

# Application of Qualitative Comparative Analysis: Competition Environment in Five Countries

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## Abstract

This paper presents a Qualitative Comparative Analysis (QCA) of the telecom market in five countries namely USA, UK, Australia, Japan and Brazil. It highlights the diversity and similarity in competition environments across the countries. The paper brings out a set of common policy initiatives that these five countries have implemented called as the **necessary conditions**. It also provides a set of alternative combination of policy initiatives that some of the countries have implemented, this set is the **sufficient conditions**. Thus this paper shows that different causal paths – each path being relevant, in a distinct way – may lead to the same outcome in competition regulation. For the five countries studied, it is found that Opening up of Essential Facilities (OEF), Regulating Prices (RP), Unified and Multi-service Licensing (UML), Mobile Virtual Network Operator (MVNO), Infrastructure Sharing (IS) and Voice Over Internet Protocol (VOIP) are the necessary pre-conditions for a country to have an Effective Environment for Competition. The combination of variables like Opening up of Essential Facilities (OEL), Regulating Prices (RP), Spectrum Trading and Leasing (STL), Unified and Multi-service Licensing (UML), Mobile Virtual Network Operator (MVNO), Infrastructure Sharing (IS) and Voice Over Internet Protocol (VOIP) are observed in four countries USA, UK, Brazil and Australia. Whereas, combination of variables like Opening up of Essential Facilities (OEL), Regulating Prices (RP), Unified and Multi-service Licensing (UML), Mobile Virtual Network Operator (MVNO), Infrastructure Sharing (IS) and Voice Over Internet Protocol (VOIP) is observed in Japan.

**Keywords:** Competition, Convergence, Regulatory Framework

## 1. Introduction

As per the Telecommunications Regulation Handbook (2011) published by The World Bank, and the International Telecommunication Union, competition issues such as Control of Mergers and Acquisitions, Regulating Prices, Licensing And Authorizing Services, Spectrum Management, Network Access and Interconnection are typically regulated by the telecom regulator of a country. And that telecommunications are an essential means for reaching the Bottom of the Pyramid and enabling individuals to reduce poverty and improve the quality of their lives. As highlighted by the Handbook, this can

be achieved if policymakers evaluate policy options and decide on appropriate regulations. With 1990 decade being the decade of privatization, liberalization and globalization, challenges for regulators from developing countries have increased multi-fold.

For India, telecom sector was liberalized in 1994 and the telecom industry in India has grown from having tele-density of 1.94 % and subscriber base of 14.8 million (TRAI Study Paper No. 2/2005) in 1997-98 to 71.34 % and 922.04 million in 2014 (TRAI, Press Release No. 13/2014) respectively. India stands third in the world in TV market after China and USA. As on March 2014, of the 2701 million households, around 1691 million

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have Television sets which are being served by cable TV systems, DTH services, IPTV services and the terrestrial TV network of Doordarshan. The pay TV universe consists of around 991 million Cable TV subscribers, 64.822 million registered DTH subscribers (including 37.192 million active subscribers) and around half a million IPTV subscribers (TRAI, Annual Report 2014). So, while the growth of telecom and broadcasting sector in India has been impressive, it can be further enhanced through effective policy initiatives.

India has predominantly followed the ministerial-bureaucratic process for policy formulation and implementation. In 2007, India was ranked below other Asian countries in parameters such as independence, transparency, consistency, pro-competitiveness. (TRE, 2007). Industry leaders and investors opined that the telecom sector is no longer an attractive option for investment on account of policy uncertainty.

With involvement of the Supreme Court of India in the 2G spectrum allocation case and the subsequent cancellation of 122 licenses by it in 2012 has further worsened the regulatory environment in India. All these factors seem to have contributed to the 85% decrease in FDI in telecom in India from US \$ 2 billion in 2011 to US \$ 304 million in 2012-13. (Hindu Business Line, 2013).

Considering all these points, the researcher felt the need to study the competition environment of a few developed and developing countries with an aim to (1) Bring out the good practices in competition environment the selected countries. (2) Bring out the commonalities and diversity of the competition in the selected countries.

## 2. Literature Review

Literature on competition environment and its relationship with investment can be classified into four strands.

