

Inter-State Variation in Digital Economy in India: Is there any Role of Digital and Financial Literacy?

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Abstract

Innovation in Information, Communication and Technology (ICT) has brought the 'Digital Economy' at the centre stage for fostering growth and development in the context of present informational age. The strength of the digital economy lies in its spill-over effect that promotes economic growth, ability of lowering non-accelerant inflation rate of unemployment, equilibrating inflation and unemployment in short run, introducing of innovative and quality products and services and dampening the business cycle (which allows the economy to operate at full capacity) and controlling corruption. However, the transformation into the digital economy is conditioned upon the state of the financial and digital literacy in the context of the present knowledge economy. The existing literature clearly suggests that there is scanty of literature on various aspect of digital economy by synthesising the role of both financial and digital literacy. In this prelude, the present study makes a modest attempt to highlight the state of the Digital Economy Infrastructure (DEI) of major Indian States by constructing DEI Index and the changing scenario of such infrastructure over 2014 to 2017. Moreover, the association between the sub-components of DEI Index (use and access of digital economy infrastructure) with the Financial Literacy and Digital Literacy has also been explored using Canonical Correlation Analysis (CCA). The outcome of the study suggests that Punjab, Kerala, Tamil Nadu and Karnataka has consistently performed well in terms of DEI over the study period whereas the DEI was found to be poor for Bihar, Assam, Orissa, Uttar Pradesh and Madhya Pradesh during the entire period of study. However, significant improvements in terms of DEI during the period of study could be observed for Himachal Pradesh, Jammu & Kashmir, Gujarat and North Eastern States. The outcome of CCA clearly indicated the existence of high degree of association between the DEI Index (consisting of use and access of digital economy infrastructure) and Skill Index (consisting of financial and digital literacy). Moreover, the empirical results of CCA also suggested that the effect of digital literacy on DEI Index was found to be stronger than that of the financial literacy.

Key Words: ICT, Digital Economy, DEI Index, Digital Literacy, Financial Literacy, Canonical correlation, Indian states.

JEL Classification: A29; I29, O33; C39

Inter-State Variation in Digital Economy in India: Is there any Role of Digital and Financial Literacy?

Introduction:

Innovation in Information, Communication and Technology (ICT) has brought the 'Digital Economy' at the centre stage for fostering growth and development in the context of present informational age (Sharma et al., 2016). The spectrum of digital economy encompasses wide range of ideas such as e-commerce, e-governance, e-payment system, e-banking, e-knowledge processing, internet banking, mobile banking, payment wallets etc. (Quah, 2003; Chakravorti et al, 2016). The strength of the digital economy lies in its spill-over effect that promotes economic growth, ability of lowering non-accelerant inflation rate of unemployment¹, equilibrating inflation and unemployment in short run, introducing of innovative and quality products and services and dampening the business cycle (which allows the economy to operate at full capacity) and controlling corruption (L'Hoest, 2001; Kamel, 2005; Atkinson & McKay, 2007; Howard et al., 2010; Saxena, 2018).

However, the transformation into the digital economy is conditioned upon the state of the financial and digital literacy in the context of the present knowledge economy (Servon and Kaestner, 2008). The importance of these two can be understood from the linkage with Sustainable Development Goal 4² in general and linkage of digital literacy in particular with SDG Target 4.4³ with Target Indicator 4.4.1⁴. Financial literacy is also equally important as the digital payment system covers a large section of the digital economy. Financial literacy is the basic condition which consequently must be supported by the digital literacy for successful transformation into digital economy. In fact, it is very much possible that a financially literate person not adopting digital mode of transaction (especially digital payment) because of the concerns related to the digital knowledge deficit, security issues, digital exclusion etc. or vice-versa⁵. Financial literacy is the genesis of happy life and personal wellbeing that eventually improves the overall economic wellbeing of the nations

¹It is that rate of unemployment in the economy which does not allow inflation to accelerate. For details please see Gordon, R. J. (1997). The time-varying NAIRU and its implications for economic policy. *Journal of Economic Perspectives*, 11(1), 11-32.

²"Inclusive and quality education for all and promote lifelong learning"

³"By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship"

⁴Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill.

