameters are both quantitative and qualitative. The qualitative data was appropriately transformed into quantitative form for the purpose of the model.

Data for this analysis was collected both from secondary data sources like DoT Annual Statistics, Statistical Abstracts, Economic Survey, Census publication and various web sites and from the survey of the various departments of the state governments with a well structured questionnaire. The raw data was then transformed into variables representing

indicators and sub-indicators wherever required using appropriate normalising factors. This transformation of the raw data into relevant variables is essential to maintain the comparability of the indicators across the states.

Some of the indicators considered initially for the model were dropped due to their non-availability for the majority of the state as well as for data inaccuracy. We have dropped those indicators where sufficient data points are not available (if the data is not available in case of more than 50 per cent of the states). Otherwise, the data has been adjusted through appropriate interpolation and extrapolation norms in case of most of the variables for the states where the data is not available. Extrapolation norms are identified either through correlation with relevant explanatory variables or based on income criteria which are considered as the most effective means for this purpose. In some cases where extrapolation is not possible, the missing data has been replaced by an appropriate statistic.

2.3 Methodology

To compare the states 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 can 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 apriori and imposed externally.

We have used a multi-stage Principal Component Analysis to construct the e-readiness index of the states. Annex1 contains the details of this model. In case of multi-stage Principal Component Analysis, 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, when the variables are identified at various 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 subgroup of the identified components of e-readiness. The first principal factors obtained from the different subgroups 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 components of the broad indicators of e-readiness were used to obtain the composite e-readiness index. This method alleviates the necessity of taking more than one principal factor, since the correlations among the variables in a sub-group are generally high and consequently, the first principal component explains an adequate proportion of variation in the data matrix. This method has been extensively used because of its desired properties.

2.4 Results

The framework of analysis used this year has evolved from our exercise last year, feedback received from the concerned states and government departments, and in light of latest developments in the international arena regarding e-preparedness. Last year the e-preparedness index was calculated based on six groups (sub-indices):

- Network Access
- Network Learning
- Network society
- Network Economy
- Network Policy
- E-governance

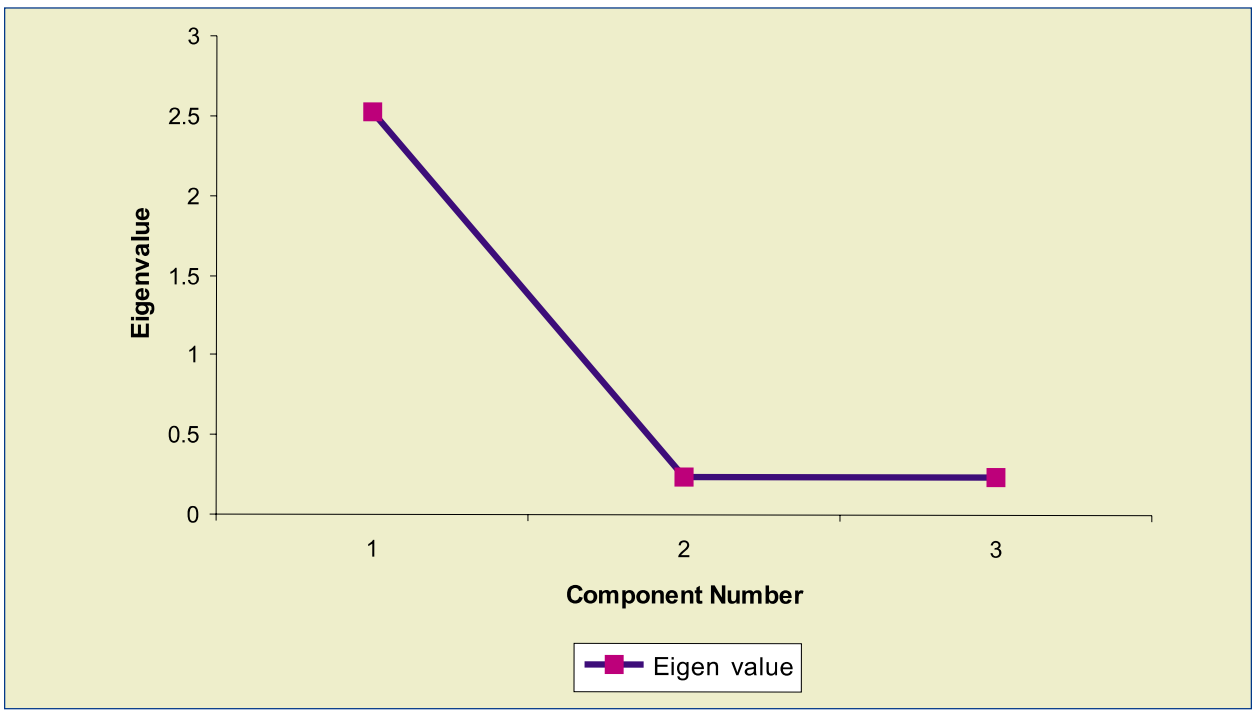
These groups had various sub-groups or indicators. The Networked Readiness Framework 2003-2004 has used a similar framework used for our study this year to rank countries across the World. The framework depicted in Figure 2.1 has been used because of its potential not only to evaluate a state's relative development in the use of ICT but also to allow for a better understanding of a state's strengths and weaknesses with respect to ICT. As mentioned in the introductory chapter other frameworks lacked this virtue.

