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Sales, Connectivity and
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POLICY IMPACTS ON INDIAN TELECOM SERVICES INDUSTRY: SALES, CONNECTIVITY AND USAGES

Prajeesh Karonnon^{*} and Meenakshi Rajeev^{}**

Abstract

The telecom sector in India has undergone major policy shifts during the post 1990 period which have impacted the telecom sector in multiple ways. This paper analyses the impact of major policy shifts in the Indian telecom service sector, particularly from opening the market in 1990s to the recent introduction of fifth generation services. The policy impacts on three broad dimensions of the sector (usage, connectivity, and sales) are analysed using the secondary data. The analysis shows that the policy has been evidently successful in delivering its objectives up to a large extent in the post-2008. The trends in subscriber base, minutes of usage, rural and urban teledensity (though rural areas still lag behind), the Average Revenue Per User and the Minutes of Usage (ARPU) indicate the same. The success of these policies has been passed on to the customers in the form of tariff cuts and more connectivity. The analysis also showed that the increase in regulatory and access charges do not negatively affect the sales of the industry. Hence, more regulation of this nature may not significantly affect the industry negatively in terms of sales.

Key Words: Teledensity, Connectivity, Usage, Sale, TRAI, ARPU

Introduction

The importance of communication services especially the telecommunication services is growing day-by-day as an integral part of the infrastructural base for the overall socio- economic development. Accordingly, there has been a growing demand for transforming the structure of this industry from being a government monopoly to one, characterized by more competition so that communication services are provided efficiently at the lowest price and with improved quality (Das, 2000). In the reform era, in particular the policy makers have come to show a greater concern towards the development of the telecommunication sector. The major reason for this is the growing importance of telecommunication sector in terms of helping people and the market through a better flow of information in that, especially the activities of firms can be better coordinated and people can save on their transaction costs. As a major part of the infrastructural base, the telecom industry has linkages with almost all the other industries, with a multiplier effect on the economy. This multiplier effect, in turn has led the policy makers to give more weightage to this industry. These factors along with the privatization made the industry change its structure from monopoly to duopoly in the beginning and

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later to oligopoly and monopolistic competition. As a result, the industry has grown exponentially with India becoming the second largest telecommunications network in the world. Against this backdrop, this research attempts to study telecommunication industry with a specific focus on some of the important supply side aspects.

A look back to the 1950's shows that India had just over 300 telephone departmental exchanges with the number of telephone connections not exceeding even 83000 and the teledensity¹ also being very low (0.22) (Ahluvalia, 2000). The initiation of the crucial phase of telecommunications reforms began with the implementation of the New Telecom Policy-1999. The importance of this reform is that it privatised the telecom services, thereby promoting a healthy competition through an unrestricted entry to almost all services. During this period, 1000 new telephone lines were added every hour (Dossani, 2003). The development of Indian telecom sector became much rapid thereafter. From a teledensity of 1.94 in 1998, we have reached an overall teledensity of 84.46 as of April, 2023 (TRAI, 2023). The government's proactive and positive interventions with significant contributions from both the public and private sectors have been the main drivers of this rapid growth; the most important one being the changing market structure due after privatization. Further, changes in the regulations concerning the sector have also led to a faster growth.

Given this context of policy shifts and structural changes in Indian telecom services sector, this paper attempts to analyse the impact of the major policy shifts on the industry. The impact is analysed in terms of usage, connectivity, and sales. A comprehensive analysis of the impacts of the policy shifts in Indian telecom sector is missing in the existing literature and this analysis cater to that research gap. The study is carried out with quantitative research methods using the secondary data from the Department of Telecom, TRAI, Centre for Monitoring Indian Economy (CMIE) and various policy documents.

The rest of the paper unfolds as follows. The second section of the paper discusses the policy development and evolution of Indian telecom sector, the third section discusses the data and methodology, the fourth section analyses the impact of telecom sector policies on major indicators of the industry, and the fifth section concludes the analysis.

Policy Evolution of Telecom Sector in India

Pre-reform period

The history of Indian telecom sector goes back to the year 1851, when telegraph was introduced in India, at a time when the entire country was under the control of East India Company. The Britishers used telegraph as the best tool for the expansion and integration of their power. Following the company's acquisition, the British government privatized some exchanges in Mumbai, Calcutta, and Madras in 1882 to advance the telecom industry (Chowdary, 1998). To achieve further command over

¹Number of telephones per 100 people

India, they combined postal service and telegraph in 1883. However, there was certain confusion about the jurisdiction of telegraph services among various sections of the government. So the British government implemented the first Act in respect of this sector i.e., the telegraph act in the year 1885. The major feature of this Act was, it clearly defined that the central government's exclusive power with respect to establishing, maintaining, and working of telegraph services. This act also contained certain rules and regulations related to the administration of telegraph services in India. For a further improvement of telegraph service, wireless telegraph was incorporated this sector through the implementation of a special act called the Indian wireless telegraph act, 1933.

Post independence, the major focus of the government was on achieving self-reliance and promoting indigenous technology. As part of this, in the year 1948, the government set up the Indian telecom industry (ITI), the largest public sector telecom equipment manufacturing unit. In the second plan period, more importance was given to the development of industrial sector. Accordingly, as a part of promoting technology in telecom sector, in the year 1956, the government set up telecom research centre in Delhi. This apart, in the telecom service sector, in the year 1960, Subscriber Trunk Dialling (STD) was introduced between Kanpur and Lucknow as the first step towards developing the telecom sector across the country. In continuation of this, the government started International Subscriber Dialling (ISD) connecting Mumbai and London in the year 1976 as part of spreading telecom service at the international level.

The major problems which an industry could face are institutional, technological and economic resources (Horvath & Szabo, 2019). These problems were faced by the Indian telecom industry before the reforms. During the tenure of Rajiv Gandhi, telecom remained one of the six science and technology mission areas alongside more conventional development concerns such as rural drinking water and adult literacy. In 1981 seven lakh people were in the waiting line list for getting a telephone connection and only one percent of total villages in India had access to telecom. Sam Pitroda, who was advisor to the previous Prime Minister Manmohan Singh, came up with the scheme of state of the art digital switching system and he recommended to set up small rural exchanges all over India, and called for a greater investment in research (Abraham, 2017). With the twin aim of expanding telecom services and job creation, telecom mission advisers and the Department of Telecom launched a new scheme of payphones (STD booths) across India in 1988.