⁵For example, Chakravorti (2016, *ibid* Foot Note p.1) suggested that in 2005 the shares of cash-on-delivery for online shopping in China and India were 80% whereas the same in 2015 were found to be 30% and 75% for China and India respectively. It shows that though the people have a tendency to move towards digital transactions but due to the lack of adequate financial knowledge along with mistrust on digital payment systems, people in India are reluctant to adopt e-payment system.

(Marcolin and Abraham, 2006). It has become even more important considering the fact that the Governments of various countries are encouraging the people to take care of their post-retirement livelihood which requires steady savings in the present time so as to meet the future financial need based on the prevailing and the expected future market situation (Beal and Delpachitra, 2003). In this backdrop of analysis, this paper specifically investigates into the empirical evidences on usage and access of digital services and its linkages to financial and digital literacy across Indian states.

Review of literature and Identification of Research Gap

The research works on the role of financial and digital literacy in promoting digital economy is scanty in numbers both at national and international level.

International

The pervasiveness of ICT in every sphere of human life in this present knowledge economy is so great that the digital exclusion can be considered at par with the other socio-economic problems existing in the society (Helpser, 2008). The innumerable benefits of ICT can only be harnessed by imparting digital literacy amongst the people (Helpser, 2008). However, there exists a digital divide between those who have and have not's and that primarily emanates from the prevailing socio-economic divide (Bach et al., 2013). In addition to it, there are plenty of other barriers such as general awareness issues, psychological innovation resistance, trust and security concerns, internet infrastructure, speed of internet, negative peer effect, cost of technology, resistance to learn, lack of knowledge in channel usage, negative attitude towards the use of internet, lack of awareness etc. (Mattila et al., 2003; Kusima et al., 2007; Nedungadi et al., 2018).

Like digital literacy, financial literacy is also important in making informed financial choices (Cole et al., 2009). The absence of financial literacy can cause improper financial planning, low savings, falling into vicious debt trap, exorbitant interest burden, choosing sub-optimal credit contract etc. (Agarwal et al., 2015; Lusardi and Tufano, 2015). In contrast, financially literate people are better equipped in making proper financial and retirement planning, risk diversification etc. (Lusardi and Mitchell, 2014; Abreu and Mendes, 2010). In India on an average 24% adults are financially literate which is much lower in comparison of the major emerging economies (Klapper et al., 2015). In an integrated approach, only one study showed the linkage between financial as well as digital literacy in promoting digital economy (Servon and Kaestner, 2008).

National

In the context of India, Maharana and Mishra (2007); Moghaddaszadeh and Nikam (2012); Parvathamma and Pattar (2013); Tabusum et al. (2014), Bansal (2015), Bansode and Viswe (2017) have conducted studies on the assessment of digital literacy of different groups of people in various regions of India. While, Chauhan and Murthy (2006); Tripathi (2006), Thomas and Parayil (2008); Haneefa and Shukkoor (2010); Suriya (2013) and Khokar (2016) have tried to identify the various causes of digital divide and suggested measures to narrow the existing digital divide in India. On a large scale National Digital Literacy Mission Report (2017)⁶ suggests that some of the states in India have performed better in terms of digital literacy while others have not. The top three states in terms of digital literacy index were Andhra Pradesh (0.67), Chandigarh (0.66) and Gujarat (0.65). The performance of the West Bengal is dismal, securing 0.35 (i.e. 24th position) in the digital literacy index,⁷ which is much lower than the national average of 0.56.

On the other hand, Financial Literacy and Inclusion in India Report (2015)⁸ showed that the position of the state of West Bengal (with financial literacy of 21%) is 16th along with Tripura, Haryana and Pondicherry. The existing research studies reveal that various demographic and socio-economic factors affect the level of financial literacy (Gaurav and Singh, 2012; Agarwala et al., 2013; Agarwala et al., 2015)

The studies so far conducted have failed to highlight the state the digital economy in India and the existence of the inter-state variation in it. There is dearth of literature which have tried to bring out the association between the digital economy and the digital and financial literacy. To address this gap of research, this paper establishes a relationship between the digital economy, financial literacy and digital literacy.

