

Feasibility Study of Enhancement of Mobile Spectrums (with Special Reference to 2G, 3G, 4G and Proposed 5G)

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Abstract—Role of telecommunication has increased tremendously in today's scenario. Due to faster changes in Information and Communication Technology (ICT), these changes have also influenced various countries at global platform. Growth in telecommunication industry directly affects its software, hardware, service providers and regulators, but indirectly it affects almost all the sectors of any economy.

The present study intends to find out the feasibility growth of this industry by establishing backward and forward linkage with ancillary industries. It will also include the technical analysis and challenges faced by the industry at various fronts like data security, need and importance of spectrum enhancement, vis-à-vis requirement of infrastructure support, service verticals, customer's preference, and role of regulatory authority (TRI) especially in India etc. Any advancement in technology brings risk factors of financial, social and technical nature. Therefore, there is an urgent need to examine those factors before it becomes difficult to juggle.

The study will be based on secondary data collected through various published reports, and relevant articles and other historical data. The data so collected will be analysed using statistical techniques. The recommendations and suggestions of the study will be useful for service providers, regulators, hardware manufacturer, software developers and end user of the service.

Keywords: Data Security, Service Verticals, Spectrum, Secondary Trading, Mobile Eco System

1. INTRODUCTION

Efficient spectrum must include right amount of allocation to specific classes of users, assignment of usage rights and adjustment of established policies as technology and market evolves overtime. (Bauer 2008). To use the spectrum space by the user it should be loaded with significant amount of incentives as well as expansion plan of useable range. However, this industry always faces the challenges of minimizing operating and capital cost to reduce the transaction cost. A good spectrum policy must be well equipped with the required security feature so that national data security should not be compromised. Due to change in existing technology and various innovations in communication technology customer preferences have also changed rapidly. Now due to

change in customer's preferences (retail and institutional) the service provider has to change the spectrum usage assignment to optimize the cost and profit ratio. The demand for radio spectrum has increased drastically due to technological development in broadcast and mobile communication. It has created high demand of spectrums than the available supply. Therefore, it is need to time to review economic efficiency, technical efficiency and public policy of spectrum auctions in developing countries like India. Hence, efficiency in the spectrum allocation and assignment needs to be addressed to get optimum benefits. Allocation of spectrum refers to the purpose and uses whereas assignment refers to the carrier which uses the spectrum. Spectrum usage is coordinated by International Telecommunication Union (ITU) at global level but at national level country specific regulatory authority and concerned departments of union ministry take care of allocation and assignment of spectrum, like in India it is jointly handled by Department of Telecommunication and Telecom Regulatory Authority of India (TRAI). However, due to market mechanism and common model approaches, the power of the regulator has been reduced significantly. Fair assignment of property rights creates business opportunities of secondary trading of spectrum. The secondary trading market provides benefit of transfer of usage rights between the firms. Regulators need to decide the degree of freedom in use of spectrum among available carrier in the particular market. FM (Frequency Modulation) Broadcasting has increased the price competition in the spectrum market. The qualitative improvement in Tri-Band and Quad-Band mobile phone demanded technical and price efficiency in hardware and software industry of mobile communication. In principle, security and defense usage are covered under license exempt spectrum.

To ensure that quality voice transmission government had decided to allow 4G license to Reliance Jio with an entry fees of Rs1658Crores under UAS License Scheme. The government's auction rule 2010 mentioned 3 categories of bidders like existing licenses, fresh entrants and Internet

Service Providers (ISPs). The government allocated it assuming 3G and 4G spectrum at par.¹ Economic Times, March 12, 2015.

Migration is taking place rapidly from 2G to 3G/4G year over year; therefore, many carriers maintained all three levels of spectrums. Presently the penetration of 2G is decreasing gradually worldwide replaced by 3G/4G. The pace of migration is so fast that while 3G took about 10 years to reach upto half of the population whereas 4G will get the same milestone in nearly 8 years. The migration and existing multiple level of network like 2G, 3G and 4G involves huge capital and operating cost to serve all types of customers. The Mobile Economy (2015) GSMA.