First are studies that form the foundation such as the provisions of GATT (General Agreement on Tariffs and Trade) in Services and World Bank Telecommunications Regulation Handbook. (Telecommunications Regulation Handbook, 2011, pg. 21). Second are inter-country qualitative analyses such as analysis of the reforms undertaken by four countries on the four factors Interconnection, Equal access, Unbundling and Industry structure (Spiller and Cardilli, 1997), criticality of competition regulation (Makhaya et

al., 2003), role of competition regulation in privatization (Mariscal, 2004), difference in competition environment in India and China (Liu and Jayakar, 2012). Third strand comprises of single country analyses such as macro-analysis of competition environment in China (Gao and Lyytinen, 2000), study that traces the history of introduction of competition in Indian telecom (Singh, et al., 2000), critique of India's regulatory institutions and institutional structures (Dossani and Manikutty 2000), regulatory institutions and institutional structures in competition regulation in UK (Scott, 2000), privatization, liberalization and introduction of competition in the telecom industry in Botswana (McCormick, 2001), the study of institutional change that promoted regulated private-sector competition in India's booming telecommunications sector (Mukherji, 2009), case study on pro-competition policy in Pakistan (Gao and Rafiq, 2009). Fourth are quantitative studies that bring out the positive impact of competitive entrants in a liberalized telecom sector (Gutierrez and Berg, 2000), brings out the positive effects of privatization, competition, and regulation on telecommunications performance in 30 African and Latin American countries (Wallsten, March 2001), analysis of competition policies from 50 countries from 1990 to 1998 (Li and Xu, 2002), brings out that Competition and privatization (ownership) are associated positively with the level of network (Guitierrez, 2003), highlights the relative success of privatization and competition programs in improving telecom sector performance for 200 countries (1990-1998) (McNary, 2004), brings out that there was inadequate competition in rural area in India (Biancini, 2011), study that examines the impact of the mandatory unbundling on network size and competition (Madden et al., 2013).

So, there has been adequate research analyzing the evolution of telecom regulation, competition policy, licensing etc. As well as criticism of the Indian Telecom Regulatory framework. The literature review above identifies two gaps in the literature. First, discussion regarding competition framework in general is abundant, studies based on variables discussed in World Bank Telecommunications Regulation Handbook are rare. Second, the comprehensive comparative analysis of competition environment of developed/developing countries bringing out country-specific policy initiatives that have contributed to growth in competition have been less in number. This paper attempts to fill this gap.

This paper is organized as follows. In the next section, the method used for selection of the countries, the variables to be compared and the research methodology are presented. The next section shows the Qualitative Comparative Analysis of the five countries and country-specific policies implemented by them. In the final section, interpretation and conclusions have been provided.

### 3. Research Methodology

Statistical Research involving multiple countries and their regulatory environment is based on generalizing the regulatory environment in a large number of countries on the basis of certain common parameters. However, since the attempt here is to highlight the good practices in structure and processes that each of the five countries have adopted qualitative research method is used. Qualitative research methods (Charles Ragin, 1994) help to bring forth the similarity as well as the diversity in the regulatory set-up of the various countries.

The study is based on literature review of research papers, secondary research and documents published by the regulators of the above-mentioned countries. The research methodology used is qualitative comparative analysis (QCA) (Charles Ragin, 1994), (Benoit Rihoux, Charles C. Ragin, 2009) case-based research of five countries. The researchers have chosen only a few countries so as to study these countries in detail, their regulatory set-up and also highlight country specific diversity in regulation of competition.

Considering the fact that each country is a complex entity, the researcher has recorded the conditions (independent variables) that produce the outcome in each of the cases. The summarization of the presence or absence of the conditions is done in a truth table. This is followed by Boolean minimization – that is, reducing the long Boolean expression, which consists in the long description of the truth table, to the shortest possible expression (the minimal formula, which is the list of the prime implicants) that unveils the regularities in the data. (Benoit Rihoux, Charles C. Ragin, 2009)

This shortest possible expression highlights the presence of certain conditions in all the cases, this forms the similarities in the cases. This set of common conditions is called as the **necessary conditions** and a set

of alternative combination of conditions is also obtained as an output of this process. This set is the sufficient conditions. Thus different causal paths – each path being relevant, in a distinct way – may lead to the same outcome.

### 4. Selection of Variables

**For selection of variables for cross-country comparison the researcher has referred to:**

- The provisions of **GATTS** (General Agreement on Tariffs and Trade (GATT) in Services.
- World Bank Telecommunications Regulation Handbook. (Telecommunications Regulation Handbook, 2011, pg. 21).
- Inclusion of variables specific to Indian telecom industry.

