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ICT FOR SUSTAINED COMMUNITY DEVELOPMENT IN INDIA IN THE 5G ERA

Dr. Manoj P. K.

Head, Department of Applied Economics,
Cochin University of Science and Technology (CUSAT),
Kochi, Kerala. E-mail: manoj_p_k2004@yahoo.co.in,
ORCID ID: https://orcid.org/0000-0002-5710-1086

Abstract

Introduction: Considering the immense development potential of ICT, this paper closely looks into the innovations in the telecom sector like 5G. It examines how such innovations can be used to bring about fast, equitable and sustainable economic development in India with a focus the rural community, given the vast linkage effects of the telecom sector. Its ability to reduce gender-divide, rural-urban divide etc. are discussed and suggestions are made to effectively use its potential. Methodology: This exploratory study is structured into a descriptive-analytical type research paper. It is based on secondary data from the Governmental and other authentic sources, and uses basic statistical tools for data analysis and interpretation. Results: Based on an extensive study of the latest data, an imminent need for ICT adoption for the faster and sustainable economic development in India in this 5G era has been noted. Conclusion: Strategies like expanding the ICT infrastructure in India especially tele-density in the country and that in a sustainable manner (e.g. 'Green Telecom) have been suggested.

Keywords: ICT, 5G, Telecom, FinTech, ONDC, Women Empowerment, Rural Credit.

JEL Codes: D-83, J-16, O32, Q32.

1. INTRODUCTION

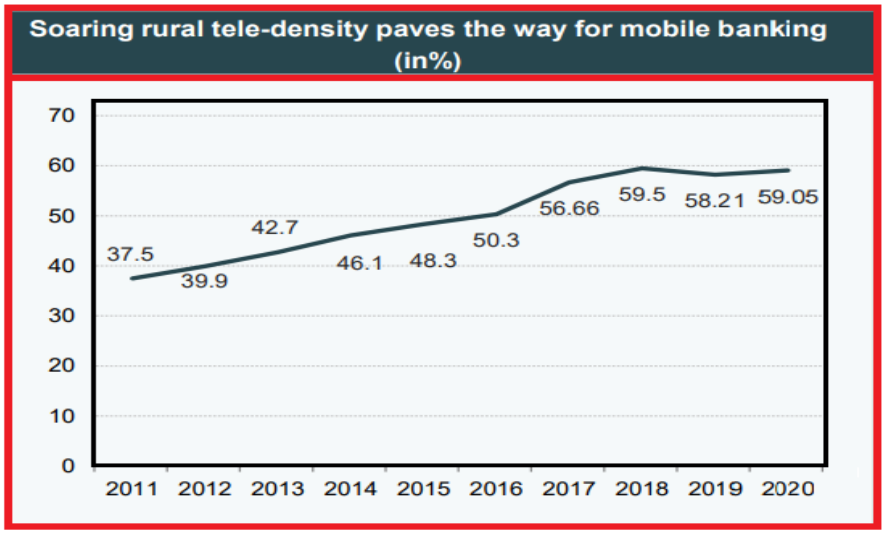
Worldwide, digital transformation is the new normal and it modernizes every sector, and India is no exception. ICT advances trigger digital transformation in every sector and the Telecommunication (Telecom) industry acts as a key enabler of the digitalization process. Govt. of India (GoI) through its *Digital India* mission has been striving to rebuild Indian economy into a knowledge economy – a digitally empowered society, since 01 July 2015. ICT's huge potential is increasingly being manifested in the fast growth of FinTech sector, and latest initiatives like ONDC (Open Network for Digital Commerce). Today India being one among the 'fastest growing FinTech markets in the world' and a global leader in digitalization having growing telecom and internet penetration. (RBI, 2021). With the launch of ONDC, 5G services and such others, these latest initiatives will drive Indian digital economy in the ongoing 'techade' (RBI, 2023). In this context, this paper looks into the role of 5G and other latest initiatives along with a robust Telecom infrastructure for fast economic growth of India and that too equitably and sustainably.

2. SIGNIFICANCE OF THE STUDY

Once we trace the growth trajectory of Indian Telecom sector, it may be noted that it had a robust beginning with the launch of the Telecom Policy, 1994. The policy priority to this vital sector continued till date and the initiatives like *Digital India* (July 2015) could reinforce such a move. Policy focus on ESG (Environmental, Social and Governance), global imperative for sustainable growth of any sector, has been made applicable to this key sector of the economy so as to provide a 'Green' (sustainability) touch. A steady growth in tele-density could be observed in India over the years, from 2011 to 2020. This is particularly relevant regarding the rural tele-density (IBEF, Nov.

2022), as the rural tele-density can make the growth more equitable, balanced and sustainable. (Figure I)

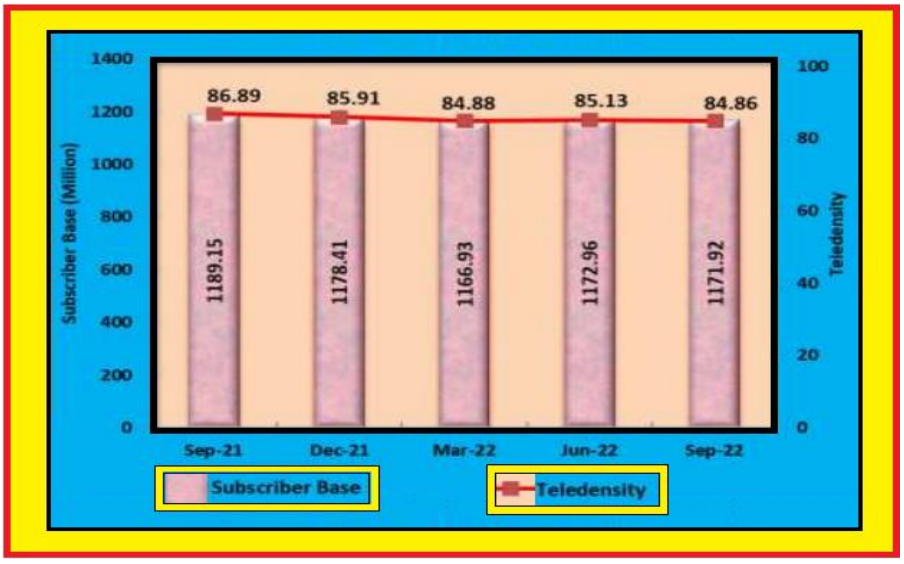
Figure I: Growing Tele-density in India (2011-2020)



Source: IBEF (2022) *Banking*, Nov., p.18.

