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ICT (Information and communication technology) infrastructure and e-governance: Indian experience

Nishitha Pankan and Dr. K Gangadharan

Abstract

Each and every country faces a different set of factors that can help or hamper its overall growth towards e-government development. In the late 1990s, ICT (Information and Communication Technology) has been introduced as an instrument to governance, a leap forward leading to e-governance. India has kept up with ICT developments worldwide, but, compared to other nations in a similar economic, position, and the overall ICT infrastructure is poor. In this backdrop, the present study tries to assess the status of e-governance development of Indian economy based on certain indicators. Moreover, the paper also attempt to analyse the relationship between level of income and EGDI (E-Governance Development Index) and related indices of selected countries of the world. Finally, it will make a comparative analysis of China and India in the e-governance indicators. From the study it can be seen that Indian economy is making serious steps in the development of international benchmarking indices, moreover, it is also analysed that the development of EGDI will uplift the country to a high profile nation and can grab the opportunities in the arena of e-governance and related endeavour.

Keywords: ICT, e-governance, Indian economy, EGDI, GNI

1. Introduction

E-governance, is defined as the application of Information and Communications Technology to the government processes to bring Simple, Moral, Accountable, Responsive and Transparent (SMART) governance (Heeks, 2001) ^[1]. It is also defined as the use of information technology to support government operations, engage citizens, and provide government services (West and Wind, 1996) ^[2]. Each and every country faces a different set of factors that can help or hamper its overall growth towards e-government development. In the late 1990s, ICT (Information and Communication Technology) has been introduced as an instrument to governance, a leap forward leading to e-governance.

2. Objectives and methodology

- To assess the present status of e-governance of Indian economy based on indicators.
- To analyse the relationship between level of income and EGDI and related indices of selected countries of the world.
- To make a comparative analysis of China and India in the e-governance indicators

Hypotheses

H0: There is no significant difference between income level and EGDI level between countries

H1: There is significant difference between income levels and Level of EGDI between countries

The paper is solely based on secondary data. The data have been collected from various published and unpublished sources including a range of government official websites and other related books, articles and journals.

3. Review of literature

World Bank (2001) defined e-governance as the government owned or operated systems of information and communication technologies that transform relations with citizens, the private sector and/or other government agencies so as to promote citizens' empowerment,

improve service delivery, strengthen accountability, increase transparency, or improve government efficiency. Various studies are conducted in connection with e-governance and its related aspects. To review all of those being a herculean task, few studies have been reviewed here.

(Shah, 2007) ^[16] discussed the position of India in e-governance environment. The study confirmed that ICT and of e-governance has a positive impact on the rural economy and quality of life of the masses. Chaudhari *et al.* (2011) ^[4] explored the role and relevance of the Electronic/Digital Governance using ICTs and wireless technologies for agriculture and rural development in the rural regions of Maharashtra. The study concluded that the e-governance have improved the prospects and opportunities for economic development, agricultural development and management, marketing management, increased participation in usage and adoption of information and communication technologies (ICTs) by rural people in Maharashtra. The findings of the study made by (Al-Shafi and Weerakkody, 2009) ^[10] revealed that effort expectancy and social influence determined citizens' behavioural intention towards e-governance. Additionally, facilitating environment and behavioural intention were found to determine citizens' use of e-government services in Qatar. Hassan Rizwan, (2013) discussed the performance and challenges e-government implementation in Bangladesh. According to the study, change in government policy with change in government, lack of adequate skilled well-trained human resource, supply of sufficient fund for implementing such capital intensive project, etc identified as the main obstacles hindered the e-Governance implementation in Bangladesh. The study suggested the remedial measures such as political consensus, development of human resource, ICT penetration, and taking proper long-term plan for the effective implementation of e-government in Bangladesh. (Hasnan and Bt, 2015) ^[5] investigated the factors affecting the e-Government performance and implementation. The study found that effort expectancy and performance expectancy has an important impact as control factors in directly influencing citizens' intention to use e-Government. Shahnewaz Liton and Md. Ahsan Habib (2015) ^[7] analysed the challenges and opportunities of the implementation of e-Government in Bangladesh. The study found that poor ICT infrastructure, Online Service Index, e-participation index, insufficient human resources, lack of trust, Telecommunication infrastructure component, and lack of awareness are the important barriers in the successful implementation of e-Governance in Bangladesh. (Liton and Habib, 2015) ^[7]. Ephias Ruhode (2016) ^[8] studied the Government of Zimbabwe's position towards intentions to implement e-government. The numerous ICT policy documents presented confirmed that the government is fully aware of the need to improve service delivery through ICTs. The study revealed that all policy documents ignored the political, social and economic setting of Zimbabwe. Moreover, these factors have a direct influence in the funding of capital projects including e-government. (Ruhode, 2016) ^[8] From the review of literature, it can be found that the study related to the assessment of progression of e-governance indicators in Indian economy is very limited. The present study tries to fill this research gap.