The composite index of e-readiness has been derived from multi-stage Principal Component Analysis (PCA). In the first stage the variables in each user or environmental category were used for PCA. The component explaining the highest variation has been retained for further calculation of the sub-indices. The correlation between the retained principal

components and the original variables are used as weights to arrive at the index score for each state. In the second stage these sub-indices are combined through PCA to arrive at the indices of each categories, environment, readiness and usage. Finally, in the third stage we combine the indices of these categories to form the composite e-readiness index. A note of caution, the composite index computed through Principal Component Analysis is essentially a relative measure. An individual score only shows its relative strength compared to others and does not depict its e-readiness level in an absolute sense. Due to this, it is always advisable to analyse the scores in certain groups rather than considering them as single data points. In our analysis also, we have presented the states in six groups based on their strengths to participate in the networked world.

We have confirmed the statistical validity of inclusion of only the first principal component in our model through statistical tests. The model derived three principal components, as there are three variables included in it. The strength of each factor in representing the model is computed by the corresponding eigen values. The eigen value is also suggestive of the explanatory capacity of a particular component. Any principal component with an eigen value of 1.0 and above may be considered as an important factor in explaining the model. The first component of our model has an eigen value of 2.53 and all the other principal components has an eigen value less than 1.0. The percentage of variance being explained by the first principal component is more than 84 per cent. These facts along with the scree plot[1] below are indicative of the fact that the first principal component is suitable enough to be used for computing the composite index of e-readiness.

Figure 2.2: Scree Plot



2.5 The Composite E-Readiness Index

The PCA analysis used generated objective weights to be assigned to the indicators of e-readiness optimally. The procedure has already been outlined in the methodology section of this chapter. Following table show cases the weights and relative weights assigned to each indicator. As we can see, the model has assigned equal weights to all three indicators implying that they are equally important in influencing the overall index of e-readiness.

[1] A scree plot shows the contribution of the components in the model.

Table 2.1: The Weights of the Indicators for the Final Composite Index

Indicator	Weight	Relative weight (per cent)
Environment	0.577	33.33
Readiness	0.578	33.34
Usage	0.577	33.33

Based on these weights, we have combined the variables linearly to arrive at the composite index. The states have been classified into six groups depending on their composite e-readiness index score. Due to the nature of the composite index, it is better to study them in groups rather than compare them in terms of the magnitude of the composite index. The categorisation of the states based on their level of e-readiness is presented in the following Figure 2.3.

Figure 2.3: E-Readiness - Indian States

Amongst the leaders, Tamil Nadu has improved its e-Readiness by consciously working on readiness and environment, especially involving the private sector in development of ICT infrastructure and through evolution of ICT growth in state level policies. Kerala has strategised in utilizing the competitive advantage of the state (high proportion of literacy, awareness of citizens) to pole-vault in the usage segment. Madhya Pradesh's ascent is largely on account of the private sector involvement in developmental activities (e.g. e-Choupal). Gujarat has tried to replicate its success in industry segments such as petro-chemicals, chemicals etc. in the ICT sector but marginally fails in graduating to the leader's group in the first round of iteration.

Table 2.2 presents a distinctive picture of the region-wise distribution of the states according to their status of e-readiness.

Table 2.2: Regional Distribution of the States/UTs in terms of e-Readiness Index

Region	Leaders	Aspiring leaders	Expectants	Average achievers	Below Average Achievers	Least Achievers	Total
Central	0	0	1	1	0	0	2
East	0	0	1	1	1	2	5
North	1	3	0	2	2	0	8
North-east	0	0	0	1	3	4	8
South	3	1	1	0	0	1	6
West	1	2	0	1	0	2	6

North- Punjab, Uttar Pradesh, Uttaranchal, Jammu & Kashmir, Himachal Pradesh, Haryana, Delhi, Chandigarh
South- Tamil Nadu, Pondicherry, Lakshadweep, Kerala, Karnataka, Andhra Pradesh
Central- Chattisgarh, Madhya Pradesh
East- Andaman & Nicobar Islands, Bihar, Jharkhand, Orissa, West Bengal
West- Dadra & Nagar Haveli, Daman & Diu, Goa, Gujarat, Maharashtra, Rajasthan
North-east- Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura

2.6 Sub-Index: Environment

The Environment sub-index is designed to measure the degree of conduciveness of the environment that a state provides for the development and use of ICT.