In 1985, the government created the Department of Telecommunications (DoT) as a separate department in response to the growing significance of telecommunication. This was followed by the setting up of two public sector enterprises such as Mahanagar Telecommunication Nigam (MTNL) across the metro cities of Mumbai, Delhi, and Calcutta, and Vidhesh Sanchar Nigam Limited (VSNL) for international services. The purpose of establishing the enterprises was to improve the quality of telecommunications. Further, in view of the growing functions of the telecommunication department, in the year 1989, a separate telecom commission was formed under the telecommunications department with the major functions of policy formulation for the department of telecom and to prepare the budget.

Post-reform Period

The reform in the sector has its origin during the pre-independence era. However, its prominence developed in the early 1980s and that evidently resulted in bringing more access to telecom by enhancing connectivity in the country. The growing importance of the sector and its linkage effects further has paved way for more government intervention in the sector during post 1990s. The 1990s marked a decade of reforms in the Indian economy. Considering that the government viewed telecommunication services as a necessary service rather than a luxury service, this sector also experienced reforms. Before reforms this industry was under the total control of the government. The primary reasons for natural monopoly in telecommunication services were the huge fixed and sunk costs associated with investment. Post reforms, the Indian government also felt the need to include more operators, especially in the basic telecom services market mainly due to two factors: (i) a continued increase in the waiting line of subscribers indicating a supply-demand gap; and (ii) a continued poor quality of service provided by the government operators (Jain & Sridhar, 2003). This led to the introduction of new policies in this sector. The major initiative which facilitated the development of telecommunication sector was the policy changes.

As already discussed, after 1990, there have been drastic changes in the telecom service sector of India. Government implemented the following changes in telecom sector through the introduction of several policies as documented in Table 1.

Table 1: Key Policy Reforms

Sr no	Year	Reforms
1	1991	<i>Announcement of the New Economic Policy in July 1991 Manufacturing delicensed</i>
2	1992	<i>Value Added Services (VAS) declared open to the private sector Private participation in service provision</i>
3	1994	<i>Formulation of National Telecom Policy 1994 Licence issued for providing mobile phone services in four metros. Two operators given licence per circle for ten years under a fixed licence fee regime</i>
4	1997	<i>Separation of policy and regulation: TRAI set up on March 28, 1997</i>
5	1999	<i>Formulation of New Telecom Policy 1999 The Government replaced the fixed annual license fee with revenue share regime</i>
6	2000	<i>BSNL formed in October 1, 2000 Restructuring of TRAI The Telecom Disputes Settlement and Appellate Tribunal (TDSAT) introduced. Private participation in National Long Distance Corporatization of BSNL</i>
7	2001	<i>Introduction of fourth cellular operator The Communication Convergence Bill 2001 introduced in the Lok Sabha</i>
8	2002	<i>Development of a framework for Universal Service Obligation Fund VSNL privatized Internet Telephony opened up since April 1, 2002</i>
9	2003	<i>Allowing limited local mobility operators as cellular operators Unification of access licenses Calling Party Pays introduced</i>
10	2004	<i>Private participation in International Long Distance India under the GATS agreed to open up International Telephony Broadband policy announced</i>
11	2005	<i>The FDI limit rose from 49% to 74%.</i>
12	2008	<i>Introduction of additional 2G licenses Access Deficit Charges (ADC) abolished for all calls</i>
14	2010	<i>Mobile Number Portability implemented</i>

		<i>3G and BWA Auctions</i>
15	2012	<i>Formulation of National Telecom Policy 2012</i> <i>Universalizing Broadband Access</i>
16	2013	<i>Uniform license regime</i>
17	2018	<i>National digital communication policy 2018.</i>
18	2021	<i>Telecom Reform Package 2021 – 100 % FDI</i>
19	2022	<i>National Telecom Bill 2022</i>

Source: Authors compilation based on various DoT and TRAI documents

The telecommunication sector suffered from inefficiencies, including longer waiting hours to access the service and the poor quality of the available services. The then ongoing debate on the dismal performance of the telecommunication sector culminated with the birth of the National Telecom Policy (NTP -1994). This was one of the major policy decisions in this sector during the post-reform era. The main policy goals include ensuring the prompt availability of telephone services on demand, enabling everyone to access a few essential telecom services at fair and affordable prices, ensuring world-class telecom services by the year 1997, turning India into a manufacturing hub for telecom equipment and lastly, attracting foreign investment in the sector, among other things (GOI,1994). As a result of the 1994 policy, bids were invited to supply basic services, although only one private company was allowed to operate in each telecom circle. Thus, a duopoly market structure was introduced in the telecom sector through circles with one private player and the incumbent Department of Telecom (DoT)T (Jain, 2011). There are 22 telecom circles in India and these circles are classified into four categories, based on their location and revenue. The service provision to each circle depends on the license fee which differs across the circles.

Formation of TRAI

With the entry of the private firms in this sector, there followed a series of conflicts and controversies between the private players and the incumbent DoT regarding service provision and legal issues (Dokeniya,1999). The establishment of an independent regulatory authority was required in this sector as a result of the arrival of private companies. To regulate the telecom services, for fixing and revising tariffs, and for fulfilling the commitments made upon joining the World Trade Organisation in 1995², the Telecom Regulatory Authority of India (TRAI) was set up in 1997.

A paradigm change was occurred as a result of the creation of TRAI. This is because it allowed for the separation of regulatory functions from policymaking and operational duties, which remained under the control of DoT. The functions of the TRAI included recommending the need and timing for the introduction of new service providers, safeguarding the interests of telecom service users, fixing tariffs, establishing and ensuring compliance with license terms and conditions, establishing and ensuring service provider standards of performance, recommending license terms and conditions for service providers, and providing advice to the Central Government on issues pertaining to the development of telecommunication technology, and anything else that is significant to the industry at

²These commitments included-initiating domestic reforms with pro-competitive practice;shift from monopoly to competitive markets etc.

large (TRAI,1997). The Indian telecom sector acquired a new focus owing to policies including tariff fixing, service standard assurance, and license issuance.