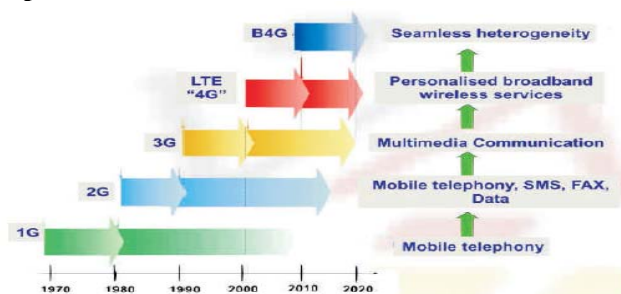
Low level of technical awareness about spectrum enhancement creates a lot of challenges because the capable buyer has little knowledge of all these operations due to age and other factors while technically sound teenagers who love to enjoy higher spectrum are not so financially sound because of their high financial dependence on their parents. However, US and European countries where people start earning at their younger age and enjoy the benefits of higher spectrum. However, at the global level under 2G expected percentage of covered population is always higher than the percentage covered under 3G/4G.

Another phenomena has been observed that European mobile network operators started merger and acquisition. This consolidation of business will reduce the overall cost burden and boost the investment in next generation mobile infrastructure. These mergers are focusing on short term revenue benefits not on the long term benefits. Faster migration of 3G and 4G network from 2G is being driven through availability of smartphones, more extensive and deeper network coverage along with easy finance schemes launched by strategic partners particularly banks and non-banking finance companies.

2. FLEXIBLE LICENSING

The basic purpose of flexible licensing is to rationalize the spectrum auctions. It creates exclusive rights for spectrums. The flexibility allows necessary adjustment according to fast changing market trend.

Graph #1



Source: Technology Digest, Bulletin of Telecom Technology, Issue April 20, 2013 published by TRAI

3. REVIEW OF LITERATURE

Do Van, Do H. and Chakka, 2012, model spectrum renting policies and call admission to control the spectrum wastage in a realistic manner. Queuing model incorporates exponentially distributed call duration to evaluate the performance of mobile cellular network. Spectrum users use renting of unused spectrum for its efficient use. Block of user channel as technical background, the study has modelling assumptions for regression analysis to find out relationship between number of rented frequencies and number of available channels. LFGC, QUFGC and UFGC are compared with renting options and without renting options. The study shows that variants of Fractional Guard Channel policy makes efficient tools to guarantee and enhance the grade of service handover calls.

Hwang and Yoon, 2009, explain that because of scarcity of spectrum and increase in the value of spectrum it's efficient management became more complex. Every approach is blended with its advantages and disadvantages, therefore, the present study shows current situation and propose mixed strategy for efficient spectrum in Korea. With little role of market forces Korean policy makers believe in command and control concept. The present study has examined the various attributes which are dependent on technology, survey characteristics and wireless communication market. It addresses issues related to property rights approach by allowing secondary trading, unlicensed approach and spectrum sharing approach with international trends by comparing all approaches SINR Utility Function Model and Welfare Model. It also presents scenario description, parameter description with results depending on market condition. To take final decision mixed regime was adopted by allowing secondary use (secondary trading and opportunistic use) and unlicensed use. The study concludes with certain assumptions that some countries are developing midterm spectrum framework.

Jho, 2007, presents a case of standardization in telecommunication in Korea. It also highlights the linkage between technological development and its benefits with sense of understanding of the government to make it migration to 2G and 3G networks after understanding of market forces by the state actor and it becomes a very relevant factor. Collective impacts of political, social, economic and technical variables influence the government to take the decision of technology standardization. The study focuses that how the Korean government worked on its agenda by satisfying diverse stake holder and other market actors. To continue with CDMA was easy for the government because it was well equipped with infrastructure support and seemed financially viable scheme for average consumer. Failure of upgradation of CDMA technology to dominate global standards, the government was forced to pay huge loyalty to Qualcomm. So it could adopt standard policies for evaluation of communication system.