This sub-index has been computed based on three indicators, Market Environment, Political and Regulatory Environment and Infrastructure Environment. These indicators can be further sub-divided into the sub-indicators shown in Table 2.3.

Table 2.3: Indicators of Environment

Indicator	Sub-Indicators
Market Environment	• ICT exports / total exports • Competition in the ISP sector: Number of Players; Market share of lead players (in per cent); Any government organisations getting benefits vis à-vis private sector; Range of price charged for internet connections (per 100 hrs). • Competition in the cellular sector: Number of Players; Market share of lead players (in per cent); Any government organisations getting benefits vis à-vis private sector; Range of price charged for internet connections (per 100 hours). • Competition in the cellular sector: Number of Players; Market share of lead players(in per cent) • Competition in the telecom sector: Number of Players; Market share of players (per cent).
Political and Regulatory Environment	• Does IT policy exist? • Is there a section in the in the IT policy document on the following: - Enabling Policy. - Regulatory Policy. - Legal Policy. • Does a state level action plan exist? • Does a supplementary budget exist for state level projects? • Has a task force been set up for e-governance projects? • Has an e-governance committee been set up? • Is there a MOST document for e-governance? • Is there any state policy to promote state level ICT projects? • Is there a transparent policy for public private partnerships for e-governance activities? • Do laws relating to ICT exist? • Are there cyber laws that confer legal status to electronic transactions and documents? • Is there a law on regulation of digital signatures and encryption? • Does the state have a security policy that applies to all government agencies? • Have tax concessions been given? • Is there any provision for deferred taxes? • Have incentives been given to software companies? • Are subsidized utilities provided to ICT firms? • Are special rates available for internet access? • Is the issue of IPR addressed in ICT policy? • Is there effective legal machinery to tackle the problem of piracy of ICT products? • Number of initiatives taken for telecom regulation and ICT trade policy?
Infrastructure Environment	• Number of villages with VPT / total villages. • Number of public pay telephones / thousand population. • Waiting time for telephone lines (Number of days). • Total number of telephone mainlines / total population. • Total number of cellular connections / hundred fixed lines. • Number of schools with Internet access / total schools • Number of schools with Computer labs access / total schools. • Number of schools with websites / total schools. • Number of colleges with Internet access / total colleges. • Number of colleges with Computer labs access / total colleges. • Number of colleges with websites / total colleges. • Is there effective usage of satellite and wireless networks in government and businesses? • Is there dedicated infrastructure for: - Gateway (e-payment/e-government) - OFC/Networks. - IT parks. - Earth Stations. - Technology being used for internet. - Cable connections. • Number of universities offering ICT courses / total number of universities. • Number of universities or Institutes with online courses / total number of universities.

The variables that emerged significant while computing the Environment sub-index are presented in Table 2.4. These variables have been accorded significant weight by the model in comparison to the other variables. Thus states having higher value in these variables are likely to get a higher rank in terms of the Environment sub-index.

Table 2.4: Environment: Indicators of Significance

Market	Political and Regulatory	Infrastructure
• Number of players in the cellular sector. • Competition in the ISP sector: Number of Players • ICT exports / Total exports	• Is there a section in IT policy document on enabling policy? • Is there a section in IT policy document on legal policy? • Is there any state policy to promote state level ICT projects? • Do laws relating to ICT exist? • Have incentives been given to software companies? • Are subsidized utilities provided to ICT firms?	• Total number of telephone mainlines / total population. • Total number of cellular connections / '00 fixed lines. • Number of schools with access to Computer labs/ total schools. • Number of colleges with Internet access / total colleges. • Number of colleges with access to Computer labs / total colleges. • Is there a dedicated infrastructure for OFC/Networks?

The categorisation of the states based on "Environment sub-index" is shown in Table 2.5 below:

Table 2.5: Categorisation of the States/UTs Based on Sub-Index-Environment

Levels	States
Level 1	Chandigarh, Goa, Tamil Nadu, Gujarat, Punjab, Kerala, Haryana, Maharashtra, Andhra Pradesh
Level 2	Pondicherry, Chattisgarh, Karnataka
Level 3	West Bengal, Sikkim, Uttar Pradesh, Orissa, Delhi
Level 4	Madhya Pradesh, Jammu & Kashmir
Level 5	Uttaranchal
Level 6	Mizoram, Meghalaya, Assam, Himachal Pradesh, Jharkhand, Rajasthan, Lakshadweep, Tripura, Manipur, Arunachal Pradesh, Dadra & Nagar Haveli, Andaman & Nicobar Islands, Nagaland, Daman & Diu, Bihar

The region-wise distribution of the states according to their status of "Environment sub-index" is given in Table 2.6 below:

Table 2.6: Regional distribution of States/ UT's based on Environment Sub-Index

Region	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Total
Central	0	1	0	1	0	0	2
East	0	0	2	0	0	3	5
North	2	0	2	1	1	2	8
North-East	0	0	1	0	0	7	8
South	3	2	0	0	0	1	6
West	3	0	0	0	0	3	6

Almost half the states fall in level 6 in this category. This implies that there is lot to be achieved in terms of providing a sound environment for ICT development in most of the states.