Relationship between Digital Economy and Skill Development: A Conceptual Framework

The inter-linkage between the digital economy infrastructure⁹ and the skill requirement as an important part of the overall eco-system is complex and causal linkages are difficult to comprehend. It may happen that as a part of the development process in an economy the digital economy infrastructure is created and thereby there is a requirement of supporting skill sets such as digital and financial literacy. It can simply be understood from the fact that

⁶Retrieved from <http://www.csindia.org/pdfs/Project-reports/Digital-Literacy-Report-2017.pdf>

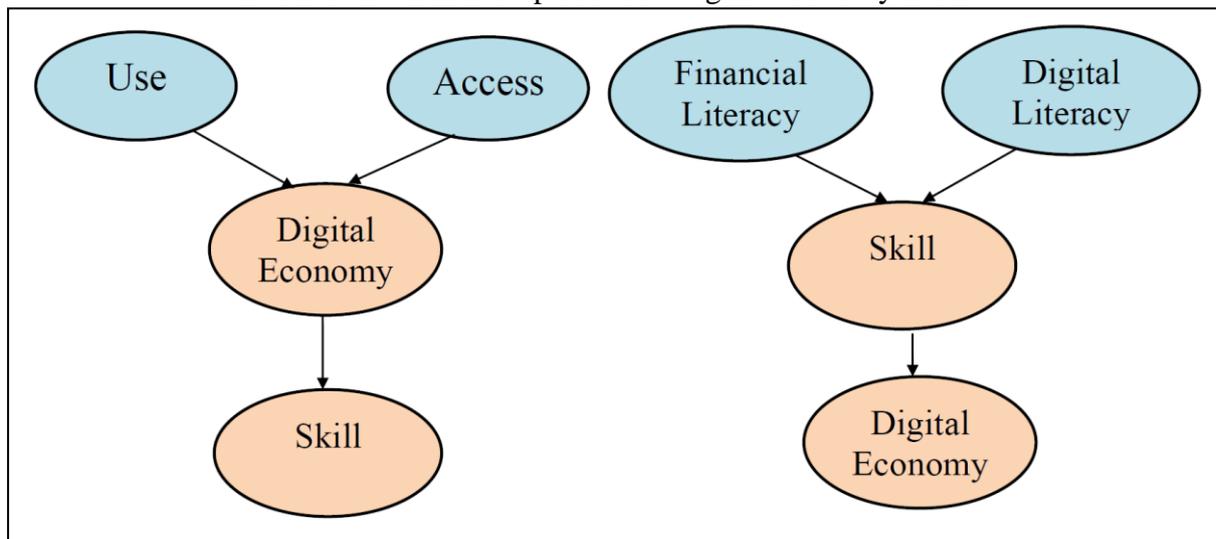
⁷The Impact Assessment of the National Digital Literacy Mission Report (2017), pp.58.

⁸Retrieved from https://www.ncfe.org.in/images/pdfs/nasional-surveyy/NISM_Final%20Report%20-%20All%20India.pdf

⁹For the purpose of creating digital infrastructure, the roles of 'Use' and 'Access' dimensions are equally important.

although the availability of digital infrastructure was already available as indicated by high ‘Access’, the ‘Use’ will only increase with the improvement in the skills required to ‘use’ the ‘Access’. It may happen otherwise also that in an economy the people have adequate skill sets to ‘use’ the digital infrastructure however there may be lack of ‘Access’. As a consequence the digital economy infrastructure will in that case only flourish in response to the demand side pressure. Therefore, the causal linkage may be bi-directional in nature which is represented through Figure 1.

Figure 1
Bi-directional Relationship between Digital Economy and Skill



Source: Author’s own representation

Data Sources& Methodology:

Data Sources:The present study is essentially analytical in nature. For the purpose of the study the required data were collected from various secondary sources such as Telecom Statistics India-2018 (published by Economics Research Unit – Statistics, Department of Telecommunications, Ministry of Communications, Government of India), Telecom Sector in India: A Decadal Profile 2012 (published by Telecom Regulatory Authority of India), Financial Inclusion Insight Survey Database and All India Survey on Higher Education Reports from 2010-11 to 2017-18 (published by Department of Higher Education, Ministry of Human Resource Development, Government of India).