**Variables Vs Countries**

**Truth Table- Competition Environment:**

### 5. Analysis of the Findings

**Step 1:**

$$\text{OEF.RP.STL.UML.MVNO.IS.VOIP} + \text{OEF.RP.STL.UML.MVNO.IS.VOIP} + \text{OEF.RP.STL.UML.MVNO.IS.VOIP} + \text{OEF.RP.UML.MVNO.IS.VOIP} + \text{OEF.RP.UML.MVNO.IS.VOIP} + \text{OEF.RP.UML.MVNO.IS.VOIP} \rightarrow \text{ECE}$$

The four Boolean terms highlighted in the Step1 are similar and hence can be reduced to two terms according to basic rule of Boolean algebra i.e.  $A + A = A$

The highlighted terms in Step 1 have been reduced using the basic rules of Boolean Algebra

$$1) +A = 1 \text{ and } 2) A.1 + AC = A(1+C) = A.1 = A$$

**Step2:**

$$\text{OEF.RP.STL.UML.MVNO.IS.VOIP} + \text{OEF.RP.UML.MVNO.IS.VOIP} \rightarrow \text{ECE}$$

$$\text{OEF.RP.UML.MVNO.IS.VOIP} ( \text{ STL}+1 ) \rightarrow \text{ECE}$$

The two terms in Step 2 have been reduced using the basic rules of Boolean Algebra

$$1 + A = 1 \text{ and } 2) A.1 + AC = A(1+C) = A.1 = A$$

**Final equation after Boolean minimization is:**

$$\text{OEF.RP.UML.MVNO.IS.VOIP} \rightarrow \text{ECE}$$

**Table 1.** Variables for Five Country Comparison of Competition Environment

| Variable  | USA  | UK   | Australia  | Japan  | Brazil   |
|---|--|--|--|--|--|
| Opening up of Essential Facilities                                | Yes, for copper lines but not for optical fibre (LLU, OECD, pg. 19 & 18, 2003.)  | Yes for both copper and optical fibre (LLU, OECD, pg. 19 & 18, 2003.)  | Yes, for copper lines but not for optical fibre (Minami-hashii, 2003)  | Yes for both copper and optical fibre (LLU, OECD, pg. 17, 2003)  | Yes, for both copper and optical fibre as per the new Competition policy enacted in 2012   |
| Regulating Prices-  | Yes, for services as well as interconnection (FCC-Regulation of Cable TV rates)  | Yes, for services as well as interconnection (OfCom-Regulating Prices) (OfCom- Stakeholder consultations )                           | Yes, for services as well as interconnection   | Yes, for services as well as interconnection (Japan- Interconnection Prices)   | Yes, prices for services given in backward areas of Brazil are regulated the rest are market-driven. (Brazil- Telecoms and Media 2013) |
| Spectrum Trading & Leasing  | Yes, License is not required for leasing but is required for spectrum transfer (ComReg-Spectrum Trading Issues)                      | Yes, License is not required for leasing but is required for spectrum transfer (ComReg-Spectrum Trading Issues)                      | Yes, License is not required for leasing but is required for spectrum transfer (ComReg-Spectrum Trading Issues)                      | No, since spectrum is allocated and not auctioned  | Yes, License is not required for leasing but is required for spectrum transfer   |
| Unified and Multi-service Licensing and Virtual Network Operator. | Yes, and provision of Unified and Multi-service Licensing & Virtual Operator license   | Yes, and provision of Unified and Multi-service Licensing & Virtual Operator license (Kuscu, 2009, pg. 25,)                          | Yes, and provision of Unified and Multi-service Licensing & Virtual Operator license (MVNO licenses in Australia)                    | Yes, and provision of Unified and Multi-service Licensing & Virtual Operator license (ictregulation toolkit, pg. 66)                       | Yes, and provision of Unified and Multi-service Licensing & Virtual Operator license (ictregulation toolkit Practice Note/890)         |
| Infrastructure Sharing- Active & Passive                          | Yes, Passive is allowed without regulations and Active is subject to regulatory approval (ITU-Infrastructure Sharing, 2010, pg. 12,) | Yes, Passive is allowed without regulations and Active is subject to regulatory approval (ITU-Infrastructure Sharing, 2014, pg. 13,) | Yes, Passive is allowed without regulations and Active is subject to regulatory approval (ITU-Infrastructure Sharing, 2014, pg. 13,) | Yes, Passive is allowed without regulations and Active is subject to regulatory approval (Onishi and Tsuna, 2010, pg. 17)                  | Yes, Passive is allowed without regulations and Active is subject to regulatory approval (ITU-Infrastructure Sharing, 2014, pg. 13,)   |
| VOIP License and Interconnection with traditional phone network.  | Yes and interconnection with traditional phone network is also allowed (Convergence in ICT services, 2008, pg. 30)                   | Yes and interconnection with traditional phone network is also allowed (Jose R. Vargens, 2005)                                       | Yes and interconnection with traditional phone network is also allowed (SATRC COUNTRIES, , 2012, pg. 67)                             | Yes and interconnection with traditional phone network is also allowed (TRAI, Paper on Issues related to Internet Telephony, 2008, pg. 37) | Yes and interconnection with traditional phone network is also allowed (Rendón et al., 2008)   |