2.7 Sub-Index: Readiness

The Readiness of a state in this context measures the capability of the principal agents of an economy (individual, business and government) to leverage the potential of ICT. Readiness sub-index comprising of sub-indicators representing individual readiness, business readiness and government readiness are shown in Table 2.7 below:

Table 2.7: Indicators of Readiness

Indicators	Sub-Indicators
Individual Readiness	• Household expenditure on education / total households expenditure. • Number of IT qualified teachers / total teachers. • Total number of technical students / total students. • Number of households with radios / total population. • Number of households with T.V / '000 households. • Number of households with PC's / '000 households. • Per capita net state domestic product.
Business Readiness	• Total number of IT parks. • Total number of employment in IT companies / total number of IT parks. • Number of registered training centres / '000 population. • Total number of IT companies / total companies.
Government Readiness	• Does an intranet exist in government departments? • Total number of government websites. • Total number of websites in local language. • Do ERP/online Performance Evaluation System packages exist? • Does a PERT chart exist for new ventures? • Have any documents regarding architectural standards been published by the government? • Is there any provision for renowned consultants to build on the architectural standards? • Does a separate ministry exist for ICT? • Percentage of top officials trained in ICT/with access to computer training programme. • Number of government officials with online training programme.

The variables of significance in this category are presented in Table 2.8. Variables of significance for individual mainly depend on affordability. Thus, the state governments should lay special emphasis on income growth as well as fair distribution of that incremental income. Higher values for variables in the Business column depend on public private partnership. Governments should take appropriate steps so that private initiatives can flourish. To make governance effective, suitable measures should be introduced within the government machinery.

Table 2.8 : Readiness: Indicators of Significance

Individual	Business	Government
• Number of households with T.V / '000 households. • Number of households with PC's / '000 households.	• Total number of IT parks. • Total number of employment in IT companies / total number of IT parks.	• Total number of government web-sites. • Do ERP/online Performance evaluation system packages exist? • Have any documents regarding architectural standards been published by the government? • Is there any provision for renowned consultants to build on the architectural standards?

The categorisation of the states based on "Readiness sub-index" is presented in Table 2.9.

Table 2.9: Categorization of States / UT's based on Readiness score

Levels	States	Number of states
Level 1	Andhra Pradesh, Tamil Nadu, Delhi, Maharashtra, Karnataka	5
Level 2	Kerala, Gujarat, Punjab,	3
Level 3	West Bengal, Haryana, Chandigarh, Madhya Pradesh, Goa	5
Level 4	Uttar Pradesh, Meghalaya, Himachal Pradesh	3
Level 5	Orissa, Rajasthan, Assam, Mizoram, Sikkim, Pondicherry, Uttaranchal, Jammu & Kashmir, Jharkhand	9
Level 6	Lakshadweep, Chattisgarh, Arunachal Pradesh, Manipur, Tripura, Daman & Diu, Bihar, Andaman & Nicobar Islands, Dadra & Nagar Haveli, Nagaland	10

Table 2.10 represents the distinctive picture of the region-wise distribution of states according to the status of "readiness sub-index".

Table 2.10: Regional Distribution of States/ UT's based on Readiness sub-index

Region	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Total
Central	0	0	1	0	0	1	2
East	0	0	1	0	2	2	5
North	1	1	2	2	2	0	8
North-East	0	0	0	1	3	4	8
South	3	1	0	0	1	1	6
West	1	1	1	0	1	2	6

In this category most of the states fall in the last two levels. The distribution of states is less skewed than the "Environment sub-index".

2.8 Sub-Index: Usage

Usage aims at measuring the degree of utilisation of ICT by individuals, business and the government. The sub-indicators of this category are presented in Table 2.11.

Table 2.11 : Indicators of Usage	
Indicators	**Sub-Indicators**
Individual Usage	• Total number of households with internet connections / total households. • Number of ISDN subscribers / PC's in business. • Total number of households with cable TV connections / total households. • Penetration radios / '000 households.
Business Usage	• Total computers in business / total companies. • Companies involved in e-commerce / total companies
Government Usage	• WLL phones in rural areas / total number of villages. • Application of ICT in Agriculture. • Application of ICT in Health services. • Application of ICT in Transportation. • Application of ICT in Energy. • Application of ICT in Trade. • Total number of e-governance projects undertaken. • Have Government employee records been computerised. • Have Land Records been computerised. • Have Movable Property been computerised. • Facilities available online: Services-land registration. Stamp paper registration. Utilities billing. Crime registration. Municipality administration.