Construction of DEI:While constructing the DEI Index, both the ‘Use’ proxy of the demand side (fixed broadband density per 100 inhabitants and mobile broadband density per 100 inhabitants) and ‘Access’ indicator of supply side (wire line tele-density per 100 inhabitants and wireless tele-density per 100 inhabitants)were taken into account. DEI Index was

computed using normalized inverse Euclidean distance of the ‘Use’ and ‘Access’ dimension indices from their ideal values. Algebraically,

$$DEI\ Index = 1 - \sqrt{\frac{(1 - d_1)^2 + (1 - d_2)^2}{2}}$$

Measuring Financial and Digital Literacy:The financial literacy scores of different states have been computed from the Financial Inclusion Insight database for India for 2014 and 2017. To assess the financial literacy as per the OECD accepted methodology, financial knowledge, financial behaviour and financial attitude were considered. In the said database survey in various Indian states are carried out. In that survey questionnaire there are questions on financial knowledge, financial behaviour and financial attitude amongst others. For the purpose of this study all these dimensions were taken into account to get a composite score indicating financial literacy. However, measurement of digital literacy was a problematic issue. In India, in 2017 digital literacy was measured for the people across various states in India who were earlier trained under National Digital Literacy Mission but since it was measuring the level of digital literacy for a segment of the people across different states it could not be taken as a proxy of digital literacy. No other credible source of data on digital literacy could be found. International Telecommunication Union (ITU) is an international organization which measures the ICT Development Index (IDI) of which digital skill is an important component. In measuring digital skill, ITU takes into consideration the Adult Literacy Rate and Gross Enrolment Ratio (GER) in secondary and tertiary level. Unfortunately, in India, state level data on such a disaggregated level such as GER in secondary and tertiary education is not available. Moreover, the Adult Literacy Rate for states in India is neither available for 2014 nor 2017 under Census and NSSO data. Keeping in mind such data limitation, it was decided that GER in higher education(which is available from AISHE Reports) will be taken up as the closest possible proxy for digital literacy in line with IDI for the purpose of the study.

Canonical Correlation Analysis:As there are many components of the digital economy index and skill index and determination of exogenous and endogenous set of variables are not theoretically established, simple measures of correlation analysis such as Pearson Correlation, Spearman’s correlation or Kendall’s correlation are not capable of measuring the nature and magnitude of association amongst the underlying variables. This kind of situation can be taken care of by Canonical Correlation Analysis (CCA). It is a multivariate form of general linear regression model which can be applied to explore the relationship amongst two or more

variables each consisting of at least two variables (Thompson, 2005). In CCA first the canonical variates are constituted by taking into account the weighted sum of the variables and then the strength of the association between such canonical variates are explored using CCA. By allowing for multiple variables on both the ‘dependent’ and the ‘independent’ side of the relationship, this method allows for a better understanding of the association between digital economy and skill than techniques that only have one ‘dependent’ variable and multiple independent variables.

Let CV_{X1} be a $(1 \times p)$ vector associated with X digital economy indicator and CV_{Y1} be a $(1 \times q)$ vector associated with Y skill indicators, where n and m are the number of variables in each set. For the first latent association (CV_{X1}, CV_{Y1}) , CCA seeks to get the best linear combination of X and Y variables that maximizes the correlation between the variates. Mathematically,

$$CV_{X1} = a_1x_1 + a_2x_2 + a_3x_3 + \dots + a_nx_n \dots \dots (1)$$

$$CV_{Y1} = b_1y_1 + b_2y_2 + b_3y_3 + \dots + b_my_m \dots \dots (2)$$

where, $a_1, a_2 \dots a_n$ and $b_1, b_2 \dots b_m$ are the canonical weights of each canonical variates. CCA involves a correlation determination process until the highest correlation is determined by finding the linear combination of canonical variates. Wilks’ lamda is used to test the statistical significance of the canonical correlation coefficient. CCA was done on a pooled data for major Indian states for the year 2014 and 2017 only as the financial literacy data for states in India for 2011 was not available.

Results& Discussion:

State of Digital Economy across Indian States:

Table 1 highlights the position of the major Indian states in 2011 and 2017 in accordance with ‘Use’ and ‘Access’ dimensions. Most of the Southern states were found to be outperforming other states in both the dimension over the period of study.