**Table 2.** Truth Table - Five Country Comparison of the Competition Environment

| Variables                                       | USA | UK  | Australia | Japan | Brazil |
|---|-----|-----|-----------|-------|--------|
| Opening up of Essential Facilities (OEF)        | Yes | Yes | Yes       | Yes   | Yes    |
| Regulating Prices(RP)                           | Yes | Yes | Yes       | Yes   | Yes    |
| Spectrum Trading and Leasing (STL)              | Yes | Yes | Yes       | No    | Yes    |
| Unified and Multi-service Licensing (UML)       | Yes | Yes | Yes       | Yes   | Yes    |
| Mobile Virtual Network Operator license( MVNO)  | Yes | Yes | Yes       | Yes   | Yes    |
| Infrastructure Sharing- Active and Passive (IS) | Yes | Yes | Yes       | Yes   | Yes    |
| Voice Over Internet Protocol (VOIP)             | Yes | Yes | Yes       | Yes   | Yes    |

### 5.1 Necessary and Sufficient Conditions for Effective Competition Environment

It is found that Opening up of Essential Facilities (OEF), Regulating Prices (RP), Unified and Multi-service Licensing (UML), Mobile Virtual Network Operator (MVNO), Infrastructure Sharing (IS) and Voice over Internet Protocol (VOIP) are the necessary pre-conditions for a country to have an Effective Competition Environment.

The combination of variables like Opening up of Essential Facilities (OEL), Regulating Prices (RP), Spectrum Trading and Leasing (STL), Unified and Multi-service Licensing (UML), Mobile Virtual Network Operator (MVNO), Infrastructure Sharing (IS) and Voice Over Internet Protocol (VOIP) are observed in four countries USA, UK, Brazil and Australia.

Whereas, the combination of variables like Opening up of Essential Facilities (OEL), Regulating Prices (RP), Unified and Multi-service Licensing (UML), Mobile Virtual Network Operator (MVNO), Infrastructure Sharing (IS) and Voice Over Internet Protocol (VOIP) is observed in Japan.

## 6. Interpretation of the Findings

### 6.1 Opening up of Essential Facilities

All of the five countries have implemented the Opening up of Essential Facilities have implemented it through the sharing of wired infrastructure with competitors. This is called as Last Loop Unbundling (LLU). However, the impact of LLU and the extension of LLU to optical fibre have been different across these countries. Researchers have shown that infrastructure-based competition has a positive impact on broadband diffusion in the longer term, whereas regulatory-induced service-based competition has a positive impact only in the initial market phase (Wallsten (2005)) and full local loop unbundling has no significant effect. Boyle et al (2008) examine the impact of local loop unbundling on broadband penetration using yearly OECD data from 2002 to 2005 and conclude that the contribution of local loop unbundling at the level of national broadband uptake is statistically insignificant. Crandall, Jeffrey and Ingraham(2013) find that unbundling obligations have almost no significant impact on broadband penetration in the short run but a significantly negative impact on penetration in the long run. Furthermore, the authors argue that extending unbundling obligations to fiber infrastructure increases the risk of regulatory errors substantially. This explains why US has not extended the LLU to optical fibre deployments (John de Ridder, 2008, pg15). This can be attributed as one of the reasons for the fibre deployments in US to have been more wide spread as compared to European Union (EU).