The various indicators of significance presented in Table 2.12, show the items, which have got higher weightage in computation of the composite index. Thus, these are the major components through which usage has been measured.

Table 2.12 : Usage: Indicators of Significance		
Individual	**Business**	**Government**
• Total number of households with internet connections / total households. • Number of ISDN subscribers / PC's in business. • Percentage of households with cable connections.	• Total computers in business / total companies.	• WLL phones in rural areas / total number of villages. • Application of ICT in energy. • Application of ICT in transportation. • Total number of e-governance projects undertaken. • Availability of stamp paper registration online. • Availability of utilities billing online. • Availability of municipality administration online

The states have been categorised in six levels according to their usage scores as follows in Table 2.13.

Table 2.13: Categorisation of States / UT's based on Usage score

Levels	States	Number of states
Level 1	Karnataka, Kerala, Haryana	3
Level 2	Pondicherry, Andhra Pradesh, Chandigarh, Punjab, Tamil Nadu, Delhi, Maharashtra, West Bengal	8
Level 3	Gujarat, Goa, Chattisgarh	3
Level 4	Madhya Pradesh, Uttar Pradesh, Himachal Pradesh, Orissa	4
Level 5	Sikkim, Lakshadweep, Jharkhand, Mizoram, Assam, Bihar, Manipur	7
Level 6	Andaman & Nicobar Islands, Nagaland, Rajasthan, Daman & Diu, Tripura, Uttaranchal, Meghalaya, Jammu & Kashmir, Arunachal Pradesh, Dadra & Nagar Haveli	10

The region-wise distribution of the Usage sub-index score levels is presented in Table 2.14.

Table 2.14: Regional Distribution of States/ UT's based on Usage Sub index

Region	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Total
Central	0	0	1	1	0	0	2
East	0	1	0	1	2	1	5
North	1	3	2	0	0	2	8
North-East	0	0	0	0	4	4	8
South	2	3	0	0	1	0	6
West	0	1	2	0	0	3	6

In this category more states are in the levels above average scores (Level 4) than the other two categories. However, seventeen states are still below average. So the relative standings of all three categories show that there is a lot to be achieved in terms of balanced regional development of ICT.

2.9 Relationship between Per Capita Net State Domestic Product and e-Readiness Index and its Components

Table 2.15: Correlation Coefficients between Per-capita Net State Domestic Product and Composite Index and its Components

Per-Capita Net State Domestic Product	E-readiness	Environment Score	Readiness Score	Usage score
	0.21	0.21	0.15	0.89

An attempt has been made here to approximate the e-readiness of a state through a single measure. Thus it would be an interesting exercise to see the relationship between a broad measure like per capita income and such an index. We wanted to find out whether there is any relationship between a measure of well being and e-readiness. As Table 2.15 and Figure 2.4 shows though the association between e-readiness index and its components and per-capita income are positive the strength of association is low except for Usage score. Though nothing can be inferred about causality from such figures strong association between per-capita income and usage score and not with the other components may imply

that usage is demand driven, where as environment and readiness are policy driven and not very much dependent on income of the state.

Figure 2.4: Scatter Plots Showing Relationships between Per Capita Net State Domestic Product and Composite E-Readiness Index and Sub-Indices