Yan, 2004, describes issues and challenges while adopting 3G licensing in Hong Kong. The study examines the impact of

Hong Kong's 3G license schemes on licensing policies and ancillary industries. The government mainly faced issues like choice of technical standards including dual mode design network of 3G terminals to enable backward compatibility with 2G networks, allocation of radio spectrums like migration issue from 2G network to 3G network, assignment of 2G spectrum and auction of 3G spectrum. In Europe and U.K., the government generated huge license fees through 3G spectrum auction, but due to negative reaction on stock exchange again it brought down the license fees. The government adopted annual royalty payment auction with minimum guaranteed payment which caused breakeven to the carrier companies after first 5 years. Up to some extent the Hong Kong 3G spectrum auction maintained the balance between spectrum efficiency and market competition.

Bykowsky, 2003, discusses the steps to enhance market liquidity by secondary trading of spectrums. The transaction and other costs could be reduced in the presence of central brokers. Secondary trading also exposes liquidity risks and performance risks. The efficiency of secondary market will be dependent to minimize transaction cost and maximize trader's surplus. The point at which demand and supply intersect is termed as market clearing price. The difference in the two bids reflects premium from seller's side. An electronic call market can enhance market liquidity and can be designed to incorporate call option.

Hazlett and Muñoz, 2006, study the relationship between spectrum policy and efficiency in output market. The price system is mainly based on following 3 parameters like Beauty Contest, Saving the cost of re-assignment and generation of revenues for public use. It discriminates among spectrum allocation, license assignment and retail market. Spectrum license created and market structure rules come under spectrum allocation, license assignment includes auction rules and retail market comprises of prices, output and tax savings. The study intends to allocate spectrum to promote the most efficient delivery of wireless services to assign licenses that maximises social values and minimize the present value of payments to the government.

4. OBJECTIVES OF THE STUDY

- To find out the feasibility growth of this industry by establishing backward and forward linkage with ancillary industries.
- To examine the challenges faced by the industry at various fronts like data security, need and importance of spectrum enhancement, vis-à-vis requirement of infrastructure support, service verticals, customer's preference.
- To assess the role of Telecom Regulatory Authority of India (TRAI) especially in India etc.
- To identify the future risk due to change in technology and innovations.

- To understand other economic and social aspect affecting the telecommunication industry.

5. RESEARCH METHODOLOGY

The study is an exploratory research to find out relationship between spectrum enhancement and economic growth alongwith technical advancement. The study will be based on secondary data collected through various published reports, and relevant articles and other historical data.

Data Analysis

As far as the feasibility growth of telecommunication industry we need to find multidimensional approach, which should include following aspects

- Technical Viability
- Financial Feasibility
- Socio economic analysis

Technical Viability

Technical viability is very crucial for any business, as it is forced fail if a business does not meet its technical viability. It also establishes backward and forward linkage with ancillary industries. With the help of following graph, forward and backward linkage of various industries can be explained, which directly affect telecommunication. These ancillary businesses check the technical suitability of business.

Financial Feasibility

It takes into account various financial and economic indicators like GDP growth, Production and Industrial Growth supplier and customer end industries etc.

Socio Economic Analysis

Socio economic analysis represents social cost benefit analysis. In case of telecommunications the mobile tower generates a significant radiations, as well as all the mobile sets and other electronic devices which are needed in this business consumes significant amount of power and energy as well as emits other pollutants.

Therefore, there is a need to analyses the industry growth in the light of input and output reference. For better understanding, we should know the Input and Output components for Data Envelopment Analysis.

Equation: Input=Desirable Output + Undesirable Output

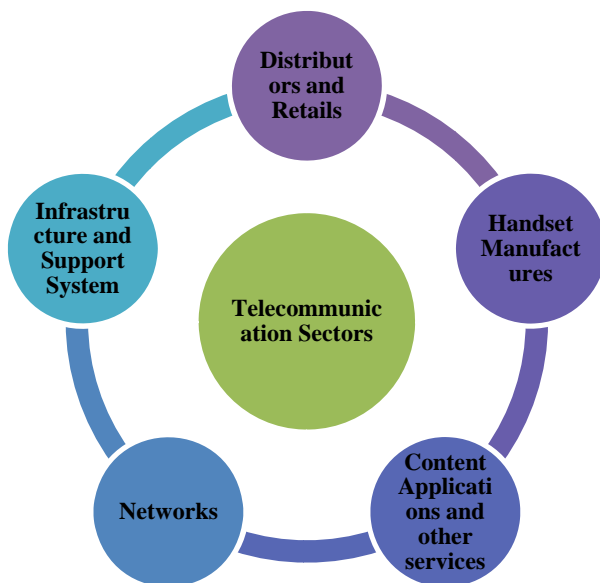
Input	Desirable Output	Undesirable Output
Infrastructure	Employment of Skilled Labour	Health danger (radiations, skin effects, effects on eyes and deterioration of bone density etc)
Capital Expenditure (License Fees, etc)	Speedy transactions of data	