Despite the steady growth in tele-density over the years 2011 to 2020 (Figure I), of late, a stagnancy together with indications of slight decline also (Figure II) can be noted. This trend needs to be reversed for accelerating the pace of economic growth in India, since telecom infrastructure is essential for the growth of any sector. As noted earlier, rural tele-density is more relevant due to its capacity for rural development and hence balanced and sustainable economic growth. The rather discouraging trend is noticeable in Figure II which is based on the latest official data of TRAI dt. 03 Feb. 2023. (Figure II).

Figure II: Stagnancy and Slight Decline in Tele-density in India since 2021



Source: Govt. of India, TRAI, *Press Release No.8/2023* dt. 03 Feb. 2023. p.5 of 11.

It is further noted that while telephone subscribers in urban India increased from 6491 lakhs (June-end, 2022) to 6516 lakhs (Sept.-end, 2022) urban tele-density in India

declined from 134.72 percent to 134.62 period during the above period (June-Sept. 2022).

Regarding the telecom infrastructure, the latest trend in rural India is worse than urban India because rural telephone subscribers fell from 5232.7 lakhs (June-end, 2022) to 5203 lakhs (Sept.-end, 2022) and the rural tele-density too declined from 58.46 percent to 58.01 percent during this period. Despite the fact that India had the second largest telecom subscribers (11678.2 lakhs) and the second largest number of internet users (7887.7 lakhs) as of April 2022, the more recent statistics (Feb. 2023) suggests the need for further improvement and the need for reversal of the falling trends. Similarly, though India could attract an FDI of USD 38.33 Billion during the period April 2000 to March 2022, the FDI inflows too needs scaling up. Considering the huge demand due to *Digital India* and other ICT-based initiatives, the telecom infrastructure in India, tele-density, internet penetration etc. need to be improved, and these aspects need to be studied closely and in detail using the latest data, say, as of Jan. 2023. This study assumes significance in this context.

3. OBJECTIVES OF THE STUDY AND METHODOLOGY

This paper aims: (i) to study the current status of telecom sector in India, marked changes in its earlier growth pattern in the recent past, and also the implications of such changes (ii) to study the need for migration to 5G and also as to how a robust telecom sector can support ICT-enabled services that enable women empowerment, rural development, and sustained economic growth; (iii) to suggest strategies for the sustained and equitable growth of India through digital transformation backed by a robust telecom network.

This descriptive-analytical study is exploratory too, and it uses secondary data from authentic sources, like, the reports and other publications by Government agencies, like, RBI, TRAI, etc. And also reputed global level research agencies, like, McKinsey.

4. CURRENT STATUS OF THE INDIAN TELECOM: NEED FOR FASTER AND SUSTAINED GROWTH

There was a steady and fast growth of Indian telecom sector ever since the adoption of Telecom Policy of 1994, till FY 2021. The advent of cellular (mobile) phones and its dramatic growth surpassing the landline phones was possible due to the robust telecom infrastructure. A revenue-sharing model between the government and the telecom service providers formed the basis for expansion of India's telecom infrastructure, whereby Spectrum fees and Licensing fees were the two basic fees payable by the telecom providers to the government. The inception of Indian telecom industry was in the British regime when the government had the monopoly over it and this continued in independent India till 1991, when as part of globalization the telecom industry too was opened up for the private sector; leading to many players in the industry. Since its opening up, Indian telecom industry has been witnessing fast transformation all over. The rural tele-density in India is as high as 44.25 percent as against 55.75 percent for the urban. (Table I).

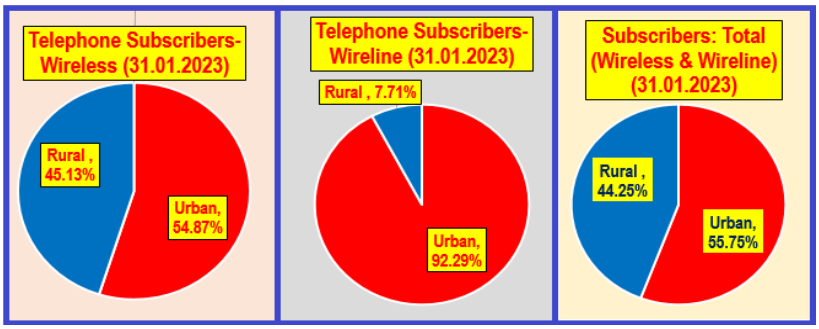
Table I: Latest Status of Telecom Infrastructure in India (31 Jan. 2023)

Highlights of Telecom Subscription Data as on 31st January, 2023			
Particulars	**Wireless**	**Wireline**	**Total** (Wireless+ Wireline)
Broadband Subscribers (Million)	**806.07**	**33.11**	**839.18**
Urban Telephone Subscribers (Million)	**627.13**	**25.59**	**652.72**
Net Addition in January, 2023 (Million)	0.10	0.24	0.33
Monthly Growth Rate	0.02%	0.94%	0.05%
Rural Telephone Subscribers (Million)	**515.89**	**2.14**	**518.03**
Net Addition in January, 2023 (Million)	0.00	0.039	0.04
Monthly Growth Rate	0.00%	1.87%	0.01%
Total Telephone Subscribers (Million)	**1143.02**	**27.73**	**1170.75**
Net Addition in January, 2023 (Million)	0.10	0.28	0.37
Monthly Growth Rate	0.01%	1.01%	0.03%
Overall Tele-density*(%)	**82.52%**	**2.00%**	**84.52%**
Urban Tele-density*(%)	128.76%	5.25%	134.02%
Rural Tele-density*(%)	57.44%	0.24%	57.68%
Share of Urban Subscribers	54.87%	92.29%	55.75%
Share of Rural Subscribers	45.13%	7.71%	44.25%

Source: TRAI (2023), *Press Release* dt. 31.03.2023. (www.trai.gov.in)

From the analogue landline days (that required many days to install), India adopted the much faster digital technology. Indian population fast embraced the technological advances, right from the 2G wireless telephone. Now 98 percent is of wireless type and the rest 2 percent is of wireline type. When we look into the current scenario (as of 31.01.2023) based on the TRAI data dated 31.03.2023) is noted that as high as 44.25 percent is the telephone subscribers (both wireless and wireline) in rural India whereas it is 55.75 percent in urban India. The respective shares in respect of the segment of wireless subscribers alone is 45.13 percent (rural) and 54.87 (urban) and these are very much similar to the former case of total subscribers. (Figure III). But, in respect of wireline subscribers, the share of rural subscribers is glaringly low and is at the level of 7.71 percent as against 92.29 percent for urban subscribers. It may be noted that the total telephone subscribers (wireless and wireline) of 1170.75 million, the lion's share of 1143.02 million (97.63 percent) goes to urban subscribers and the rest 27.73 million (2.37 percent) denotes rural subscribers. Figure III.