New Telecom Policy, 1999 (NTP-1999)

The NTP-1994 was considered as a failure due to fail in achieving most of its goals within the targeted time frame (Dokeniya,1999). For example, under this policy, the target was to provide telecom service on demand and cover all the villages within three years. But the waiting time to get a telephone connection continued to be seven to eight years. Another reason for the failure was related to the issue of regulation as there was no regulatory mechanism to ensure a fair competition. Most of the telecom circles remained vacant after the allocation of licenses because of high license fees and the institutional failure. These factors led to the implementation of the New Telecom Policy, 1999 (NTP, 1999). This served as India's most significant milestone and tool for telecom reforms. The goals of NTP, 1999 were to expand telecom services to rural regions and offer telephones on demand (adopted from NTP, 1994), to encourage private sector involvement in all areas of this sector, to strengthen the regulatory framework, to convert the departmental telecom services into a public sector corporation to enable the government to distinguish its roles in licencing and policymaking from those of an operator, to establish a standardised licencing mechanism, to allow commercial operators access to both domestic and international long distance services, addressing the issues faced by the operators to boost their confidence and improve investment climate, etc. (Dot,1999).

The introduction of NTP 1999 resulted in the expansion of the telecom sector, particularly in terms of improving the environment for attracting private enterprises to the industry. As a result, many more companies came up in this sector with a subsequent reduction in waiting time and price. Further, we can notice the corporatisation of the Department of telecommunication as Bharat Sanchar Nigam Limited (BSNL) in the year 2000. BSNL has become the major public sector service provider in this sector with a fair market share. BSNL provides different types of telecom services including mobile and basic services, internet etc. The communication sector in rural India was fully dependent on BSNL. According to the policy objective of NTP 1999, the national and international long-distance services were made available to the private sector in 2000 and 2002. It was a major policy shift in the telecommunications sector. This policy shift helped to attract many private players in the field besides leading to a reduction in the price as well (Dash, 2006).

The policy outcome witnessed a growth in the number of firms in the industry, leading to increased network effects. Due to the network effects and increase in subscribers, the cost per subscriber for firms declined drastically. The telecom sector need higher initial investment cost compared to other sectors, which includes laying of copper lines, connecting main office to each line for land line services and constructing cell sites, towers, and major exchanges for mobile services. These costs are called sunk cost because once this kind of investment is made, they cannot use it for other purpose and the return from these kinds of investment is not fast. Operationalisation of the network followed by the increase in the network (subscribers) will result in the decline of the marginal cost and the long-run

average cost of the firm. So, the policies like infrastructure sharing, uniform license etc would have crucial impact on the competitiveness in this industry (Sridhar, 2012).

There have been many changes in the telecom sector following the implementation of NTP 1999 and role played by the TRAI. A separate body named the Telecom Disputes Settlement and Appellate Tribunal (TDSAT) was established for the purpose of dispute resolution in 2000. This action caused TRAI to relinquish its oversight of this function. In order to primarily serve the public in identified net-high-cost areas, the universal service obligation fund was established in 2002. It was also considered a means for overcoming the problem of digital divide. The fund was collected by charging a certain percentage of license and revenues of the service providers (Jain and Raghuram, 2015). Another major change was the implantation of a uniform license system in the year 2003. This was a major policy initiative undertaken by TRAI. Under this system, service providers were able to get both the basic and cellular service licenses with a single bid. The license fee also was based on a revenue sharing basis rather than paying at a time basis. This policy also attracted many private firms to this sector. Further, there was a change in the interconnection policy in that earlier, whatever services were provided by the operator would first reach the DoT before reaching to the final destination. But after the policy change, the direct connection between two service operators became possible with the problem of interconnection charges coming down. The regulation and maintaining of quality of telecom services was another step taken by TRAI with respect to monitoring the service delivery and protecting the rights of subscribers. These are the major developments that have taken place in the sector in the presence of a regulatory authority and the proper implementation of policies.

National telecom policy, 2012

In an increasingly knowledge-intensive economy, the role of telecom is very crucial in overcoming the development related challenges. Telecommunication services are helpful to many fields including education, employment generation, health, agriculture and financial inclusion. However, if these services are not utilized by all sections of the society, then the desired impacts of this infrastructure cannot be attained. In addition, the problem of digital divide between urban and rural India has continued to persist. Therefore, to address these new challenges, DoT implemented a new policy called National telecom policy, 2012. This policy considered the issue of broadband on demand, in view of the increasing role of internet. An important objective of this policy was to create an investment-friendly environment. The purpose was to attract more investment in this sector, especially in infrastructure. NTP 2012 suggested the implementation of policies like e-governance and m-governance in the fields of agriculture, banking, education, health etc. This policy took the initiative to increase the availability of spectrum (radio frequencies allotted to the mobile industry and other sectors for communication over the airwaves) for telecom services in light of the growing importance of wireless technologies in the ICT sector. Spectrum allocation was carried out for triple play services of voice, video, and data. Earlier, companies were required to get a separate spectrum for these services (GOI 2012a).

Even though private firms started dominating the telecom sector, the NTP 2012 clearly mentioned the eminent role played by the public sector units, while emphasizing that the public sector

would continue its role in the further expansion of the telecom sector. The role of regulator in the growth of telecom sector is also very crucial as it balances the interests of both the consumers and service providers. NTP'12 suggested a further empowerment of TRAI. The major objectives of NTP'12 includes: to make India a global hub of telecom equipment manufacturing; to promote research and development in this sector; to increase the rural teledensity to 100 by the year 2020; to create a one-nation-one-license system across services and circles; to achieve full mobile number portability (MNP-moving to another service provider without changing the mobile number) and free roaming. The MNP policy has been implemented, with consumers getting benefitting largely from this, mainly because of an increased competition among operators in sustaining the existing subscribers.