Table 1
Ranking of the Major Indian States according to ‘Use’ & ‘Access’

States	2014						2017					
	Use	Rank	Access	Rank	DEI Index	Rank	Use	Rank	Access	Rank	DEI	Rank
AP	0.45	9	0.39	7	0.42	8	0.50	9	0.35	7	0.42	8
ASM	0.16	14	0.04	16	0.10	15	0.18	13	0.06	16	0.12	14

BIH	0.00	17	0.00	17	0.00	17	0.00	17	0.00	17	0.00	17
GUJ	0.85	3	0.50	6	0.63	5	0.70	6	0.47	6	0.57	6
HAR	0.41	10	0.38	8	0.39	9	0.50	8	0.26	9	0.37	9
HP	0.81	6	0.67	4	0.73	4	0.95	2	0.66	3	0.76	2
KAR	0.68	7	0.57	5	0.62	6	0.73	5	0.58	4	0.65	5
KER	0.87	2	0.84	1	0.86	1	0.82	3	0.78	1	0.80	1
MP	0.24	13	0.13	13	0.18	13	0.17	14	0.10	13	0.13	13
MAH	1.00	1	0.37	9	0.56	7	0.51	7	0.34	8	0.42	7
NE	0.53	8	0.24	11	0.37	10	0.45	10	0.22	11	0.33	10
OR	0.14	15	0.15	12	0.15	14	0.19	12	0.15	12	0.17	12
PUN	0.84	5	0.71	3	0.76	3	1.00	1	0.58	5	0.71	4
RAJ	0.33	11	0.30	10	0.31	11	0.31	11	0.25	10	0.28	11
TN	0.84	4	0.75	2	0.79	2	0.78	4	0.70	2	0.73	3
UP	0.07	16	0.11	14	0.09	16	0.08	16	0.09	14	0.09	16
WB	0.29	12	0.09	15	0.18	12	0.12	15	0.09	15	0.10	15
India	0.50		0.37		0.42		0.47		0.39		0.33	
Source: Author's own calculation												

From the analysis of Table 1, it can be observed that in 2014, Kerala took the 1st position followed by Tamil Nadu, Punjab, Himachal Pradesh, Gujarat, Karnataka, Maharashtra, Andhra Pradesh, Haryana, North East, Rajasthan, Madhya Pradesh, West Bengal, Orissa, Assam, Uttar Pradesh and Bihar. Likewise, the state of Kerala has again obtained the top most position in terms of DEI index followed by Himachal Pradesh, Tamil Nadu, Punjab, Karnataka, Gujarat, Maharashtra, Andhra Pradesh, Jammu & Kashmir, Haryana, North East, Rajasthan, Orissa, Madhya Pradesh, Assam, West Bengal, Uttar Pradesh and Bihar. The analysis of the data suggests that the state of Kerala has scored highest in terms of DEI index in all the years under observation. On the contrary, the DEI index of Bihar was found to be lowest during the period of study and has obtained last rank (18th) during 2014 and 2017. Most of the major Indian states such as Andhra Pradesh, Bihar, Haryana, North East Cluster, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh have maintained almost status quo relative position in terms of DEI index. The DEI Index of West Bengal has fallen from 0.18 (12th Rank) in 2014 to 0.12 (15th Rank) to 2017. The analysis of Table 1 clearly suggests that such a decline in rank was primarily because of the worsening 'Use'

parameter. The use of broadband in the state of West Bengal has reduced during 2014 to 2017. There has been a very marginal fall of overall DEI rank of Tamil Nadu from 2nd rank in 2014 to 3rd rank in 2017 because of marginal fall in both ‘Use’ and ‘Access’ aspects during the period of study. In the same way Punjab has also come one step down in the DEI ranks. It can be easily observed from the analysis of the Table 1 that although there has been a notable improvement in the ‘Use’ parameter from 2014 to 2017 however significant decline of the state in the ‘Access’ parameter did not only neutralised the positive effect of rise in ‘Use’ of the broadband in state but had exacerbated such a negative effect that the rank of the state declined from 3rd (2014) to 4th (2017). The ‘Use’ parameter for the state of Orissa has improved significantly during the period of study which enabled the state to improve its overall DEI rank from 14th in 2014 to 12th in 2017. The position of Himachal Pradesh has improved from 4th in 2014 to 2nd in 2017. Such an improvement in was primary attributed to the improvement that the state has made in ‘Use’ parameter from 0.81 in 2014 to 0.95 in 2017. The ‘Use’ and ‘Access’ parameter for Gujarat has reduced marginally during the study period leading the loss of position of the state from 5th to 6th position in 2017. The position of Assam has improved very little during 2014 to 2017 and that occurred primarily because of the slight improvement in the ‘Use’ dimension of DEI during the same period. The DEI value of India as a whole declined significantly from 0.42 in 2014 to 0.33 in 2017. The worsening ‘Use’ of DEI for majority of the states executed negative effect on the declining DEI index for India in general.