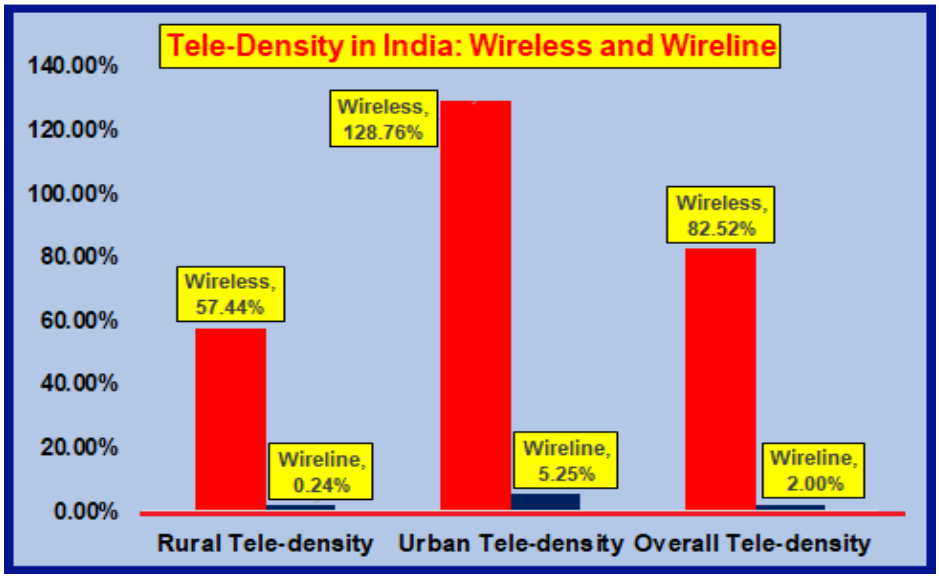
Figure III: Telephone Subscribers and Tele-Density in India (as of 31.01.2023).



Source: TRAI (2023), *Press Release* dated 31.03.2023. (www.trai.gov.in)

Regarding the changing technologies underlying the telecom industry, the age old analogue landline kind has nearly disappeared from the market now, with the arrival of GSM mobile technology. Even GSM technology is migrating slowly from 2G to 3G, then to 4G, and thereafter to 5G – different generations (G) of technologies. India's subscriber base (1170.75 million)(as of 31.01.2023) is the second largest in the whole world and the number of subscribers is fast growing too. Regarding the tele-density of rural and urban India, the overall tele-density is 82.52 percent (wireless) and 2 percent (wireline). But, if urban India alone is considered it is as high as 128.76 percent (wireless) and 5.25 percent (wireline). On the other, if rural India is considered, it is only 57.44 percent (wireless) and just 0.24 percent (wireline). It may be noted that tele-density in general needs to be improved further, especially in rural areas of India (Figure IV), especially if we consider the disturbing trend of gradual fall in tele-density since 2021 (Figure II) as noted earlier.

Figure IV: Telephone Subscribers and Tele-Density in India (as of 31.01.2023).

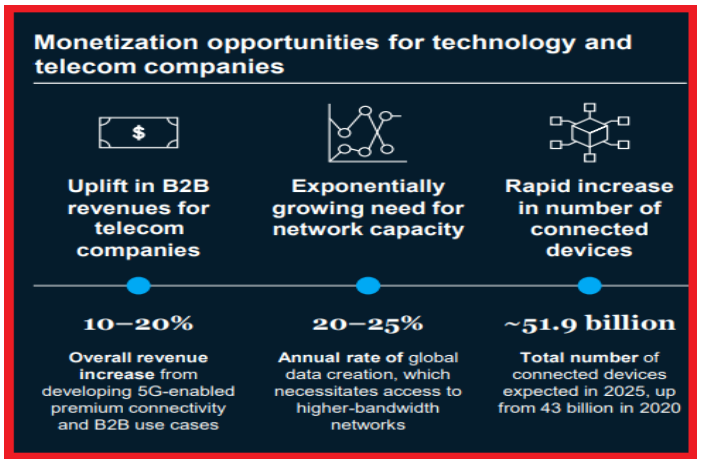


Source: TRAI (2023), *Press Release* dated 31.03.2023. (www.trai.gov.in)

5. MIGRATION TO 5G IN INDIA: AN IMPERATIVE IN THE ONGOING FINTECH ERA

Studies done at the international levels have revealed that adoption of 5G and other latest technologies by the telecom service providers could fetch them benefits, such as follows: (i) increase in the Business to Business (B2B) revenue to the extent of 10 to 20 percent, (ii) Exponential rise in network capacity-20 to 25 percent increase in global data creation, and also (iii) Quick increase in the number of connected devices – 51.9 Billion. (McKinsey, 2022. Aug.). Thus, it is now largely acknowledged that 5G adoption is a vital need for competitiveness of the telecom sector, not just an option. (Figure V).

Figure V: Telecom Industry-5G is Vital

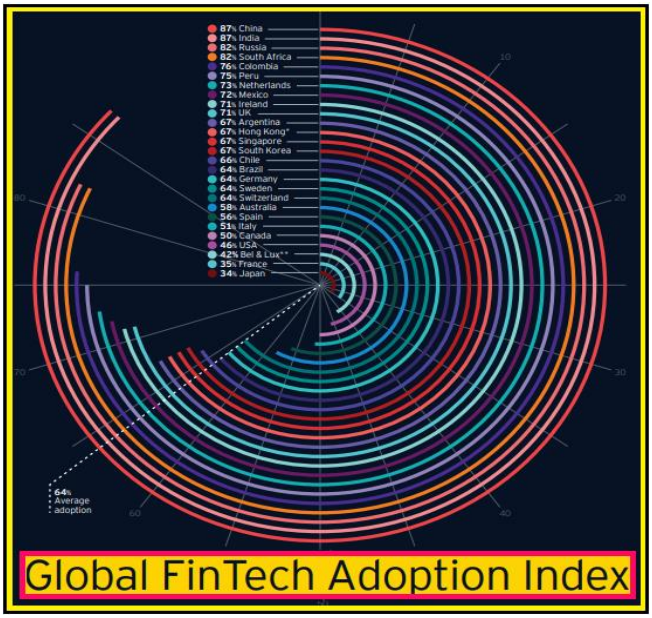


Source: McKinsey (2022). Aug.

It may be noted that the 'Global 5G Imperative' is very much applicable to India. India's tele-density has rapidly grown from 18.23 percent (FY 2016) to 88.17 percent (FY 2021). India's rural tele-density was at a high level of 60.27 percent (FY 2021) also. But, the current status (31.01.2023) warrants scaling up the telecom infrastructure, as the tele-density is 84.52 percent and rural tele-density is 57.68 percent. (Table I & Figure II).