Japan too is ahead of the EU, but reasons are different. In the early 2000s telcos had metal telephone lines, Cable TV operators had metal lines, and electric companies had their own electric lines. Therefore, it was easy to install fiber-optic lines next to their pre-existing overhead lines for telcos, Cable TV operators and electric companies. Cable TV operators and electric companies enabled by regulation entered the fiber market to earn profits from services such as high quality IP-phones, high definition TV programs, and high speed internet. During this period, NTT's infrastructure competitors preferred unbundling regulations because such regulations were

expected to decrease NTT's investment in fiber networks, in turn allowing competitors' shares in the fiber market to increase. In the middle of the decade, however, Cable TV operators and electric utilities decreased their investments or stopped building FTTH, because non-facility service providers entered the market using regulated NTT premises. These new firms took Cable TV operators' and electric utilities' potential customers. Also, even if Cable TV operators were to build their own fiber lines, they would have faced harsh price competition, since NTT premises had to be shared at a regulated low cost with non-facility service providers. Furthermore, the new service providers strongly demanded that the government reduce the rental price and increase the flexible usage of the facility (Minamihashi, 2012, pg. 9). Finally, by the end of the 2000s, NTT's share of fiber lines was around 75%; they dominated the fiber facility market, eliminating other firms under unbundling regulation. A few cable TV operators have started to borrow fiber lines from NTT, rather than build lines themselves (Minamihashi, 2012, pg. 9) this market structure was heavily criticized by both service providers and facility competitors facing a monopolistic situation. Thus, unbundling of fibre has resulted in a monopolistic situation in Japan although the fibre deployment in Japan is ahead of other developed countries.

Cave and Vogelsang (2003) point out, in order to spur facility-based competition, "transitory entry assistance" should not be limited to the obligation to lease unbundled network elements, but should encompass access charge increasing over time, i.e. a critical instrument to give the right incentives to invest. Bouckaert et al. (2010) have analyzed the evolution of broadband penetration in 20 OECD countries from 2003 to 2008, and have confirmed the view that the promotion of inter-platform competition (such as net on cable TV vs DSL) instead of LLU obligations is likely to be a more effective policy to improve the broadband penetration.

Thus, from the above-mentioned research papers and analysis brings out the need to encourage the deployment of cable infrastructure for platform based competition, which will lead to optical fibre deployments by both the telecom operators as well as the cable companies as seen in US.

## 6.2 Mobile Virtual Network Operator (MVNO)

All of the five countries have issued MVNO licenses. Shin and Bartolacci (Shin and Bartolacci, 2007) have shown that vertically integrated mobile market reduces MVNO diffusion. The second (associated with segmentation in telecom services) expresses the positive significant relationship with the MVNO diffusion; the third factor (associated with mobile market competition) shows the positive relation that higher competition is related to higher MVNO diffusion. In the event of the availability of the local level MVNO license, local entrepreneurs can serve as re-sellers of talk time as well as offer VoIP as was observed in Indonesia (Rohan Samarajiva, Ayesha Zainudeen, 2008).

## 6.3 Spectrum Trading and Leasing

All the countries except Japan have in place mechanism and regulatory policies enabling spectrum trading and leasing. Spectrum Trading (ST) is a market-based spectrum management mechanism in which buyers and sellers determine the assignments of spectrum and its uses; this way ST has the capability of addressing both the allocation and assignment aspects of spectrum use. In its simplest form, ST refers to the temporary or permanent selling of spectrum licenses (spectrum usage rights). (Olafsson et al., 2007)

The traditional command and control model for managing spectrum makes it difficult for spectrum users (wireless service providers in most scenarios) to share or trade spectrum. This limits the efficiency in the use of a band of spectrum by impeding transactions that can place spectrum resources in the hands of those who value them and need them the most at a given moment in time. (Coleman Bazelon, 2009) (Burgkhardt, 2009).

Studies in countries that have introduced greater flexibility have indicated benefits in competitiveness and lower consumer prices. These benefits arise because the market is able to more efficiently allocate spectrum resources between competing demands than a regulator. In general, spectrum trading would promote a more competitive communications environment, lowering barriers of entry to service provision for new companies/

enterprises and facilitating the introduction of new services (Randall et al., 2010). In general, the rules and behaviors governing the market structure along with any regulatory policy limitations will influence the technical and economic benefits achievable in a market-based spectrum management environment (Caicedo et al., 2008).

The main source of the economic gains as a result of spectrum trading and leasing is substantiated by an increase in innovation efficiency and improvements in competitiveness (OECD-Secondary Markets for Spectrum: Policy Issues, 2005, pg. 19).