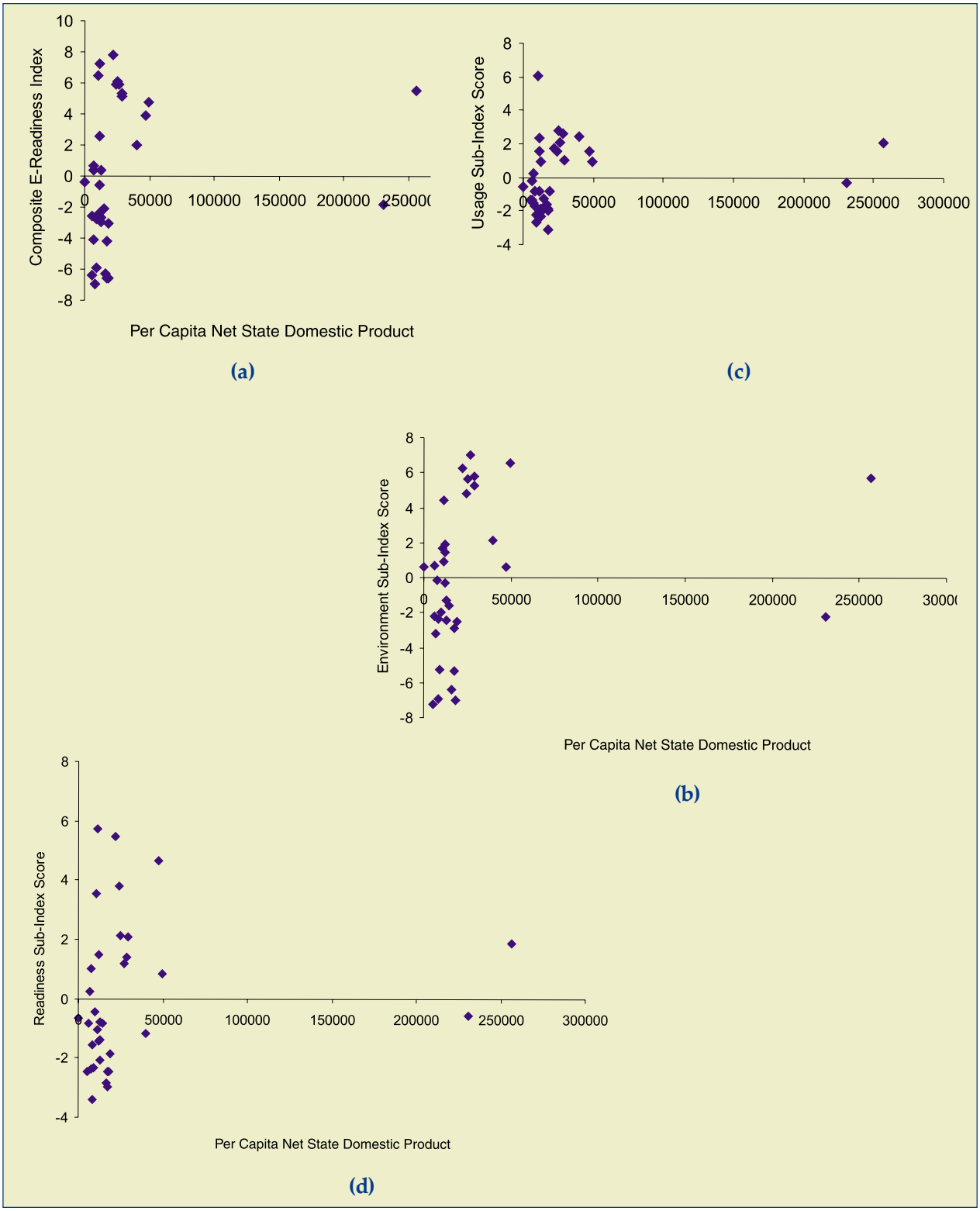
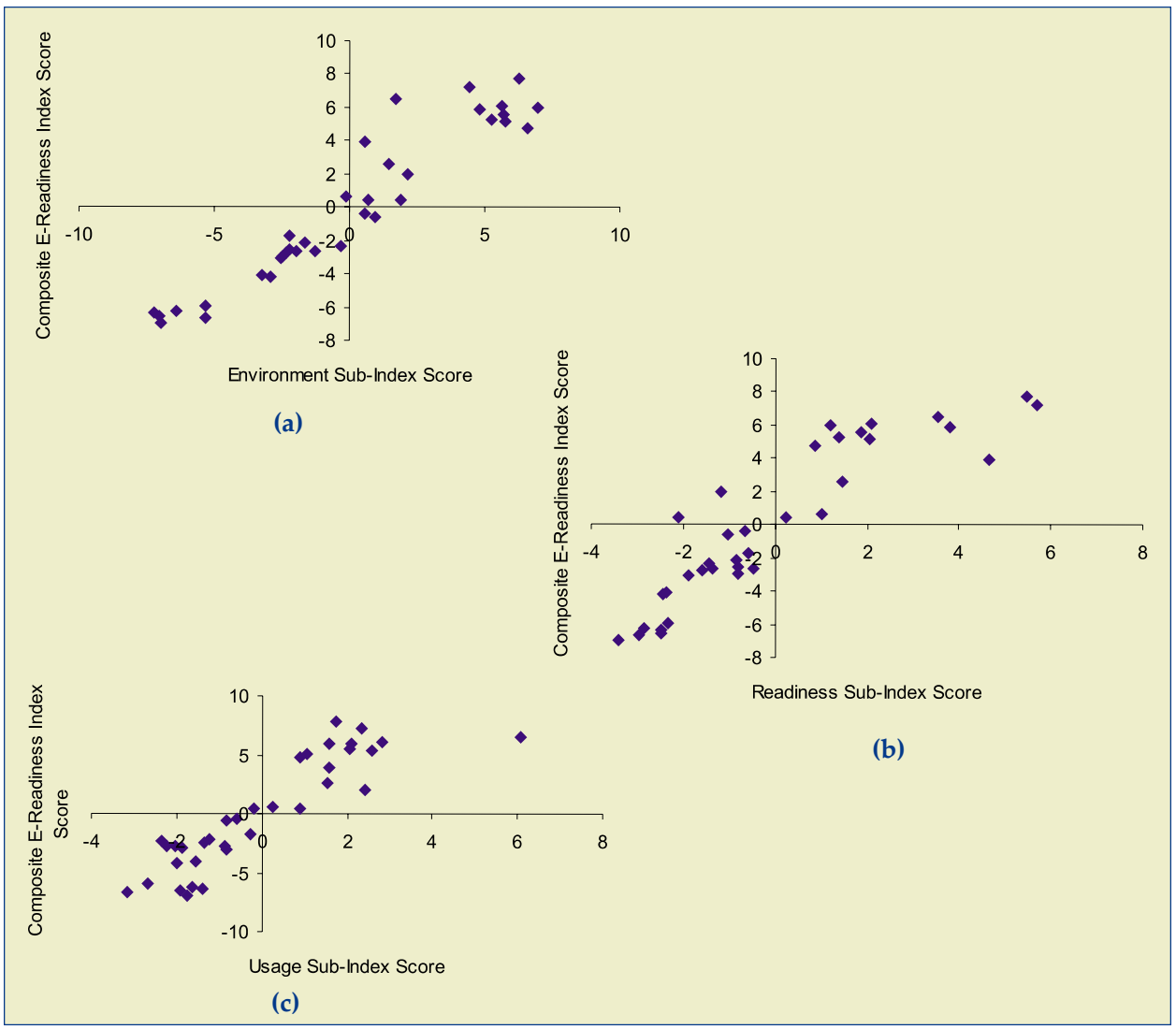