4. Results and discussions

4.1 E-Governance Development Index (EGDI) and related indices

To measure the development of national e-government development, the United Nations has formed the United Nations e-government development index (EGDI). The EGDI is a composite indicator that consists of three indices (online service index, telecommunication index and human capital index) which are equally weighted. The online service index measures a government's capability and willingness to provide services and communicate with its citizens electronically. The telecommunication infrastructure index measures the existing infrastructure that is essential for citizens to participate in e-government. Human capital index is used to measure citizens' ability to use e-government services.

Online service index measures four stages of the online availability of national authorities. The higher stages have a greater impact on the index. The first stage or emerging information service, measures if the government's website provides information to citizens in a user-friendly way. As far as this service element is concerned, none of the countries observed have a value below 75 percent, meaning that at least 75 percent of the categories monitored at this stage are rated positively.

The second stage or the interactive presence, basically tests whether a governments website facilitate one-way or simple two-way communication between authorities and citizens. The third stage, transactional services, measures the degree to which two-way communication between national administration and citizens is possible. Moreover, it also includes the possibility of handling a wide range of public services online. The fourth stage of networked presence measures the government's ability to be proactive in web 2.0 applications, and whether the government provides a wide range of tailor-made e-services for different sections of citizens. Thus, online service index depicts the digital presence and capability of governments of various countries.

4.2 E-governance in India

In the late 1990s, ICT has been introduced as an instrument to governance, a leap forward leading to e-governance. India has kept up with ICT developments worldwide, but, compared to other nations in a similar economic, position, and the overall ICT infrastructure is poor. Each and every country faces a different set of factors that can help or hamper its overall growth towards e-government development. Extent of service delivery in selected countries of the world are analysed in table 1. India has offered all services in the first stage, and 64 percent in second stage, followed by a decline in the utilisation at third stage of 33 percent. Because, the transactional stage (third stage) utilization depends, among other factors, on the level of development of the financial and economic system in the country. In the fourth stage of networked presence, India has utilised 38 percent. Thus the total utilisation range of India's online services is ranging from category of 34-66 percent. Republic of Korea heads first in the e-participation with a total utilisation of 87 percent while, Tuvalu had a bare minimum offering at 5 per cent. It can be concluded from the table 1 that governments in the high income countries are far advanced in their provision of public information, online services, communications and outreach to citizens, as well as overall electronic access to government.

Table 1: Extend of service delivery in selected countries of the world

Country	Stage 1 emerging presence	Stage 2 Interactive presence	Stage 3 Transactional presence	Stage 4 Networked presence	Total
67-100% Utilisation					
Republic of Korea	100	79	92	87	87
Singapore	100	79	94	86	87
United States	100	90	88	83	87
United Kingdom	100	95	79	81	85
Canada	100	83	81	68	78
Finland	100	90	75	67	77
France	100	79	85	65	77
Bahrain	100	76	81	67	75
United Arab Emirates	100	74	83	67	75
Sweden	92	90	71	62	74
34-66% utilization					
Chile	100	62	67	61	66
Qatar	83	64	62	64	65
Mexico	100	69	62	57	64
Lithuania	83	67	54	59	61
EI Salvador	100	71	38	59	59
Portugal	100	74	42	51	57
Serbia	100	64	38	42	50
India	100	64	33	38	47
China	92	55	40	38	46
Honduras	92	52	15	25	33
Grenada	83	8	8	28	31
Tonga	100	33	2	14	21
Sao Tome and Principe	58	7	4	9	10
Tuvalu	17	2	2	6	5

Source: UN E-government survey 2016

E-governance development in countries with population larger than 100 million is presented in table 2. It can be analysed from the table 2 that each of the country has made a special effort to improve service delivery to large sheathe of their populations. Lack of access to both ICT (Information and Communication Technology) and education infrastructure in the developing countries is considered as a major restraint on e-governance

development. Per capita income imposes another constraint in lower income countries having a higher marginal cost for a dollar spent on ICT. Inclusive growth becomes delicate if the country has a large population with a less land area, such as in India, since e-inclusion demands that online service access and infrastructure be available to all. In this backdrop, the e-governance initiative came up and is viewed as an effective tool in achieving this objective.