National Digital Communication Policy 2018 (NDCP 2018)

The National Digital Communication Policy 2018 replaced the national telecom policy 2012 due the demand in the sector for modern technology adaptation (5G, IoT, M2M). So in order to cope up with these changes the telecom policy also have to be updated by emerging opportunities. With the increasing smart phone and internet penetration, influence of social media platform, digitalizing the service provisions altogether made the economy a data driven one. Thus, the latest policy aims at catalysing economic growth and development with generation of new age jobs and livelihoods with providing latest services to the citizens with universal coverage. The next generation of networks, such as 5G and satellite communications, offer the potential to expand mobile and broadband connectivity across the country. Further broadband penetration is a key driver of economic growth, and a 10% increase in broadband penetration could lead to an over 1% increase in GDP (GoI, 2018).

This policy came with three broad missions: connect India (broadband for all), propel India (enabling next generation technology) and secure India (to ensure sovereignty, safety, and security of digital Communications). Further policy recognizes the significance of continued advancement in the regulatory framework for inviting investments and guaranteeing fair competition and to serve the demands of citizens. Over the years the telecom sector has changed from a voice dominated market to a data driven market. The objectives of NDGP 2018 were in accordance with the changes that happened in the telecom market. As a result of NDGP the 5G spectrum allocation has rolled out in 2022, which will help the sector to achieve more advanced and faster services to the customers, and the spillover effects of this will help the interlinked sectors and the economy in general.

In the year 2022, the new policy proposal has come in the telecom sector called as Indian telecommunication act 2022. Currently this has been put forward as a bill and the Indian parliament yet to discuss this bill. By repealing the Indian Telegraph Act 1885, the Indian Wireless Telegraphy Act 1933, and the Telegraph Wires (Unlawful) Possession Act 1950, the bill intends to restructure the legal and regulatory environment. Additionally, Over The Top (OTT) communication services are now included in the definition of "telecommunication services". Therefore, OTT telecommunication services can be regulated by the same licensing requirements as telecom service providers. Further in this act the

merger and acquisition (M&A) is proposed to be a simple procedural role where only intimation is needed rather than a permission (DoT, 2022)

The above sections discussed various policy initiatives happened in the telecom sector over the years and the outcomes of these policy. By historically tracing the policy initiatives in the sector has given an understanding about the changing market structure and the increasing role of telecom sector in the economy. Policies will have effect on the number of firms in the industry, the changes in teledensity, data and voices usages further the sales of firms. From here we are going to analyse how these policies has helped the customers and the firms over the years.

Data source and methodology

Policies play a major role in shaping and influencing various aspects of an economy. As a sector like telecom the policies are formed to regulate the industry, ensure fair competition, licensing, protect the right of customers and firms and preventing the monopoly characters, efficient allocation of spectrum and infrastructure and also to promote the innovation and new technological adoption.

This study is analysing the policy impacts on telecom sector based on three broad categories such as, usage, connectivity, and sales. The usage and connectivity have been analysed by using Average Revenue Per User (ARPU), Minutes of Usage (MoU), subscriber base and tele density. The data these variables are obtained from various quarterly reports of TRAI. Sales have been analysed at firm level based on annual financial statement data given by Centre for Monitoring Indian Economy (CMIE) Prowess. We have taken the data of telecom service providers based on NIC 2008 classification. From this we have removed the small firms having data only for less than five years on the assumption that these are very small firms and do not have much influence on the industry performance. The total number of firms is 39, ranging from 2001 to 2022. The size of our panel is 300. The major variables which we have taken for analysis are sales, profit after tax, expenditures on regulatory charges, access charges and network charges. The variables have been selected based on its policy implications on sales. All variables are deflated using GDP deflators 2011-12 base period.

- *Access charges are payments made by telecom companies to local exchange network and local service providers for facilitating calls on that network. This captures access charges and other expenses of similar nature like interconnection usage charges (IUC) and port charges and roaming charges.*
- *Regulatory charges of telecom enterprises capture all the regulatory charges reported by companies in the telecommunication sector, under operating expenditure. This includes expense heads like license fees, Wireless Planning & Co-ordination (WPC) and spectrum charges, revenue sharing with department of telecommunication.*
- *Network cost of telecom enterprises are all expenses relating to the network establishment of telecom companies. The common nomenclatures included under this head are leased line & gateway charges, lease line & connectivity charges, passive infrastructure charges, installation*

charges, PSTN charges, transmission cost, transponder charges, signaling charges, internet access & bandwidth charges, network repairs & maintenance, other network operating expenses. (CMIE)

To analyse the impact of these policy instruments on the sales telecom services in the country we employed a fixed effect two-way panel regression model. Often the changes in sales alone do not capture the impact of policy changes over time as far as firms are concerned. The changes in the market such as an increase in competition, price changes, and a change in subscriber base can affect the sales revenue. So, in order to capture the policy impact on the firm level we have considered profit after tax as a dependent variable as well and has run a random effect two-way panel regression model.

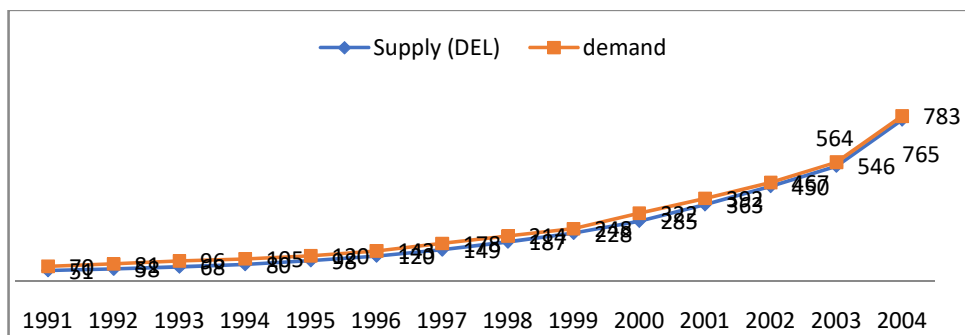
Analysis

Policy regulations and its implementations over the years by the government has had different objectives over the years. Its impact on the sector basically from the customers and firms point can be broadly assessed based on three major concepts: usage, sales, and connectivity. For example, the National Telecom Policy-1994 and the New Telecom Policy-1999 have targeted at expanding competitiveness in the sector by bringing more private players in the industry. This was majorly employed by rolling out licenses to the firms, encouraging foreign investments, etc. The ultimate goal has been to reduce the cost of provisioning these services, which further has its implications on the usage of the service. NTP-99 enabled operators to transform their license fees into a lower one-time entry fee and a yearly revenue share for the license's duration. This move has the potential to enhance competitiveness, leading to cost reduction and subsequently promoting increased utilization.