As a consequence of rapid telecom penetration, the Fintech sector gets a conducive environment for its fast growth in India. At present, as high as 87 percent of the digitally active population in India has adopted Fintech (RBI, FSR, 2021, p.87); because of the high penetration of the telecom, internet and mobile (smart) phones. It may be noted that India is topmost (second only to China), both China and India having the highest Fintech Adoption Index of 87 percent each, among 27 major nations worldwide. (Figure VI).

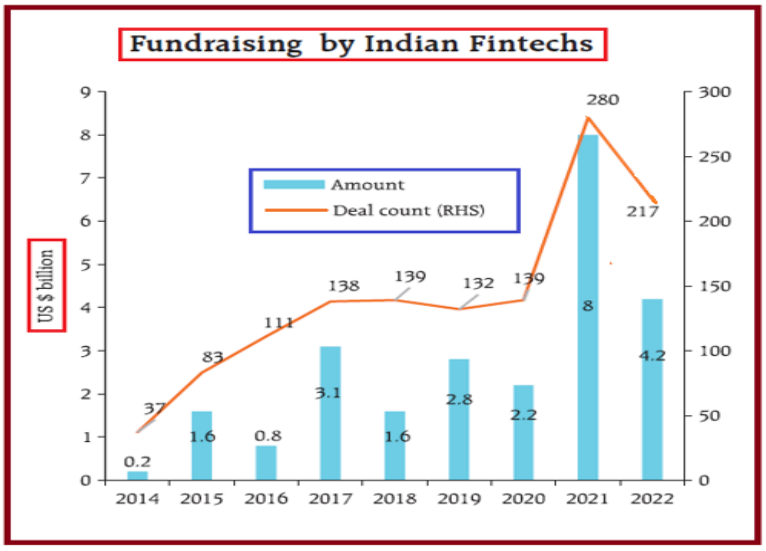
Figure VI: Global FinTech Adoption Index- India is second only to China



Source: EY (2019) (ey-global-fintech-adoption-index-2019.pdf)

India has witnessed commendable growth in Fintechs over the last few years because of the conducive governmental and regulatory environment, like, the thrust on *Digital India* as an umbrella scheme to promote digital transactions in all sectors, including payments under the diverse schemes of the Government like MGNREGS. There has been steady growth in the fund-raising by the Fintechs in India. In 2021 the Fintechs in India could raise a record amount of USD 8 Billion. But in 2022, there has been a fall in the funds raised by 47 percent to USD 4.2 Billion, and this trend needs to be corrected or reversed through more vigorous promotional measures by the Government, on the lines of JAM, Digital India etc. Figure VII is self-explanatory in this regard.

Figure VII: Growing Trend in Fund-raising by the Fintechs in India



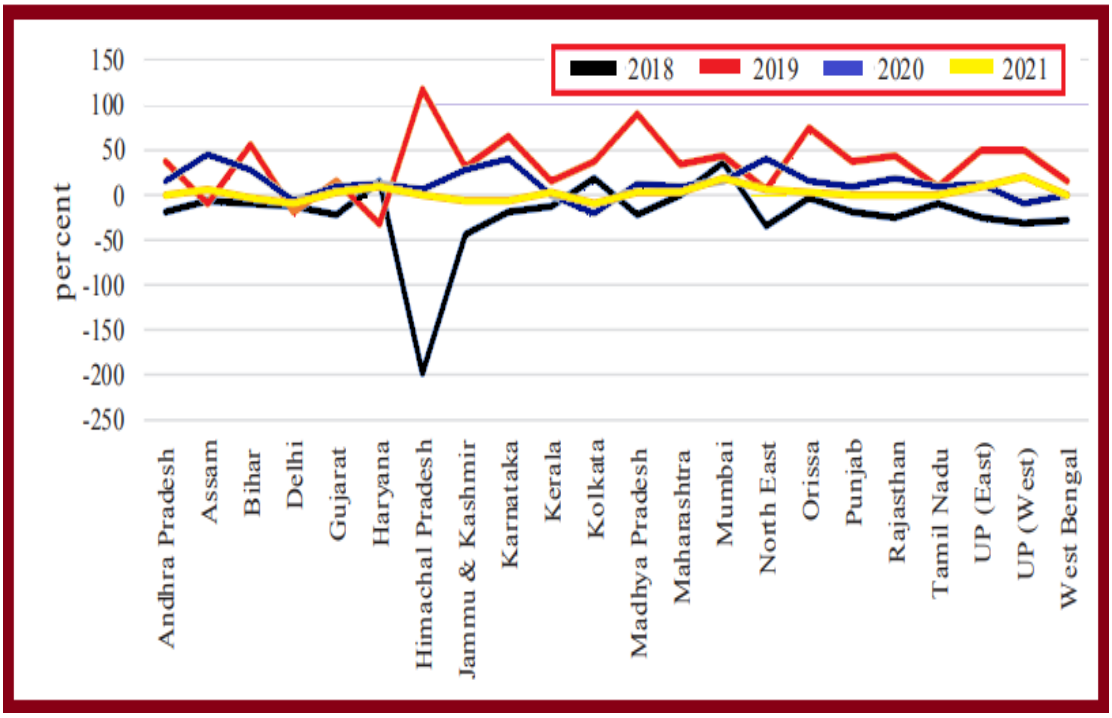
Source: RBI (2023), *RBI Bulletin,* Jan., p.54.

As per the latest statistics, India has 1170.75 million telephone subscribers (wireless and wireline) and tele-density of 84.52 percent (31 Jan.2023; Table I). India has 837 Crore internet connections (June 2022), and 676 million smartphone users. Worldwide, there is an imminent transition to 5G and other latest technologies. India is very much a part of this global '5G Imperative', as noted earlier. So, every week 2500 new 5G-Towers are being mounted in India, against a target of 10,000 Towers. India is projected to have 35 Crore 5G subscribers by 2026, representing 27 percent of the total. By 2025, India will require 22 million skilled workers in 5G-centric technologies.

6. FINTECH REVOLUTION AND 5G ADOPTION IN INDIA: MACRO ECONOMIC IMPLICATIONS

The rapid proliferation of telecom services and that of advanced types like 5G enables the fast growth of the FinTech providers and such other ICT-based services. The COVID-19 pandemic, in one way, triggered the 'digitization' kind of transformation in Indian society because the Government promoted online kind of education as well as all online (digital) mode dealings in all sectors. Services like FoodTech, EdTech, HealthTech in particular, and E-commerce in general had high growth momentum in the recent past. (2019-2021).

Figure VIII: LSA-wise Difference-Rural Growth over Urban Growth-Internet Subscribers



Source: RBI (2023), *RBI Bulletin,* Jan., p.54.