Table 2: e-governance development in largest population countries

Country	E-Government Development Index		World e-government development ranking		Population (In millions)
	2012	2010	2012	2010	
China	0.5359	0.4700	78	72	1341
India	0.3829	0.3567	125	119	1225
United States	0.8687	0.8510	5	2	310
Indonesia	0.4949	0.4026	97	109	240
Brazil	0.6167	0.5006	59	61	195
Pakistan	0.2823	0.2755	156	146	174
Nigeria	0.2676	0.2687	162	150	158
Bangladesh	0.2991	0.3028	150	134	149
Russian federation	0.7345	0.5136	27	59	143
Japan	0.8019	0.7152	18	17	127
Mexico	0.6240	0.5150	55	56	113

Source: compiled from UN E-government survey 2012 and 2010

Table 3: Telecommunication Infrastructure Index (TII) and its components (2016)

Indicator	India	Asia	World
TII	0.1430	0.3730	0.3711
Percentage of individual's using the internet	18	42.95	43.34
Fixed telephone subscriptions per 100 inhabitants	2.13	19.84	17.35
Mobile cellular telephone subscriptions per 100 inhabitants	74.48	109.86	103.28
Fixed (wired) broadband subscriptions per 100 inhabitants	1.24	11.03	11.26
Wireless broadband subscriptions per 100 inhabitants	3.20	21.75	30.16

Source: UN E-government survey 2016

4.3 Comparative analysis of E-governance indicators between India and China

Table 4: E-Participation Index (EPI) and its utilisation by stages (2016)

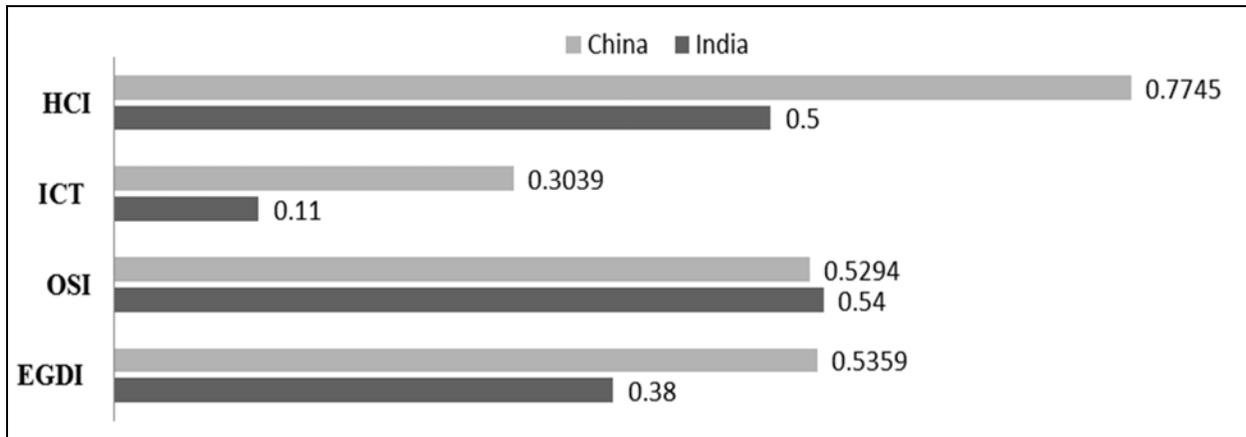
Indicator	China	India	Regional average
Rank	22	27	
EPI	0.8136	0.7627	0.5182
Total percentage	81.7	76.7	52.60
Stage 1 percent	94.1	79.4	62.30
Stage 2 percent	84.2	94.7	41.90
Stage 3 percent	14.3	14.3	13.10

Source: compiled from UN E-government survey 2012 and 2010

Table 5: E-government development in India and China for the year 2012

Indicator	India	China
EGDI	0.38	0.5359
OSI	0.54	0.5294
ICT	0.11	0.3039
HCI	0.50	0.7745
World average EGDI	0.4882	
Regional average(Asia)	0.4992	

Source: UN E-government survey 2012



Source: UN E-government survey 2012

Fig 1: Comparative analysis of E-Governance infrastructure in India and China

It can be analysed that China is far ahead as compared to India's e-government infrastructure indicators such as HCI, ICT, OSI and EGDI (source: figure 1, table 4 and 5).

The correlation between level of EGDI and GNI per capita of 75 countries in different regions of the world is examined in the table 6. It can be analysed from the table 6 that there exist significant correlation between level of EGDI and GNI per capita. Pearson correlation value is 0.723 and it is highly significant (0.000) at 0.01 level and its positive value indicating that there exist a positive and highly significant correlation between the level of EGDI and level of GNI per capita. In other words, countries with high GNI per capita income have higher level of EGDI.