Connectivity and Usage

While looking at the policy impacts on usage and connectivity, we can see a huge waiting list in accessing the telecom service. The Department of Telecom alone was not able to meet this demand initially. Even though the major objective of NTP 1994 was to give telecom access to all villages by 2002, this was not achieved because of huge license fee and spectrum fee that restricted the private players to enter the market. This difference in the demand and supply is evident in the industry which can be understood from figure 1

Figure 1: Demand and supply of telephones (fixed lines) during the years 1991 to 2004³ (In lakhs)



Source: CAG audit report, 2005

The demand was higher than the supply during the 1990s. The demand was around 70 lakhs in the year 1991 whereas the supply was only 51 lakhs. Over the years, though both demand and supply increased, the gap between them also increased. The policies helped to match supply with rising demand. In the absence of continuous support from the government, the supply would have been lower, and the gap would have been higher. From the beginning of 2000, more private firms entered into the market and thereby further improved the supply. Even though the demand also increased substantially, the gap was reduced due to the entry of new players.

Subscriber Base

The telecom connectivity of a nation can be easily understood by looking at the telecom subscriber base. The more infrastructure development and the competition in the industry, the more the industry will attract customers. The role of regulatory authority will make a level playing ground in the industry and it will automatically attract more firms into the industry. After 2000, the introduction of Universal Licensing Policy and increase in the FDI cap from 49% to 74% in the year 2004 led to more investment in the industry. This altogether resulted in a sudden hike in the number of subscribers post 2000.

Table 2: Telecom Subscribers (in million)

Year	Total	Wireline	Wireless	Policies
2000	28.55	26.65	1.9	
2001	36.28	32.71	3.58	4 th mobile service approved
2002	44.97	38.33	6.54	USOF
2003	54.61	41.48	13	Universal access service license
2004	76.54	42.84	33.69	IUC 30 paisa, Calling party pays (cpp) Increase in FDI cap from 49% to 74%
2005	98.41	46.19	52.22	
2006	142.09	40.22	101.87	Mobile under USOF
2007	205.87	40.77	165.08	
2008	300.49	39.41	261.08	
2009	429.72	37.96	391.76	

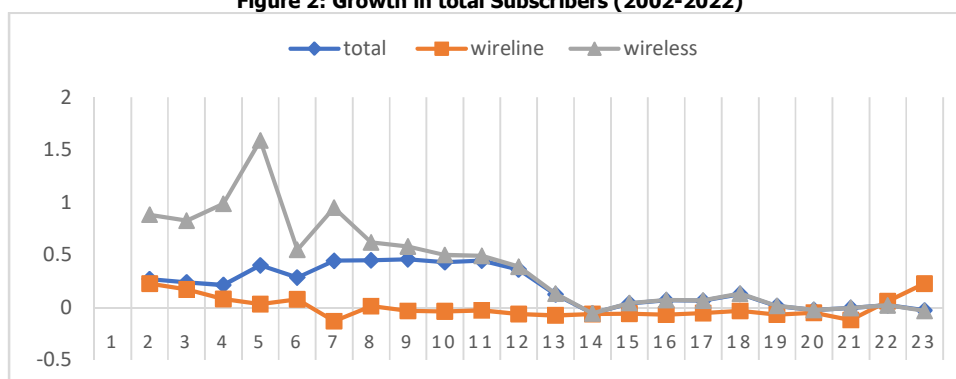
³The demand data of telephones is not available after 2004

2010	621.28	36.96	584.32	
2011	846.33	34.73	811.60	MNP
2012	951.35	32.17	919.17	
2013	898.02	30.21	867.81	Increase in FDI from 74% to 100%
2014	933.02	28.50	904.52	
2015	996.13	26.59	969.54	IUC 14 paisa
2016	1059.33	25.22	1034.11	Entry of Jio
2017	1194.99	24.40	1170.59	IUC 6 paisa/ roaming charge has taken out
2018	1211.80	22.81	1188.99	NDCP 2018
2019	1183.41	21.70	1161.71	
2020	1176.79	19.13	1157.67	
2021	1201.2	20.24	1180.96	
2022	1166.93	24.84	1142.09	

Source: Annual Report, TRAI (various years)

Table-1 shows the rise in telecom subscribers over the period of 2000 to 2022. The wireline service occupied most of the market till 2004. Technological advancements led to improvement in wireless service since 2004 and further, since 2005, it has overtaken the wireline service as the major service in the market. The boost in wireless service since 2005 has contributed substantially to the improvement in total subscribers. The inter linkages between private sector participation and technological advancement led to rise in both private sector participation and wireless subscribers since 2005, and by 2022 wireless service has captured around 98% of the market of total subscribers. From the table we can observe that in the year 2012-13, there is a sudden fall of more than 50 million customers. This was majorly contributed by deactivating the inactive sim cards by the service providers and the introduction of mobile number portability policy. The Mobile Number Portability (MNP) policy gave customers an option to change the service provider without changing their mobile numbers. This led to a decline in new sim card purchases.