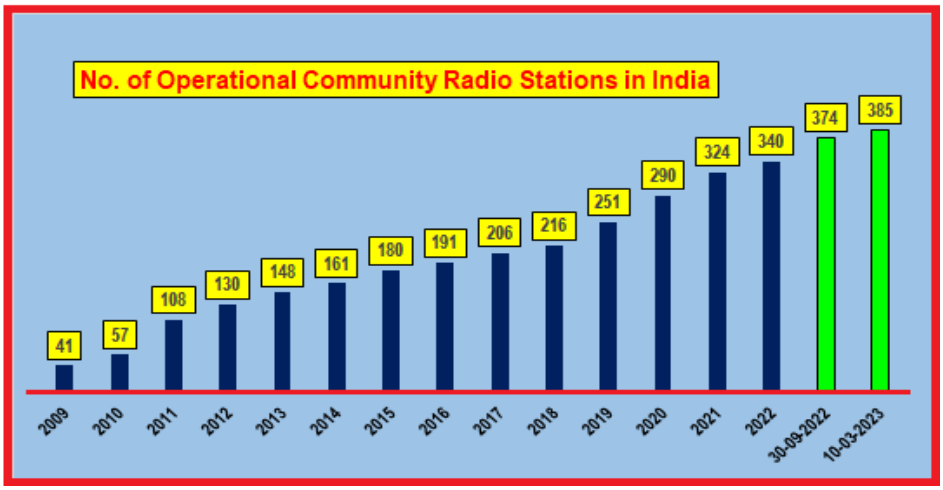
Figure VIII depicts the difference in rural growth (percent) over urban growth (percent) in internet subscribers in India over the four years' period (2018 to 2021), based on LSAs (License Service Area). By 2021, the fourth year, the rural-urban difference has almost fully been evened out.

Black curve (2018) had the largest fluctuations, followed by the Red curve (2019) with lesser fluctuations, and then by the Blue curve (2020) with still lesser fluctuations and lastly by the Yellow curve (2021) with the least fluctuations – almost like a straight line along zero, i.e.'nil' rural-urban difference (2021).(Figure VIII).

Besides evening out the rural-urban difference in internet connections (Figure VIII) over the years (2018-2021) by way of ensuring larger number of internet connections in rural India than in urban India. In fact, during the specific period of 2019-2021, there were 95.76 million rural internet connections vis-à-vis 92.81 million urban connections.

Moreover, the steady growth in Community Radio Stations (CRSs) can propel faster rural development in India, primarily through empowering the farmers, women etc. by sharing the requisite information for agricultural activities, marketing of produce etc. (Figure IX).

Figure IX: Number of the Operational Community Radio Stations in India - Trend.

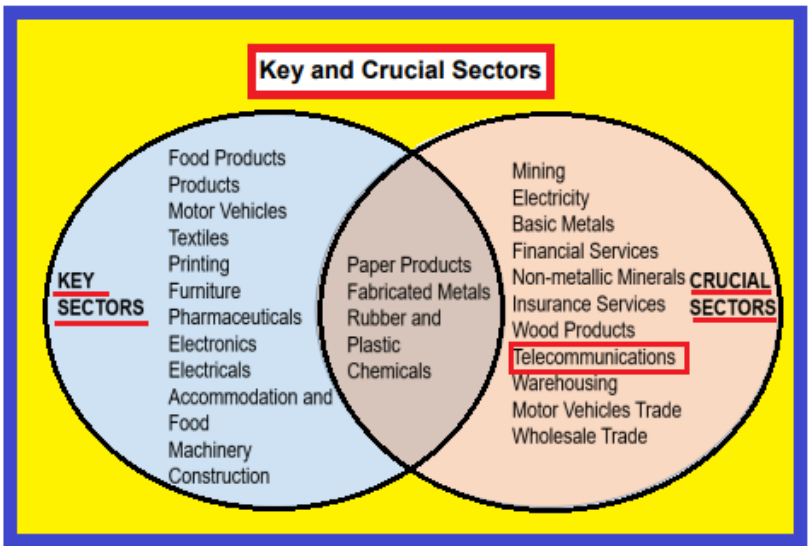


Source: GoI (2023), Ministry of Information and Broadcasting. (www.mib.gov.in).

The telecom service providers and banks as well as the banking regulator (RBI) are greatly promoting mobile banking solutions in India. They try to penetrate into the rural market through mobile banking solutions. Rural customers, including women can have banking services with the help of this simple ICT tool (mobile phone). This accelerates the financial inclusion process. It is globally acknowledged that mobile phone facilitates easy access to the formal banking services to the unbanked rural masses including women (Pickens, 2009). In India, the growing tele-density, supportive policies of the RBI and also the Governments at the Union and States etc. could expedite the financial inclusion.

In fact, telecom sector may be noted to be a 'Crucial Sector' of Indian economy that could heavily contribute towards the welfare and productivity of several other sectors and hence accelerate economic growth of the whole nation. (RBI, 2022, p.18) (Figure X).

Figure X: Telecom: A Crucial Sector.



Source: RBI Working Paper (WP: 08/2022), p.18.

The present policy of the GoI, and the RBI (including the entities regulated by RBI, like, the commercial banks) of promoting ICT, adoption of 5G and other latest systems (Web3, Metaverse, etc.) should continue in the future too with added vigor; because of their vast potential to bring about rural development, women empowerment, etc., and hence inclusive, equitable and sustainable growth of the economy. The telecom sector acts as an enabler for all sorts of ICT-enabled services as above, and hence this vital sector deserves policy focus, much more investment in the future. This is due to the fact that this key sector has high input multiplier and low CV (co-efficient of variation) or higher spread. Thus, inputs from telecom sector are being employed in a wide range of other sectors; and the sector has vast forward and backward linkages. A negative relation can be noted in a scatter diagram of forward linkages and CV. This suggests that higher multipliers of telecom are associated with higher spread of its linkages. (Figure XI).

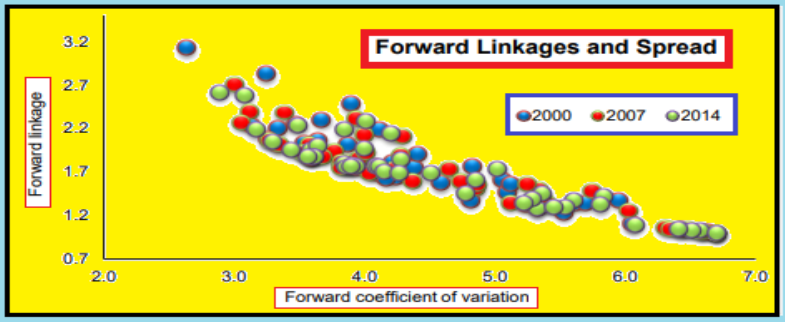
Figure XI: Forward Linkages & Spread.