The descriptive statistics for the value of EGDI is shown in table 7. The mean value for value of EGDI is 0.5181 and its Standard deviation is 0.2150. Skewness is an indicator of symmetry and the value is found to be -0.007 while the kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution and its value is -.953

Table 6: Correlations

		Level of EGDI	GNI per capita (US dollars)
Level of EGDI (E-Government Development Index)	Pearson Correlation	1	.723**
	Sig. (2-tailed)		.000
	N	75	75
GNI per capita (us dollars)	Pearson Correlation	.723**	1
	Sig. (2-tailed)	.000	
	N	75	75

** . Correlation is significant at the 0.01 level (2-tailed).

Table 7: Descriptive Statistics

Value of EGDI (E-Government Development Index)		
N	Valid	75
	Missing	0
Mean	.518180	
Std. Error of Mean	.0248379	
Median	.510800	
Mode	.0789 ^a	
Std. Deviation	.2151022	
Variance	.046	
Skewness	-.007	
Std. Error of Skewness	.277	
Kurtosis	-.953	
Std. Error of Kurtosis	.548	
Range	.8404	
Minimum	.0789	
Maximum	.9193	
Percentiles	25	.333700
	50	.510800
	75	.691000

a. Multiple modes exist. The smallest value is shown

ANOVA test has been applied to test the aforementioned hypotheses. The test result in table 8 shows that there is there is a significant difference between income levels and Level of EGDI among selected countries of different regions. The value is highly significant at 3 degrees of freedom. Moreover, the value is less than 0.05, thus, the null hypothesis is rejected. Thus, the alternative hypothesis is accepted, that is, there is significant difference between income levels and level of EGDI among countries. The post hoc test is also conducted and it shows that among all country groups there exists significant difference between EGDI level and level of GNI per capita. The value of mean difference is significant at 0.05 percent.

Table 8: ANOVA

Value of EGDI					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.619	3	.873	76.956	.000
Within Groups	.805	71	.011		
Total	3.424	74			

Table 9: Post Hoc Tests

	(I) level of income	(J) level of income	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Low	lower middle income	-.1829177*	.0403496	.000
		upper middle income	-.2929409*	.0393280	.000
		high income	-.5438024*	.0390419	.000
	Lower middle income	low	.1829177*	.0403496	.000
		upper middle income	-.1100232*	.0333546	.008
		high income	-.3608847*	.0330169	.000
	Upper middle income	low	.2929409*	.0393280	.000
		lower middle income	.1100232*	.0333546	.008
		high income	-.2508615*	.0317602	.000
	High income	low	.5438024*	.0390419	.000
		lower middle income	.3608847*	.0330169	.000
		upper middle income	.2508615*	.0317602	.000
Scheffe	Low	lower middle income	-.1829177*	.0403496	.000
		upper middle income	-.2929409*	.0393280	.000
		high income	-.5438024*	.0390419	.000
	Lower middle income	low	.1829177*	.0403496	.000
		upper middle income	-.1100232*	.0333546	.017
		high income	-.3608847*	.0330169	.000
	Upper middle income	low	.2929409*	.0393280	.000
		lower middle income	.1100232*	.0333546	.017
		high income	-.2508615*	.0317602	.000
	High income	low	.5438024*	.0390419	.000
		lower middle income	.3608847*	.0330169	.000
		upper middle income	.2508615*	.0317602	.000

*Mean difference is significant at 0.05 percent

4.4 Homogeneous Subsets

value of EGDI						
	Level of income	N	Subset for alpha = 0.05			
			1	2	3	4
Tukey HSD ^{a,b}	Low	11	.219145			
	lower middle income	19		.402063		
	upper middle income	22			.512086	
	high income	23				.762948
	Sig.			1.000	1.000	1.000
Tukey B ^{a,b}	low	11	.219145			
	lower middle income	19		.402063		
	upper middle income	22			.512086	
	high income	23				.762948
	Sig.			1.000	1.000	1.000
Scheffe ^{a,b}	low	11	.219145			
	lower middle income	19		.402063		
	upper middle income	22			.512086	
	high income	23				.762948
	Sig.			1.000	1.000	1.000
Means for groups in homogeneous subsets are displayed.						
a. Uses Harmonic Mean Sample Size = 17.206.						
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.						

5. Conclusion

E-governance is defined as the use of information technology to support government operations, engage citizens, and provide government services. Each and every country around the world are introducing the e-government as a means for reducing cost, saving time, improving social services and increasing efficiency and effectiveness of in public sector improving social services. Based on the results

it can be that Indian economy is making serious steps in the development of international e-government benchmarking indices. Moreover, it is also to be noted that the development of EGDI will uplift the country to a high profile nation and can grab the opportunities in the arena of e-governance and related endeavour.

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