Operating Expenditure (Power, etc)	Faster and Real Time Based Communication	
	Machine to Machine (M2M) Business	

In 2014 alone, the mobile subscription base of India, rose by 5.6 million. Taking the total number of mobile connections to 924.3 million. BSNL plans to install 8,700 new mobile towers in India to improve 2G and 3G services. Bharti Airtel decided to install 4,700 such tower across country. India stands in the list of countries having largest telecom industry (and also the telecom industry is a fast-growing sector of India), second to China only on the total subscriber basis. Indian telecom industry continues to grow each year. Especially, population ranging from 15-64 years in India holds a market with great potential for the service providers. In 2014, India contributed to \$400 billion to the mobile phone industry (in terms of GDP). Infact, according to GSMA (Groupe Speciale Mobile Association) this sector will generate jobs to additional 4.1 million by 2020. As per a report published by Department of Industrial Policy and Promotion (DIPP), it has got an increase of 6% in total Foreign Direct Investments (FDI) to about \$59,796 million from April 2000 to January 2014. It has experienced an increase in the subsectors too: for example,

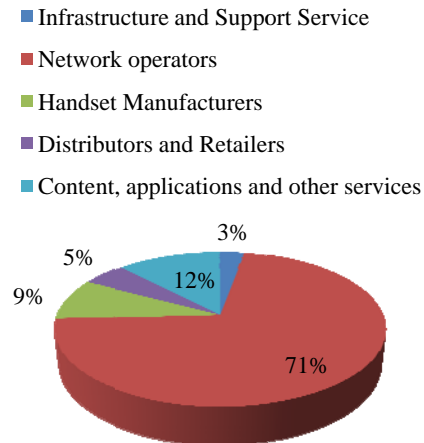
- Total of 285.35 million subscribers in India's GSM network as of January 2014.
- Data traffic by 3G(third generation) services increased by 46% during 2013.
- Smartphone market has by 71% in 2013.

The industry also has forward and backward linkage with other industries as depicted in following graph.



Graph#2

Direct GDP contribution of the mobile ecosystem



Graph #3

6. FINDINGS

Also, the great leap in tele-density from 3.58% to 74% (March 2001 – June 2013) marks a leap in the number of consumers along with revenues (from telecom services). This contributed sufficiently to the GDP growth and also provided employment to the youth (which was well needed). The employment in communications sector has reached 10.3 million in 5 years and by the end of 2015, it is expected to be one of the top growth drivers of economy with a 15.4% share of GDP (equivalent to Rs. 865,031 cr). Now a day the major problem that telecoms industry is facing is competition due to this increase in competition the investors and the consumers are really pulling their legs out of this industry.

Currently in India mostly all the telecoms companies stuck between high cost and stagnant revenues. Due to this in near future the quality of the services will definitely be affected. Due to the advancement in technology, technology has become accessible to more number of people throughout the world. Hence we can say that the number of subscriber has been increased significantly. Because of the improving network technology, the number of subscribers has reached 77.56% on the completion of the year 2014 which has the increase of 14.58% from 62.98% in year 2000.

7. CONCLUSION

In the current scenario of Indian telecom industry, it is a matter of pride for us that the Telecom industry of India is the second largest emerging economies of the world, only next to China. The innovative GSM and CDMA services have been a revolution in the telecom sector, but it's the 4G LTE(Long term evolution) that is creating the buzz. Considering about

the impact of the recent technological changes in the telecom industry, following are the impacts observed –

- Increasing speed of networks.
- Movement towards the digital technology
- Development of mobile technology.

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