Figure 2: Growth in total Subscribers (2002-2022)

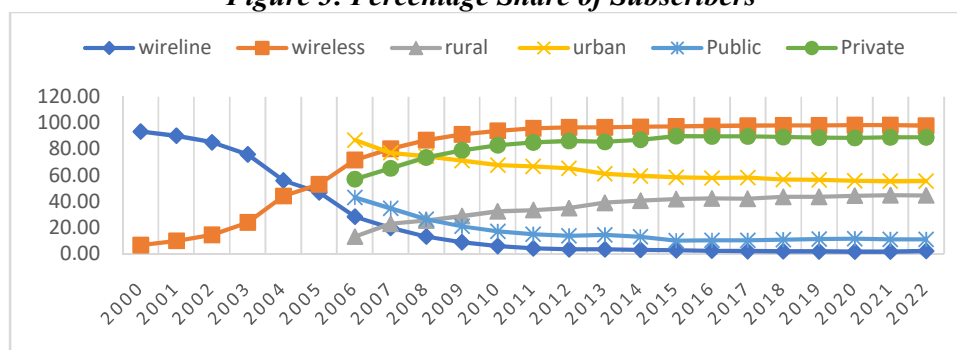


Source: Annual Report, TRAI (various years)

Figure 2 shows the growth in the total subscribers over a period of 20 years. Interestingly, we can see that post-2005, the wireline subscribers have a growth in the years 2021 and 2022 which is

more than the growth of wireless subscribers. This is mainly because of the COVID effect in the form of increased work-from-home and online education culture which demanded more broadband wireline services.

Figure 3: Percentage Share of Subscribers



Source: Annual Report, TRAI (various years)

Teledensity

Telecom policies have direct effects on the teledensity of any country. In the case of India, the policies over the years led to attract more firms in the industry and a rise in the competition made better service available to the people. A higher teledensity is a better indication of a country which implies the people have more access and usage to the telecom network. Teledensity measures the number of people having access to telecom services out of 100 population in a country. However, teledensity doesn't give a real picture of those who are connected or unconnected to the network as it takes no account of the multiple connections of the same people. The NDCP 2018 aims at achieving 'unique mobile subscriber density' of 65 by 2022. The unique mobile subscriber density measures the actual number of people connected to the network. The telecom sector comprises both wireline and wireless services. Initially, the sector was dominated by the traditional form of communication, wireline. The wireless services started dominating the market in the late 2000s because of technological advancement. The wireline subscribers represented the total subscribers. From Table 3, it can be seen that India reached a teledensity of 10 in the year 2005. However, teledensity has increased since then, and it reached 84% in 2022. The improvement in teledensity in India is majorly attributed to improvement in the teledensity of wireless services.

In the year 2011, DoT introduced Mobile Number Portability (MNP) plan which allows consumers to change their mobile service provider without having to change their mobile number. This gives consumers the choice to choose the service provider that gives the best service quality, pricing, and coverage. MNP also promotes competition among service providers, which can lead to better services and lower prices for consumers. According to Table 3, there was an increase in teledensity until 2012, followed by a decline. This decline could be attributed to the introduction of Mobile Number Portability (MNP), which reduced the demand for additional SIM cards. Further, this decline has also been contributed by the service providers by slashing out their inactive subscribers. Subsequently, there was a regular increase in teledensity, and following the entry of Jio Infocom, it experienced further

significant growth. Jio's predatory pricing strategy enticed a larger number of people to subscribe to their services. However, the occurrence of mergers and acquisitions in the telecom sector led to a shrink in the demand for new connections. Furthermore, the impact of the COVID-19 and lockdown also impacted the decline in teledensity.

It is however worth noting that though the teledensity improved in India over the years, there is a widespread inequality in terms of the urban and rural areas. The urban teledensity is higher over the years. Even though the number of subscribers has increased tremendously because of technological advancement and the role of private sector, the rural areas are still behind in achieving teledensity. Though teledensity improved in both rural and urban areas during the time period considered, the gap in teledensity has increased as well. It is symbolic of the fact that rural areas of India have further potential for improvement in teledensity. It may be read in this line of thought the new telecom policy (2018) adopted by the government of India which stresses on the improvements in rural telecom services.

Table 3: Teledensity

Year	Total	wireline	wireless	Rural*	Urban*	Public*	Private*
2000		3.11	0.34				
2001	3.58	3.64	0.62				
2002	4.29	3.85	1.21				
2003	5.11	3.84	3.08				
2004	7.02	4.16	4.70				
2005	8.95	4.45	8.00				
2006	12.74	3.61	9.13	2.34	38.28	5.48	7.26
2007	18.22	3.61	14.61	5.89	48.10	6.32	11.90
2008	26.22	3.44	22.78	9.46	66.39	6.94	19.28
2009	36.98	3.27	33.71	15.11	88.84	7.71	29.27
2010	52.73	3.14	49.60	24.31	119.45	8.99	43.75
2011	70.89	2.91	67.98	33.83	156.93	10.55	60.34
2012	78.66	2.66	70.00	39.26	169.17	10.77	67.89
2013	73.32	2.47	70.85	41.05	146.64	10.62	62.69
2014	75.23	2.30	72.94	44.01	145.46	9.68	65.55
2015	79.36	2.12	77.24	48.04	149.04	7.99	71.36
2016	83.40	1.99	81.41	51.26	154.18	8.55	74.85
2017	93.01	1.90	91.11	56.98	171.52	9.51	83.50
2018	93.27	1.76	91.51	59.25	166.64	10.13	83.14
2019	90.10	1.65	88.45	57.50	159.66	10.16	79.94
2020	88.66	1.44	87.22	57.87	153.68	10.17	78.49
2021	88.17	1.49	86.68	60.27	141.03	9.63	78.52
2022	84.88	1.8	83.07	58.07	134.94	9.25	75.63

Source: Annual Report, TRAI (various years)

*Data not available up to 2005

The introduction of the Universal service Obligation fund as a part of NTP 1999 focused on improving rural connectivity in the country. Due to low population density and geographical factors, rural and remote areas have higher capital costs and lower returns than urban areas. This makes it difficult to attract private investment, which can further hamper economic development in these areas. In-order to fill this gap, the USOF was introduced. The USOF is levied through a universal access levy which is a percentage of total revenue earned by service providers. So, it helped to reduce the digital divide over the years. Even though the rural teledensity has increased over 60, the internet density is still below 40 (see table 4), implying rural population are still deprived of access to internet which will have a negative impact on the development of rural areas.