Table 2.16: Correlation Coefficients between E-readiness Index and its Components

E-readiness Score	Environment Score	Readiness Score	Usage Score
	0.95	0.90	0.89

A very strong positive relationship between E-readiness score and its components is depicted through Table 2.16 and Figure 2.5. This is to be expected, as the justification for adopting this framework was that environment should drive readiness and consequently usage would be the reflection of the state's e-readiness. These three aspects together make a state e-ready.

Figure 2.5: Scatter Plots Showing Relationships between Composite E-Readiness Index and the Sub-Indices

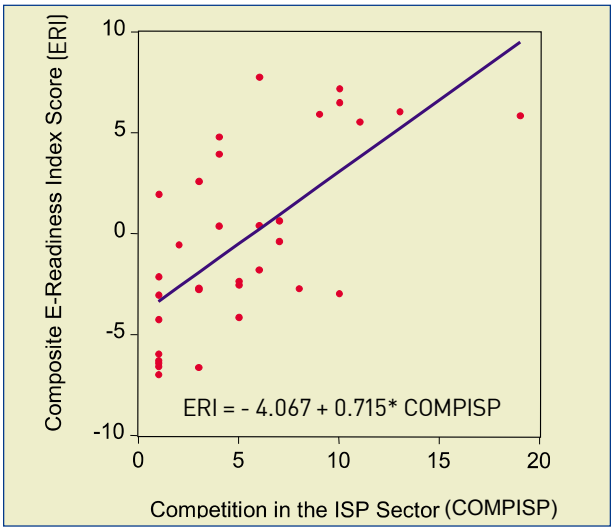


2.10 Relationship between Competition in the ISP Sector and E-Readiness Index

Theoretical literature on markets suggests that increase in competition among the sellers enhances consumer welfare. So it would be an interesting exercise to examine whether the competition in the ISP sector has had an effect on the E-Readiness of the states. Figure 2.6 below potrays a positive and significant relationship between competition in the ISP sector and E-Readiness scores of the states. Thus, ERI is seen to increase steadily as the competition in the ICT sector increases. So a policy towards increasing competition in the ICT sector

makes services more affordable which in turn results in increased usage by the key stake holders- individuals, businesses and government. As we have already seen increased readiness and usage of ICT increases the ERI of a state.

Figure 2.6: Relationship between Competition in the ISP Sector and E-Readiness Index



2.11 Relationship between Usage and Readiness

As hypothesized, readiness and usage score of a state should move in the same direction. A state having a high degree of readiness should be able to transform this ICT capability into higher usage. Table 2.17 and Figure 2.7 below shows a positive relationship between the two for the Indian states. This implies states with higher degree of readiness are also the states with higher usage score.