Backward Linkages and Spread

Sector	Output Multiplier			Backward Coefficient of Variation		
	2000	2007	2014	2000	2007	2014
Telecommunications	1.23	1.34	1.23	5.51	5.10	5.49

Forward Linkages and Spread

Sector	Input Multiplier			Forward Coefficient of Variation		
	2000	2007	2014	2000	2007	2014
Telecommunications	2.01	2.02	1.95	3.34	3.35	3.44



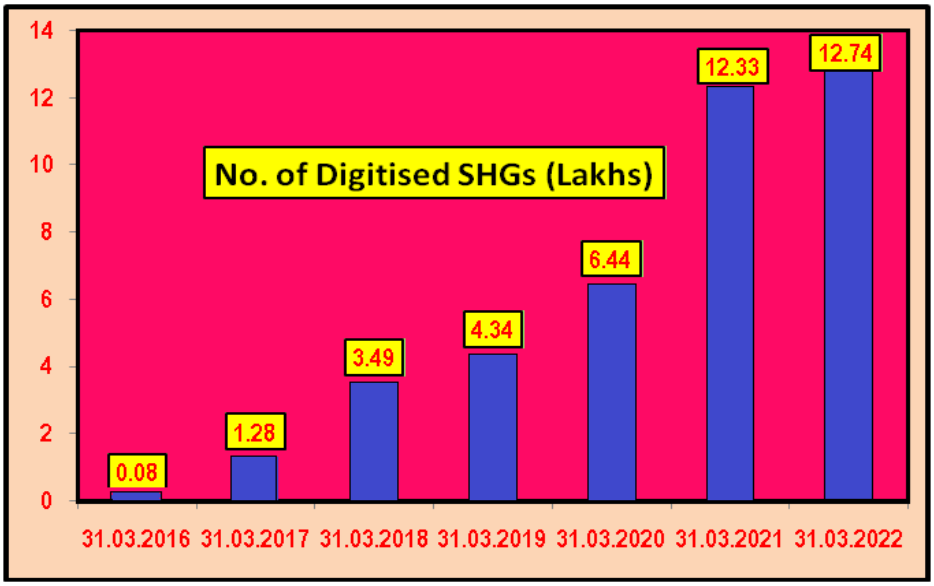
Source: RBI Working Paper (WP: 08/2022), p.18.

As a crucial sector of Indian economy (Figure X), the telecom sector can help to accelerate the financial inclusion and rural development process. In this digitalization era, ongoing innovation by adopting the latest technologies (5G, metaverse, etc.) is imperative for the telecom industry. This can ensure rich dividends in the future in the form of faster, equitable, and sustainable economic growth by expediting the financial inclusion and rural development. This augers very well with the *Digital India* initiative and other GoI schemes for rural welfare, employment and inclusive growth (PMJDY, MGNREGA etc.) because ICT integration ensures their efficient execution. The most important benefit of ICT is that it can ensure divide-free growth of all sectors – growth free of gender-divide, rural-urban divide, poor-rich divide, or such other kinds of divides. ICT is a key tool for the empowerment of women, rural development, and also balanced and equitable growth.

7. ICT FOR WOMEN EMPOWERMENT AND INCLUSIVE AND SUSTAINED GROWTH

Global experiences suggest the crucial role of ICT for women empowerment and also for equitable growth by bridging rural-urban divide, and other divides; e.g. Pickens (2009) has noted based on his empirical study in Philippines that the poor, including women, could effectively use a simple and cheap digital device viz. mobile phone for upgrading their lives. SHGs (Self Help Groups), mostly run by CSOs (Civil Society Organisations), often raise thrifts from the poor and channel such pooled savings for economic activities by the SHG members collectively. SHGs, mostly run by women (90 percent or more), enable their members to raise their livelihoods. In due course, many SHGs start their own micro enterprises (MEs) also. SHG-Bank Linkage Program (SHG-BLP), a revolutionary initiative of NABARD, is the largest in the world. *E-Shakti*, the ICT adoption by SHGs, a project of NABARD, is a radical step for empowering women through ICT. (Figure XII).

Figure XII: ICT-adopted SHGs. (*E-Shakti*)



Source: NABARD (2022), p.53.

In view of the growing affordability of mobile phones and other ICT-based devices, the masses particularly poor women can have access to formal banking services using their mobile phones or such other devices, including internet facility. Global experiences as in Philippines (Pickens, 2009) and Indian examples like those of *E-Shakti* project of NABARD or SHGs under *Kudumbashree* project under the Govt. of Kerala (GoK) are all testimonies to the empowerment potential of ICT. Diverse schemes of GoI are getting ICT-integrated fast thus ensuring better transparency, and benefits reach their intended recipients directly. Direct Benefit Transfer (DBT) schemes are growing fast. (Table II).

Table II: ICT-based DBT (GoI) Schemes - Progress

DBT (GoI)	FY-2020	FY-2021	FY-2022
Funds (Cr.)	381632	552527	630265
No. (Cr.)	144.7	179.9	178.9

Source: GoI (2023), *Economic Survey*.

8. A ROBUST TELECOM NETWORK FOR SUSTAINED ECONOMIC GROWTH: SUGGESTIONS

In view of the foregoing, given the obvious benefits of ICT (and allied services like ONDC, FinTechs, Metaverse etc.), it is meaningful to suggest some strategies based on the findings of this study. These are as follows:

(i) Despite the steady growth of telecom network and tele-density in India over the years till 2021, indications of a slight slowdown or at least stagnancy is noted in the recent past. So, added thrust on reversal of this slowdown is very much required, to sustain the growth momentum of telecom sector and hence its positive effects on the whole economy; telecom being a sector with vast multiplier (linkage) effects;

(ii) Only 'Green' initiatives will be sustainable in the long run, and the future of telecom sector is no exception. A 'Green Telecom' must be the ultimate aim so as to ensure sustainability. It supports multiple SDGs (Sustainable Development Goals) also; like, (1) SDG-1 (Poverty), by way of ICT-enabled livelihood, rural development, etc. (2) SDG-5 (Gender Equality), by way of ICT-enabled women empowerment, livelihood development etc.; (3) SDG-10 (Reduced Inequalities), since ICT reduces all kinds of divides; and (4) SDG-13 (Climate Action), because all 'Green' moves straight way support climate action. In short, a 'Going Green' strategy to the telecom (and hence all ICT-enabled services) can clearly ensure rich dividends in the future by making the growth process sustainable in the long run.