Table 4: Internet Density

year	overall	urban	Rural
2013	13.45	-	-
2014	20.29	-	-
2015	24.09	49.07	12.89
2016	26.98	58.28	12.80
2017	32.86	70.83	15.49
2018	38.02	84.74	16.41
2019	48.48	97.94	25.36
2020	55.12	99.12	32.24
2021	60.73	107.3	36.24
2022	60	102.82	37.06

Source: Annual Report, TRAI (various years)

Internet density has grown to 60 in the year 2022, which is mainly contributed by the urban internet density of 102. This expansion has been propelled by elements such as the launch of economical mobile data packages, the expansion of the smartphone sector, and the Indian government's Digital India campaign, which involves allocating spectrum for quicker data transmission (4G, 5G) and the advancement of electronic platforms.

Over the years, the evolving telecom policies have led to an increase in teledensity and internet density, resulting in enhanced accessibility to telecom networks for the people. This has significant implications for both firms and consumers. Consumers benefit from the network effects, enjoying better services and connectivity, while firms capitalize on economies of scale to reduce the cost per customer. The telecom firms rivalry has changed from focusing on voice and SMS services to data services, as smartphones have become more versatile and affordable device that offer voice, video, social media, entertainment, and more. These changes in the telecom sector have effects of Average Revenue Per User (ARPU) and the Minutes of Usage (MOU)

Average Revenue Per User (ARPU) and Minutes of Usage (MOU)

Average Revenue Per User (ARPU) and Minutes of Usage (MoU) are two important measurements of the performance of telecom sector/ telecom operators. ARPU is a major source to know the revenue earned by the service providers. *ARPU is determined by dividing the total revenue generated from all customers during a specific period (typically a month or a quarter) by the total number of subscribers or users for that same period.* Whereas the *MOU per subscriber per month is calculated by dividing total minutes of usage (incoming & outgoing) by average number of subscribers in the industry.* An increasing ARPU indicates higher customer spending on additional services or an increase in the price of existing services. Whereas a decreasing ARPU could suggest intensified competition due to changes in price or shifts in customer preferences. Telecom companies use ARPU and MOU data to assess customer behavior, spot trends, and make informed choices for network optimization, pricing plans, and service enhancements. From table 5 we can observe that the ARPU has decreased over the period in the industry. The major reasons for the decline in ARPU are the increase in the number of firms, decline in the market concentration in the industry, reduction in tariff by the government and the technological advancement happened in the industry. This interplay between various provisions by the private players, government and technology made life much easier for customers with lower cost for them. (Singh, 2008).

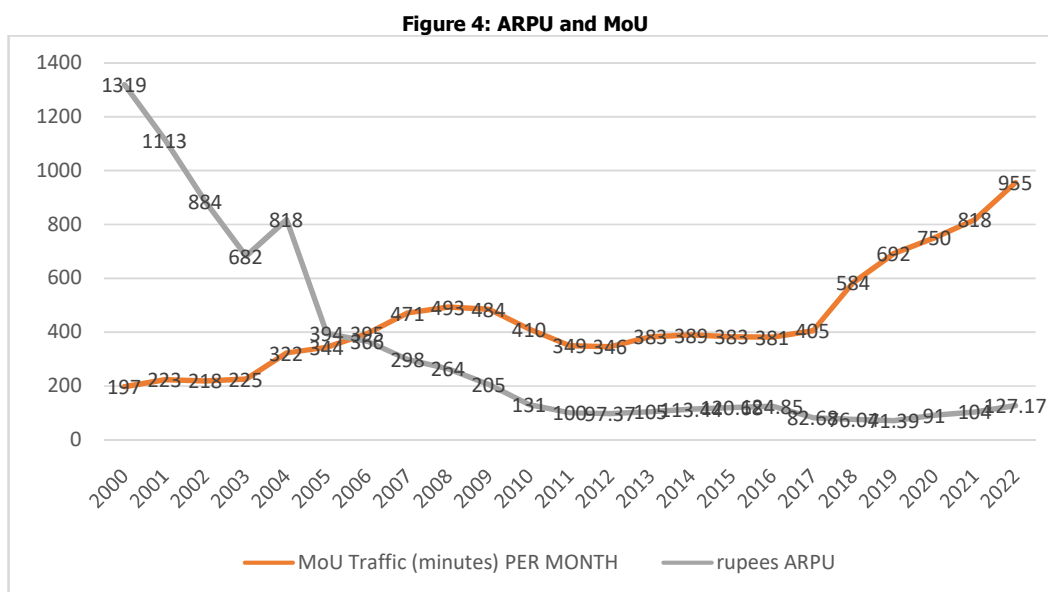
Table 5: Average revenue per user and Minutes of Usage Per month

year	MoU Traffic (minutes) PER MONTH	rupees ARPU PER MONTH
	GSM	GSM
2000	197	1319
2001	223	1113
2002	218	884
2003	225	682
2004	322	818
2005	344	394
2006	395	366
2007	471	298
2008	493	264
2009	484	205
2010	410	131
2011	349	100
2012	346	97
2013	383	105
2014	389	113
2015	383	121
2016	381	125
2017	405	83
2018	584	76
2019	692	71
2020	750	91
2021	818	104
2022	955	127

Source: Annual Report, TRAI (various years)

In the year 2000, the industry had only a few firms, and the ARPU stood at 1319. However, over the years, the ARPU experienced a decline, reaching 406 in 2004. The decline in tariff plans was a result of the increased number of subscribers and the liberal policies that allowed more firms to enter the industry. By the year 2022, the ARPU further decreased to rupees 127. During the period when ARPU was declining, the telecom industry experienced increased engagement with customers, leading to a growth in the customer base and an increase in active minutes of usage by the average customer. This pattern is illustrated in Figure 4. Concurrently, over the years, the TRAI has gradually reduced the Interconnection Usage Charges (IUC) from 30 paisa initially to zero from 2021 onwards. IUC plays a pivotal role in enabling efficient interconnection between telecom service providers (TSPs), involving wholesale fees paid by one TSP to another for call origination, termination, transiting, and carriage. Therefore, these changes in IUC are likely to have a direct impact on pricing, which, in turn, will affect both ARPU and MOU.