State of Skill Development across Indian States:

Table 2
Ranking of the Major Indian States according to ‘Financial Literacy (FL)’, ‘Digital Literacy (DL)’ & Skill Index

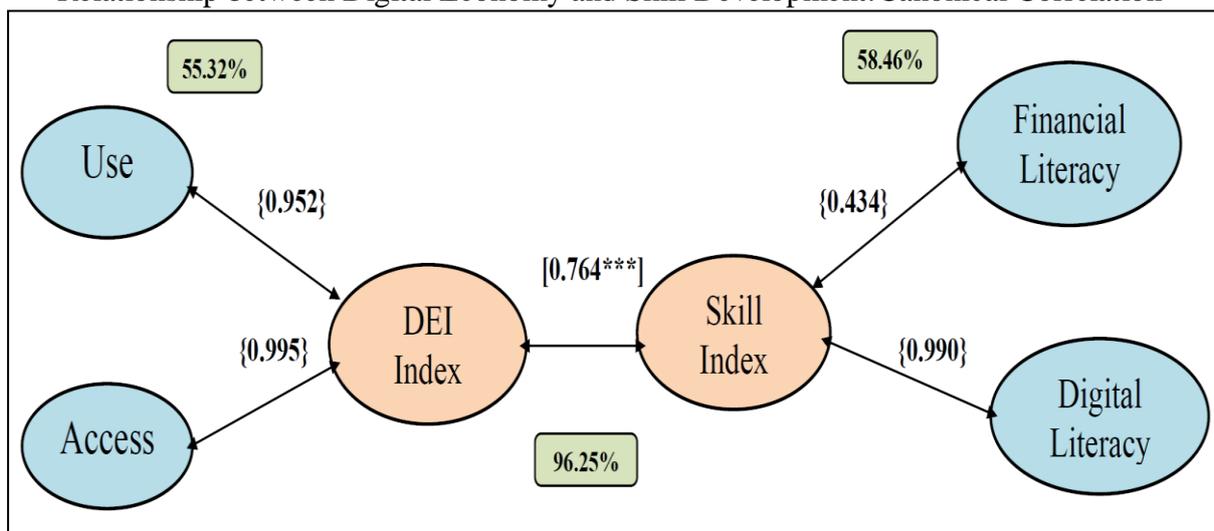
States	2014						2017					
	FL	Rank	DL	Rank	Skill Index	Rank	FL	Rank	DL	Rank	Skill Index	Rank
AP	0.49	10	0.55	2	0.52	5	1.00	1	0.50	5	0.65	4
ASM	0.44	11	0.03	16	0.21	14	0.89	4	0.15	16	0.39	13
BIH	0.40	13	0.00	17	0.17	16	0.47	16	0.00	17	0.20	17
GUJ	0.00	17	0.20	11	0.09	17	0.62	13	0.20	14	0.37	15
HAR	0.64	5	0.44	6	0.53	4	0.85	6	0.44	7	0.59	6
HP	0.89	2	0.55	3	0.67	2	0.80	8	0.70	2	0.75	1
KAR	0.58	8	0.40	8	0.48	8	0.86	5	0.42	8	0.58	7
KER	0.43	12	0.47	4	0.45	9	0.00	17	0.65	3	0.25	16
MP	0.17	15	0.18	13	0.18	15	0.70	11	0.23	13	0.42	11

MAH	0.57	9	0.45	5	0.50	6	0.96	2	0.51	4	0.65	3
NE	0.77	3	0.33	10	0.50	7	0.68	12	0.38	9	0.51	8
OR	0.31	14	0.12	14	0.21	13	0.77	9	0.25	11	0.45	10
PUN	1.00	1	0.42	7	0.59	3	0.82	7	0.49	6	0.61	5
RAJ	0.63	6	0.20	12	0.37	10	0.55	15	0.24	12	0.38	14
TN	0.59	7	1.00	1	0.71	1	0.58	14	1.00	1	0.70	2
UP	0.17	16	0.35	9	0.26	12	0.72	10	0.36	10	0.51	9
WB	0.65	4	0.11	15	0.32	11	0.91	3	0.16	15	0.40	12
India	0.51		0.34		0.40		0.72		0.39		0.49	
Source: Author's own calculation												