(iii) Having ensured a robust telecom infrastructure that can easily support ICT-enables services of all sorts, it is essential to fast adopt the innovations in the sector like 5G. Globally, 5G and other latest technologies like Metaverse have become imperatives and so India too should adopt them so as to remain competitive in the market.

(iv) To keep abreast of the changes, suitable training and development at all levels be imparted for the effective use of ICT-enables tools and applications, given the fast pace of technological advances. Such trainings and capacity building programmes are particularly relevant for the poor and the marginalized, including women, since they need training for rightly using ICT-based tools like mobile phones and ATMs.

(v) The Governments at the Centre and States should pay special attention to DBT mode of payments that directly reach the intended beneficiaries, in respect of all schemes run by them. Paperless transactions and online mode payments be promoted at all levels. Measures like DBT and online deals can improve transparency and ensure good governance including combating corruption.

References

1) Telecom Regulatory Authority of India (TRAI) (2023). Press Release. dt. 31.03.2023. (https://www.trai.gov.in/sites/default/files/PR_No.31of2023.pdf).

2) Reserve Bank of India (2021). Financial Stability Report. Dec. (www.rbi.org.in)

3) Reserve Bank of India (2022). Working Paper. WPS (DEPR): 08/2022. Towards Atma Nirbhar Bharat: An Exploration of Linkages and Leakages. (www.rbi.org.in).

4) Reserve Bank of India (2023). RBI Bulletin. Vol. LXXVII, No.1, Jan. (www.rbi.org.in).

5) IBEF (2022). Banking. India Brand Equity Federation. New Delhi, Nov.

6) IBEF (2022). Telecommunications. India Brand Equity Federation. New Delhi, Nov.

7) NABRAD (2022). Status of Microfinance in India 2021-22. (www.nabard.org.in).

8) Manoj PK (2007). ICT industry in India: a SWOT analysis. *Journal of Global Economy,* 3(4): 263–282. (doi: 10.1956/jge.v3i4.143.)

9) Ali, O.P. and Manoj, P.K. (2020). Impact of falling price of rubber-a case study of Kothamangalam Taluk in Ernakulam district. Indian Journal of Economics and Development, 16(1), 118-124.

10) McKinsey (2022). Technology Trends Outlook. Aug. (www.mckinsey.com).

11) Manoj PK and John MP (2014). Prospects of Cattle Feed Industry in India and Strategies for Utilizing the Market Potential: A Study in Kerala with a Focus on Factors Influencing Buyer Behaviour. *International Journal of Business and General Management (IJBGM)*. 3(3):1-12.

12) Manoj PK (2015).Cattle feed industry in India: a macro perspective. *International Journal of Commerce and Business Management,* IV (10)(I):96-101.

13) Monica M V & Manoj, P. K. (2014). Determinants of valuation: An empirical study of Mergers and Acquisitions in Indian Mutual Fund Industry. International Journal of Business and Administrative Research Review. 2 (4), 37-48.

14) Neeraja James and Manoj, P.K. (2014), Relevance of E-Banking Services in Rural Area–An Empirical Investigation, Journal of Management and Science, 5, 1-14.

15) Pickens, M (2009). Window on the unbanked: Mobile money in the Philippines. https://www.cgap.org/sites/default/files/CGAP-Brief-Window-on-the-Unbanked-Mobile-Money-in-the-Philippines-Dec-2009.pdf

16) Manoj P.K. (2012), Information and Communication Technology (ICT) for Effective Implementation of MGNREGA in India: An Analysis, Digital Economy of India – Security and Privacy, Serials Publications, 4830/24, New Delhi, pp.145-150, First Ed.

17) P.K Manoj (2019).Social banking in India in the reforms era and the case of financial inclusion: Relevance of ICT-based policy options. Journal of Advanced Research in Dynamical and Control Systems. 11 (7). 1654-1666.

18) P.K Manoj (2019).Dynamics of human resource management in banks in the ICT era: A Study with a focus on Kerala based old private sector banks. Journal of Advanced Research in Dynamical and Control Systems. 11 (7). 1667-1680.

19) J Joju. & PK Manoj (2019). Banking Technology and Service Quality: Evidence from Private Sector Banks in Kerala. International Journal of Recent Technology and Engineering. 8 (4). 12098-12103.

20) J Joju. S Vasantha. PK Manoj (2017). Electronic CRM & ICT-based banking services: An empirical study of the attitude of customers in Kerala. India. International Journal of Economic Research. 14(9). 413-423.

21) Jacob Joju, Vasantha, S. &Manoj, P.K. (2017). Financial technology and service quality in banks: Some empirical evidence from the old private sector banks based in Kerala, India. International Journal of Applied Business and Economic Research, 15(16), 447-457.

22) Lakshmi. & P.K Manoj (2017). Service quality in rural banking in north Kerala: A comparative study of Kannur district co-operative bank and Kerala Gramin bank. International Journal of Applied Business and Economic Research. 15 (8). 209-220.

23) P.K Manoj (2016). Bank Marketing in India in the current ICT era: Strategies for effective promotion of bank products. International Journal of Advance Research in Computer Science and Management. 4(3). 103-113.

24) P.K Manoj (2016). Real Estate Investment Trusts (REITs) for Faster Housing Development in India: An Analysis in the Context of the New Regulatory Policies of SEBI. International Journal of Advance Research in Computer Science and Management. 4(6). 152-157.

25) S Rajesh., PK Manoj, (2015). Women Employees work life and challenges to Industrial Relations: Evidence from North Kerala. IPASJ International Journal of Management (IIJM). 3 (4). 1-8.

26) PK Manoj PK (2015). Deterrents to the Housing Microfinance: Evidence from a Study of the Bankers to 'Bhavanashree' in Kerala, India. International Research Journal of Finance and Economics. 44-53.

27) Vidya Viswanath & Dr. Manoj P.K (2015). Socio-Economic Conditions of Migrant Labourers - An Empirical Study in Kerala. Indian Journal of Applied Research (IJAR). ISSN: 2249-555X. 5 (11). 88-93.

28) J Joju., S Vasantha., PK Manoj P.K. (2015). E-CRM: A perspective of Urban and Rural Banks in Kerala. International Journal of Recent Advances in Multidisciplinary Research. 2 (9). 786-791.

29) J Joju., S Vasantha., P.K. Manoj. (2017). Future of brick and mortar banking in Kerala: Relevance of branch banking in the digital era. International Journal of Civil Engineering and Technology, 8(8), 780-789.

30) Manoj, PK (2015). Socio-Economic Impact of Housing Microfinance: Findings of a Field based Study in Kerala. India. International Research Journal of Finance and Economics. 32-43.

31) S.Rajesh & PK Manoj (2014).Politicization of Trade Unions and Challenges to Industrial Relations in India: A Study with a Focus on Northern Kerala. International Journal of Business and Administration Research Review. 1(2).45-54.