Simultaneously, while the ARPU was decreasing, there was a notable increase in the industry's customer base. This increase in customer base also led to a rise in the average customer's active Minutes of Usage (MOU). These trends in ARPU and MOU are visually represented in Figure 4.



In the given diagram we can see a decline in the ARPU and increase in the MOU up to 2008. This was a period when the industry was moving towards consistency and further competition. After 2016, with the introduction of Reliance Jio and their strategy of capturing the market through unlimited calls and data packages, there was a significant increase in MoU and a subsequent decline or relatively stable ARPU. This was further intensified as rival companies were compelled to adopt similar strategies to remain competitive in the market. While ARPU initially experienced an increase and then a decrease,

the overall revenue of the telecom industry continued to rise since 2010. ARPU remained relatively consistent from 2010 onwards, and the industry's revenue showed a continuous upward trend until the entry of Reliance Jio in late 2016.

Overall, the analysis so far shows that the policy has been to a large extent successful in delivering its objectives evidently post-2008. Various indicators, such as the increase in subscriber base, teledensity in both rural and urban areas (although rural areas still lag behind), as well as improvements in ARPU and MOU, demonstrate this success. The positive outcomes of these policies have directly benefited customers through reduced tariffs and more access to the network.

From the perspective of telecom firms, policies can have a significant impact on their revenue. This revenue is basically from the sale of their services such as; voice, data, messaging, and other value-added services. Factors such as spectrum, licenses, tariffs, interconnection charges, universal service obligation fund, taxes, and technological innovations can all have a direct impact on a firm's performance. In the next section, we will analyze how policies can impact a firm's sales by looking at regulatory variables.

Sales

Over time, the telecom sector has undergone substantial transformations driven by the policy initiatives in accordance with the technological and regulatory changes with the evolving consumer preferences. Telecom policies have a significant and immediate impact on telecom firms and their operations right from the beginning. Telecom companies require substantial initial investments as sunk costs to start functioning in the industry. These costs include expenses for tower and equipment installation, license fees, spectrum fees, and other infrastructure investments. Many of these costs are directly influenced by regulatory policies which are subject to change over time. As a result, the cost structure of telecom firms, along with their sales, is closely tied to regulatory interventions. To understand and quantify the impact of policies on the sales of the telecom sector, we aim to empirically analyze the firm-level sales of telecom services using panel regression models. By employing these models, we can assess how regulatory changes affect the revenue and sales performance of individual telecom companies. This analysis will help us gain insights into the relationship between policy interventions and the financial outcomes of telecom firms within the industry.

Fixed effect model:

$$Y_{it} = \mu_t + \alpha_i + X'_{it}\beta + \varepsilon_{it}$$

Estimation results:

In panel data analysis, there are primarily three types of models: pooled regression, fixed effects, and random effects. The F test is used to assess the existence of individual effects, making the pooled regression inappropriate. The subsequent step is to establish whether the model should be a fixed

effects model or a random effects model. The Hausman test is a method employed to make this determination.

An major component of panel data model (Fixed effect model) is the presence of firm specific effects. The available statistics again indicate the presence of firm specific effects namely the managerial and entrepreneurial skill of man age. As a result, running the pooled regression is not feasible due to the impact of these specific factors on the data.

Table 6: Hausman Specification Results

Chi2	Probability
18.98	0.0003

Source: Author's Calculation

The Hausman specification test statistic rejects the null hypothesis that individual invariant effects of u_i are not correlated with the regressors i.e., $E(u_i/X_{it}) = 0$. This suggests that the model should be estimated using the fixed effect estimation technique. Further we attempted to run a two-way model to check if the model is time varying. The joint effect of time was found to be significant. The final model that we derived is given in table 6.

Table 7: Regression results of Sales on its covariates

VARIABLES	sales
Regulatory charges	0.99*** (5.20)
Network Charges	1.36*** (5.17)
Access charges	4.61*** (11.2)
Constant	12406 (0.71)
Observations	303
R-square	
Within	0.65
between	0.76
Overall	0.78
Prob>F	0.000

T -VALUE in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's Calculation

$$Sales_{it} = \alpha_i + \mu_t + 0.98Regc/arge_{it} + 1.36 Networkc/arge_{it} + 4.61Accessc/arge_{it} + \varepsilon_{it}$$

The results of the two-way fixed effect model indicate a positive and significant relationship between sales and its dependent variables. This indicates that an increase in regulatory and network expenses does not have a negative impact on sales. One possible explanation for this could be that the

investment in regulatory charges, including spectrum charges, allows the firms to offer improved services to their customers, leading to sustained sales performance.

The increase in these charges is not big enough for the changes in sales and those do not affect sales negatively. The access charge contains Interconnection Usage Charge and Roaming charges. An increase in access charges implies an increase in contribution of IUC and roaming revenue to the total revenue even though the IUC component has come down from 30p/m to 6p/m in 2017 and to zero in 2021. This implies this has a positive impact on sales. The policies, therefore, have not affected the sales in a negative manner. We can hence say that the regulatory policies brought in by the government have not hindered the activities of the firm. The time effect is found to be present here and the individual years post 2016 have been significant. This could be seen as an increase in sales post the introduction of Jio that led to a drastic decline in tariff rates.

Conclusions

As an outcome of these policies and regulation, the market structure of the telecom industry has changed drastically. In the beginning it consisted of only basic services provided by the DoT as a monopolist. Evolution into liberal licensing policies made the entry of firms in this industry and the increasing competition and technological advantage lead to greater access in telephone connections. Nature of competition changing in telecom sector has changed from traditional voice calls to data war. There are also sharp differences in rural and urban India in terms of teledensity. Overall, the analysis so far shows that the policy has been to a large extent successful in delivering its objectives evidently post-2008. Increase in subscriber base, minutes of usage, teledensity in rural and urban areas (though rural are still lag behind), ARPU and MoU are indicators of the same. The success of these policies has been passed on to the customers in the form of tariff cuts and more connectivity. The analysis also showed that the increase in regulatory and access charges do not negatively affect the sales of the industry. Hence, more regulation of this nature may not significantly and negatively affect the industry in terms of sales. However, its impacts on profits are significant and must be dealt with more caution while policies are implemented.

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