In Table 2 the relative position of major Indian states in terms of financial literacy, digital literacy and overall skill which is a combination of both digital and financial literacy is presented. The state of Tamil Nadu was found to be at the top of the skill index followed by Himachal Pradesh, Punjab, Haryana, Andhra Pradesh, Maharashtra, North East cluster, Karnataka, Kerala, Rajasthan, West Bengal, Uttar Pradesh, Orissa, Assam, Madhya Pradesh, Bihar and Gujarat. However, evaluation of financial literacy index and digital literacy index clearly suggest a contrasting picture. For example, financial literacy index of Tamil Nadu was found to be 0.59 (7th rank) whereas the digital literacy index was found to be 1 (1st rank) and such a high digital literacy index has enabled the state to hold 1st position in skill index in spite of such a low performance in financial literacy during 2014. Similarly, the evaluation of the state of Kerala also shows that the position of the state in terms of digital literacy is 4th whereas the state ranked 12th in financial literacy. On the contrary, the financial literacy index value of North East cluster was found be 0.77 (3rd rank) during 2014. However the position of the state in terms of digital literacy was found to be 10th which lead the skill index rank to be 7th during 2014. Similarly, it can also be seen that the financial literacy rank of the state of Punjab was 1st. However, the overall skill index rank was found to be 3rd primarily because of its 7th position in digital literacy index. The same was true for West Bengal in 2014 as the positions of the state in terms of financial literacy and digital literacy were found to be 4th and 15th respectively. In contrast, it can be seen that the performance of Maharashtra in terms of digital literacy (5th) was far better as compared to that of financial literacy (9th). For other states such as Himachal Pradesh, Haryana, Karnataka and Madhya Pradesh there was some consistency in performance with respect to financial and digital literacy. In 2017, Himachal Pradesh was found to be at the top of skill index overtaking Tamil Nadu (2nd in 2017). Bihar was found to be at the bottom on the basis of overall skill index. As compared to 2014, a marginal change in the overall skill index rank was observed for some of the major Indian

states such as Himachal Pradesh, Tamil Nadu, Andhra Pradesh, Karnataka, North East, West Bengal, Assam, Gujarat and Bihar. However significant improvement in overall skill ranks was observed in case of Maharashtra, Uttar Pradesh, Orissa, and Madhya Pradesh. From the analysis of the table it can be easily seen that there has been a tremendous improvement in financial literacy of Maharashtra from 0.57 (9th) in 2014 to 0.96 (2nd) 2017 which enabled the state to jump from 6th in 2014 to 3rd in 2017. Such kind of explanation can also be offered in case of Uttar Pradesh as the financial literacy index rank improved to 10th in 2017 from the bottom 2nd in 2014. For the states such as Madhya Pradesh and Orissa, it can also be seen that there has been significant improvement both in financial and digital literacy which helped both the states to improve their overall skill index rank in 2017. In contrast, some states such as Punjab, Haryana, Rajasthan and Kerala has experienced fall in overall skill index during 2017 over 2014. From the analysis of the Table 2 it is very much evident that the financial literacy of the states such as Punjab and Rajasthan has decreased to 0.82 and 0.55 in 2017 from 1 and 0.63 in 2014 respectively which ultimately resulted in the decline of overall rank of these states. Although, the digital literacy of Kerala has improved from 0.47 in 2014 to 0.65 in 2017, the states has moved from 12th (2014) position in financial literacy to bottom position (2017). It is also astonishing to notice that a state with highest level of literacy performing so poorly both in financial and digital literacy.

Figure 2
Relationship between Digital Economy and Skill Development: Canonical Correlation