Table 2.17: Correlation between Readiness Score and Usage Score

Readiness score	Usage score
	0.76

Figure 2.7: Scatter Plot Showing the Relationship between Readiness and Usage Sub-Index Score

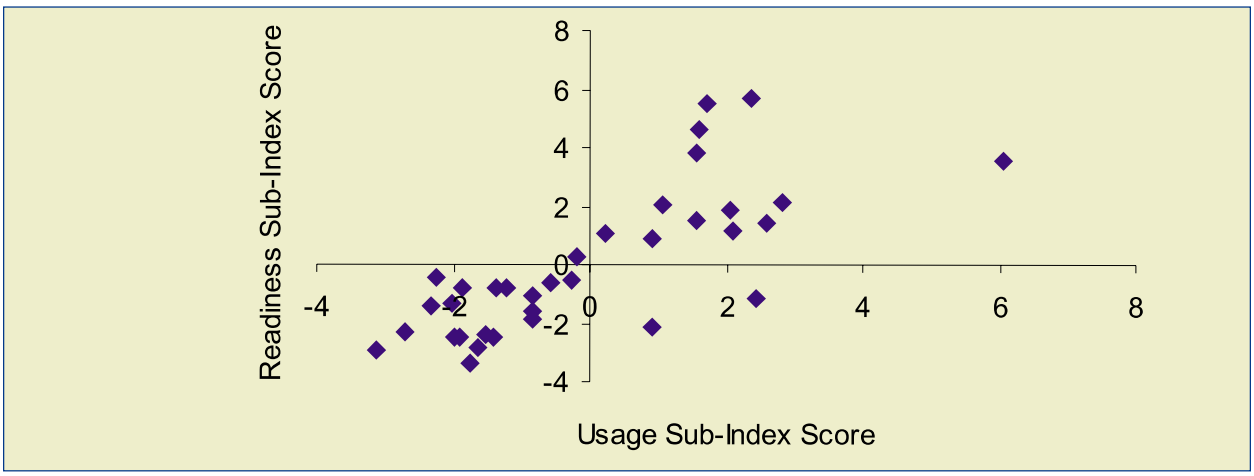


Table 3.1: Variables considered for analysis of business outcome	
Dependent Variable	**Independent Variables**
Share of IT exports in total exports of the state	Has the issue of IPR been addressed? Have sales Tax concessions been given to IT firms? Is there a dedicated infrastructure for IT? Is there a provision for deferred taxes for IT firms? Do cyber laws exist? Are subsidized utilities available for IT firms?

The results of running a least square regression model are shown in the following table. As can be seen, among the policy variables, whether subsidized utilities have been provided to the IT firms have the greatest impact on the outcome variable. This result is significant at 10% level. Thus states who have provided land, electricity, roads and other such utilities at a cheaper rate to the IT firms have recorded the highest increase in share of IT exports in total exports. The other coefficients though positive are not significant. This may be due to paucity of data.

Table 3.2 : Regression results of business outcome	
Explanatory variables	**Co-efficient**
Has the issue of IPR been addressed?	0.051
Have sales Tax concessions been given to IT firms?	0.047
Is there a dedicated infrastructure for IT?	0.053
Is there a provision for deferred taxes for IT firms?	0.027
Do cyber laws exist?	0.029
Are subsidized utilities available for IT firms?	0.107*
* Significant at 10 per cent level.	

We have run a cross-sectional regression model; thus, checking for robustness is necessary. Robust variance estimator has been used to re-run the above model, resulting in the estimates having consistent standard errors.

Internet connections per thousand households have been used as an outcome variable for the individuals. Any policy, which is geared towards e-preparedness, must affect individual readiness. It is also important to find out the main drivers of this outcome. For individuals unlike policies specifically catering to the IT companies a broad spectrum of variables affect preparedness. These are not directly the policy variables but are outcomes of some broader policy initiatives. The following table presents the variables used to find out the drivers of individual outcome.

Table 3.3: Variables considered for analysis of individual outcome	
Dependent Variable	**Independent Variables**
Internet connections per thousand households	Per Capita Net State Domestic Product Share of schools having internet connections to total schools Literacy rate Price range of internet connections.

The data on internet connections per thousand households have been taken from our in-house survey data MISH. Per capita income and literacy data have been taken from Statistical Abstract of India and the remaining two variables have been taken from last year's e-preparedness survey. The choice of variables is based on the standard theoretical premises. Here, the explanatory variables are not dummies as in the previous analysis. Results of regression are presented in Table 3.4.

Table 3.4: Regression results of individual outcome

Independent Variables	Co-efficients
Per Capita Net State Domestic Product	0.001*
Share of schools having internet connections to total schools	1.89*
Literacy rate	0.143*
Price range of internet connections	-0.082

* Significant at 10 per cent level.

The coefficient on internet connection in schools is of very high magnitude and significance. Thus its importance in this context needs no further emphasis. Literacy-rate and per capita net state domestic product have significant positive effect on internet connections at the household level. Hence, affordability and ability to comprehend are also important drivers of individual outcome. These are, to some extent, dependent on policies taken at the state level to generate growth of income and enhance literacy through various programmes. As expected, the coefficient on price is negative though is not significant. Here, we re-run the model using robust variance estimators to make standard error of estimates consistent. For both the regression model we have checked for multicollinearity in data which was found to be absent.

This chapter considered two important outcome variables and their main drivers. The purpose was to find out the important policies for driving IT developments at the state level. The states still lagging behind in terms of e-readiness can initiate such policies to accelerate IT development.