32) N James & PK Manoj (2014). Relevance of E-Banking Services in Rural Area–An Empirical Investigation. Journal of Management and Science. 5. 1-14.

33) William George AJ & PK Manoj (2013). Customer relationship management in banks: A comparative study of public and private sector banks in Kerala. International Journal of Scientific Research. 2(9).246-249.

34) P.K Manoj PK (2013). Prospects and Challenges of Green Buildings and Green Affordable Homes: A Study with Reference to Ernakulam. Kerala. Global Research Analysis. 2 (12). 45-49.

35) KK Nasar. & PK Manoj (2013). Customer satisfaction on service quality of real estate agencies: An empirical analysis with reference to Kochi Corporation of Kerala State in India. International Journal of Management. IT and Engineering. 3 (6). 213-227.

36) P.K Manoj (2012). Potential of micro enterprises in women empowerment: A critical study of micro enterprises run by women under the Kudumbashree Programme in Kerala. International Journal of Business Policy and Economics. 5(2). 1-16.

37) P.K Manoj (2011). Determinants of Profitability of Housing Finance Companies in India and Strategies for Competitiveness: a Multiple Partial Correlation Approach. International Journal of Business Intelligence and Management. 3(2). 121-137.

38) P.K. Manoj (2010). Impact of Technology on the efficiency and risk management of old private sector banks in India: Evidence from banks based in Kerala. European Journal of Social Sciences, 14(2), 278-289.

39) P.K Manoj (2010). Determinants of Successful Financial Performance of Housing Finance Companies in India and Strategies for Competitiveness: a Multivariate Discriminant Analysis. Middle Eastern Finance and Economics. 7. 199-210.

40) P.K Manoj (2010). Environment-friendly tourism for sustainable economic development in India. International Journal of Commerce and Business Management. 2 (2). 139-147.

41) P.K. Manoj (2015). Employment Generation from Rural Tourism: A Field Study of the Local Community at Kumbalangi, Kerala. International Journal of Applied Services Marketing Perspectives (IJASMP). 4(4).1880-1888.

42) United Nations (2016). Digital Financial Inclusion. *Issue Brief Series*. International Telecommunication Union (ITU) 2016. (https://www.un.org/esa/ffd/wp-content/uploads/2016/01/Digital-Financial-Inclusion_ITU_IATF-Issue-Brief.pdf).

43) P.K. Manoj (2016). Real Estate Investment Trusts (REITs) for Faster Housing Development in India: An Analysis in the Context of the New Regulatory Policies of SEBI. International Journal of Advance Research in Computer Science and Management Studies, 4(6), 152-167.

44) P.K Manoj (2016). Determinants of sustainability of rural tourism: a study of tourists at Kumbalangi in Kerala, India. International Journal of Advance Research in Computer Science and Management Studies. 4 (4). 17-30.

45) Lakshmi and Manoj, P.K. (2017). Rural customers and ICT-based bank products: A study with a focus on Kannur district co-operative bank and Kerala Gramin Bank. International Journal of Economic Research, 14(14), 423-434.

46) Manoj, P.K. (2017). Construction costs in affordable housing in Kerala: Relative significance of the various elements of costs of affordable housing projects. International Journal of Civil Engineering and Technology, 8(9), 1176-1186.

47) Manoj, P.K. (2017). Cost management in the construction of affordable housing units in kerala: A case study of the relevance of earned value analysis (EVA) approach. International Journal of Civil Engineering and Technology, 8(10), 111-129.

48) Manoj, P.K. (2018). CRM in old private sector banks and new generation private sector banks in Kerala: A comparison. Journal of Advanced Research in Dynamical and Control Systems, 10 (2 Special Issue), 846-853.

49) Manoj, P.K. (2019). Competitiveness of manufacturing industry in India: Need for flexible manufacturing systems. International Journal of Innovative Technology and Exploring Engineering, 8(12), 3041-3047. (DOI: 10.35940/ijitee.K2452.1081219).

50) J Joju and Manoj PK (2019). Digital Kerala: A study of the ICT: Initiatives in Kerala state. International Journal of Research in Engineering, IT and Social Sciences; 9: 692-703.

51) J Joju and P K Manoj (2019). Banking Technology and Service Quality: Evidence from Private Sector Banks in Kerala, International Journal of Recent Technology, 8 (4), 12098-12103.

52) Elias, Arun A (2021). Kerala's Innovations and Flexibility for Covid-19 Recovery: Storytelling using Systems Thinking. Global Journal of Flexible Systems Management, 22 (Suppl 1), June, S33-S43. (https://doi.org/10.1007/s40171-021-00268-8).

53) Nripendra Narayan Das, Pradeep P, Prasanth C.B., and Manoj P.K. (2022). Sars-Cov-2 Novel Corona Virus: Origin and the Vaccination Survey. Journal of Pharmaceutical Negative Results, 13 (1), Oct., 1032-1040. DOI: 10.47750/pnr.2022.13.S01.123.

54) Ummer O, Scott K, Mohan D, et al. (2021). Connecting the dots: Kerala's use of digital technology during the COVID-19 response. BMJ Global Health; 6:e005355. DOI: 10.1136/ bmjgh-2021-00535.

55) Ranjith Karat, Suraj E.S, Jacob Joju, Manoj PK and Nithin J (2022), Covid 19 and the Healthcare Sector in Digital India: A Case Study of The Top Six Nifty Pharma Companies, International Journal of Early Childhood Special Education, 14 (05), Aug., 7595-7604. DOI:10.9756/INTJECSE/V14I5.960.

56) Saritha, C.K & Manoj, P.K (2023). Social inequalities in IT sector: Evidence from Kerala State in India. *Environment and Social Psychology*. 8 (2). 1-13. DOI: 10.54517/esp.v8i2.1644.

57) Manoj, P.K. (2023). Health Expenditure in Covid-19 Times and the Need for Affordable Houses that Nurture Healthy Citizens: A Roadmap for Digital Economy of Kerala. Migration Letters. 20. S4(2023). 43-61.

58) Jose, S. P. et. al. (2023). Corporate Decisions and Stock Price Movements: The Case of HUL in India. Migration Letters. 20.S1(2023). 305-315.

59) Manoj, P. K. (2023). Affordable Healthcare and Affordable Housing: Need for an Integrative Approach for the Holistic Growth of the Digital Economy of Kerala, India. Community Practitioner. 20(9). 412-435

60) Govt. of India (2023). Economic Survey 2022-23. Jan. (www.indiabudget.gov.in).

61) Govt. of India (2023), TRAI, *Press Release No.8/2023* dt. 03 Feb. 2023. (www.trai.gov.in).