In the United Kingdom, of com estimated that the benefits of introducing spectrum trading will substantially exceed costs with net economic benefits ranging from GBP 67 million to GBP 144 million if the impact of increased competition is taken into account. Even if the volume of spectrum trading is only half that assumed in these estimates, the basic conclusion is unchanged, that the benefits range from GBP 33 million to GBP 72 million if the impact of greater competition is taken into account (OECD-Secondary Markets for Spectrum: Policy Issues, pg. 20, 2005).

Following reforms in the early 1990s, all spectrum licenses in Australia became tradable. Similarly in US, since 2002, the FCC has been promoting secondary markets, speeding up processes, authorising spectrum-leasing arrangements for most users and seeking advice on further improvements (London Economics, 2008). In European Union (EU), Article 9 of the current EU Framework Directive allows member States to provide for the transfer of spectrum rights with certain requirements. So, UK too has adopted the concept of spectrum trading.

Japan is an exception as Japanese operators are allocated spectrum administratively and hence are not allowed to trade spectrum in secondary markets. But, as per the recommendations submitted by the Telecommunications Policy Council in 2003 (MPMHPT Newsletter, Oct 2003), operators will be encouraged to use spectrum efficiently failing which they will be asked to return spectrum, which will be re-allocated to other operators.

Deriving from the above-mentioned sources, spectrum trading and leasing can result in service innovation, efficiency and improvements in competitiveness in telecom.

## 6.4 Voice Over Internet Protocol (VOIP)

All of the five countries have allowed operators to offer VOIP service. The rise and implementation of emergent technologies like VOIP and wireless are valued for their potential impact to increase competition in the telecommunications sector and to encourage an expansion in broadband service. (Proenza, 2006). VOIP applications have the potential to reduce prices for voice communications and enhance competition in voice markets by lowering entry barriers to these markets. (OECD, 2006). Legalization of VoIP not only drove the growth of VOIP but also the adoption of broadband and triple play in Kenya, Tanzania, and Uganda (Rajendra Singh, Siddhartha Raja, 2010). Where VOIP is permitted, small providers can evolve into information technology businesses (Rajendra Singh, Siddhartha Raja, 2010, pg.23). Failure to legalize VOIP prevents entrepreneurs from developing into a core of fast-growing information technology (IT) startups, the latter of which tends to happen in countries where VOIP is legal (Rajendra Singh, Siddhartha Raja, 2010, pg.53). One of the most relevant areas of the debate on interconnection and multiple play focuses on efforts by alternative telephone service providers to interconnect with traditional telephone networks as they begin offering VOIP services. For instance, in 2007, Time Warner Cable in the United States petitioned the FCC to allow its VOIP service to interconnect with PSTNs (Rajendra Singh, Siddhartha Raja, 2010, pg.113). The FCC allowed this petition, with the chairman noting that the decision increased competition for telephone services and encouraged deployment of broadband facilities and so lowered prices and expanded customer choice (FCC 2007e). In March 2007, the FCC also announced that rural telecommunications companies must interconnect with cable television companies (FCC 2007a).

## 7. Conclusion

- It is found that Opening up of Essential Facilities (OEF), Regulating Prices (RP), Unified and Multi-service Licensing (UML), Mobile Virtual Network Operator (MVNO), Infrastructure Sharing (IS) and Voice Over Internet Protocol (VOIP) are the necessary pre-conditions for a country to have an Effective Competition Environment.

- All the five countries have implemented the Opening up of Essential Facilities combined with inter-platform competition. And LLU should be accompanied by sunset clause so that new entrants are incentivized to invest in infrastructure.
- MVNO emerges as the other regulatory initiative adopted by all the five countries.
- All countries except Japan, have allowed trading of spectrum as spectrum in these countries has been allocated through competitive methods. In Japan spectrum was administratively allocated and not through market linked methods and hence allowing spectrum trading would have led to loss to national exchequer.
- Regulating prices: The regulators in all the five countries periodically review the telecom tariff to ensure that price cap rates are being set effectively and goals of investment, growth, and consumer savings are being met. All the countries except Brazil regulate all kinds of tariff unlike Brazil that only regulates only tariff in case of economically backward sections of the population.
- Infrastructure Sharing- All of the five countries studied have allowed both active and passive infrastructure sharing and legalization of interconnection of VOIP networks with PSTN /PLMN .This is common with the five countries studied.

## 8. Limitations

The number of countries in this research project has been limited to five. This even in the case of comparative analysis may not be enough for generalization. As this research is based on published data about the selected countries, country-specific locally known issues may have been ignored.

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