Source: Author's own representation

In Figure 2 the association between DEI Index (comprising of use and access) and Skill Index consisting of financial literacy and digital literacy has been explored with the help of

canonical loadings obtained from canonical correlation analysis. The values in second bracket and box presented in Figure 1 are the canonical loadings and percentage explained respectively. The value in third bracket is actually representing the canonical correlation. It has already been enumerated at the beginning that the success of digital economy largely depends upon the digital literacy as well as financial literacy. On the other hand the digital economy itself is dependent upon the use i.e. demand parameter and access i.e. supply parameter. However, development in DEI index may be because of the development of skill index and vice-versa. As such it was prominent to use canonical correlation analysis to explore the association. It can be observed from Figure 1 that the variance explained between the two factors of our concern i.e. DEI index and Skill index was found to be very high (96.25%). Since, the first canonical correlation explains about 96.25% and the second is explaining only 3.75%, the result of only first canonical correlation is accepted and retained. The detailed result of first and second canonical correlation is presented in Table 3. Similarly, the variances explained between use and access and DEI index and between Skill index and digital literacy and financial literacy were found to be 55.32% and 58.46% respectively which can be considered very much acceptable. Now, if we look at the canonical correlation between the canonical variable DEI index and its sub-components (use and access), they were found to be 0.952 and 0.995 which indicates high degree of association between them. Moreover, the outcome of the canonical correlation analysis also projects that financial and digital literacy can jointly explain 53% and 58% variation in use and access respectively¹⁰. On the other hand, the canonical correlation between the canonical variable skill index and its constituent's financial literacy and digital literacy were found to be 0.434 and 0.990. It implies that skill index possessed lower degree of association with financial literacy but such association with digital literacy was found out to be very strong. It can also be confirmed from the fact that the coefficient associated with financial literacy was found to be positive but statistically insignificant both against use and access. Finally, it can also be mentioned that the association between the two canonical variables DEI index and skill index to be highly positive (0.764) and statistically significant at 1% as per Wilk's lambda. It supports the fact that there should be congruity between the digital economy and skill required in the context of such digital economy for overall success of digital economy.

¹⁰ The associated F-values were also found to be statistically significant at 1%.

Table 3
Result of Canonical Correlation

Variables	First Canonical Correlation	Second Canonical Correlation
Canonical Correlation	0.764***	0.227
% Variance explained between canonical variables	96.25%	3.75%
Wilks' lamda	0.395	0.948
Degree of freedom	4	1
First set of variables	Loadings	Loadings
Use	0.952	-0.305
Access	0.995	-0.101
Second set of variables	Loadings	Loadings
Financial literacy	0.434	-0.901
Digital literacy	0.990	0.137
Source: Author's own computations		
Note: *** implies significant at 1% level		

Conclusion:

The importance of digital economy in the context of present informational era can never be overemphasised. It cannot be denied that the revolution in digital economy has been the prime driver of socio-economic development of many economies of the globe. There plenty of literature which supports the view that use of ICT in a digital economy has significant positive effect of the productivity growth on one hand. On the other hand there are evidences in the existing literature supporting the positive nexus between the investment in the DEI and economic growth. Therefore, keeping in mind the important role of digital economy the present paper made an attempt to shed some light on the DEI scenario in India over 2011 to 2017 and to highlight the inter-state variation in such DEI. Further, the study also makes an attempt to explore the association between the DEI and skill that is required in the context of a digital economy. In doing so DEI index was determined by taking into account both the demand side (use factor) and supply side (access factor). Similarly, the skill index was constituted taking into consideration both digital and financial literacy. In order to project the inter-state variation in DEI, ranking of the major Indian states based on 'Use', 'Access' and DEI index was done and scatter plots were also used to analyse the position of the states in a meaningful manner. The outcome of the study suggested most of the southern states in India have been able to maintain good DEI whereas the eastern states were found to be laggards in this direction. Amongst the major Indian states Karnataka, Kerala, Punjab, Tamil Nadu, Gujarat and Himachal Pradesh were observed to possess good digital economy infrastructure

and such infrastructure was found to be very poor in Assam, Bihar, Madhya Pradesh, Orissa, Uttar Pradesh and West Bengal in 2017. Rest of the major Indian states do have medium level of DEI. If we go by the time frame from 2011 to 2017 it must be pointed out that Himachal Pradesh, Jammu and Kashmir, North East cluster and Gujarat had experienced significant improvement in DEI whereas the situation of India as a whole in the light of DEI has not improved significantly during the period from 2011 to 2017. The outcome of CCA suggested bidirectional association between DEI index and skill index to be positive, high and statistically significant which conforms to the existing theoretical argument put forward in this article. The bidirectional variance explanatory power between these two canonical functions was also found to be very high (96.25%). The analysis of the result of CCA also suggested that association between the sub-components of Use and Use itself was very high. The same was true between skill index and digital literacy implying digital literacy is instrumental in promoting overall digital economy.

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