

TOWARDS THE MATURITY OF ICT REGULATION – INTEGRATED REGULATION

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Abstract: *The paper deals with the concept of integrated regulation of ICT sector, encompassing the evolution towards regulation led by economic and social policy goals. The integrated regulation or fully integrated policy approach has been recognized as the key to unlock the value of digital society. The correlations are portrayed on four identified within ICT Regulatory Tracker regulation areas and two subsectors of ICT treated as the most important for the development of ICT, that is, mobile-cellular and fixed broadband. The most visible strong positive correlation is between regulatory regime and fixed broadband subscriptions for all analyzed countries.*

Keywords: *regulation, integrated regulation, ICT Regulatory Tracker by ITU*

JEL Classification: L 5, L 43

1. Introduction

In the world of societies getting smartly connected, there is a challenge policy maker, regulators together with all stakeholders face in searching for common solutions of regulatory problems emerging from contemporary economic and social structures.

Broadband as an access technology for data communications (characterized by high speed and always-on Internet connectivity) together with the adoption of information technology for mobile telephony as well as the implementation of organizational and process changes in enterprises has an economic impact. Equally important are the conditions under which broadband has the effect.

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Regulatory frameworks equipped with more flexible, integrated and inclusive mechanisms appear as creators of an environment having been adjusted to remove the barriers that hinder progress to fully embrace the potential of the dynamism of digital ecosystems.

The technology advancement in the global, digitally connected society calling for market responsiveness integrate the prerequisites for regulatory pursuits. The regulatory infrastructure according to the methodology of International Telecommunication Union, ICT Regulatory Tracker [2] is viewed as being composed of regulatory authority, regulatory mandate, regulatory regime and competition frameworks. The main objective of the regulatory infrastructure of ICT sector is to channel the decisions of consumers and businesses to leverage the goals of ICT technology-driven economic growth.

The paper aims to distinguish a stimulating role of advanced ICT regulation in the course of releasing the economic potential hidden in fixed broadband and mobile cellular.

2. Background issues

Forms and the maturity of ICT regulation

Approaches to regulation of ICT sector may take different types ranging from self-regulation (attempts at solving problems by the conflicting parties before turning to state regulator), over co-regulation (cooperation of the public and the private sector in regulatory institutions), to command-and-control regulation (setting rules by government or parliament) [7, p. 140]. The forms of regulation stretch out into the interventions relating to particular areas of ICT sector, such as: wholesale access to fixed line networks, wholesale access to mobile networks, interconnection, net neutrality, search engines, cloud computing, social media, data privacy protection, data retention, and consumer protection [8].

From the command-and-control approach of regulation marked by the existence of ILEC (incumbent local exchange carriers) wielding market power (G1 generation of regulation [2]), through the phase of liberalization and privatization, focusing on competition and consumer protection, currently the regulation generally represents relatively light-handed approach. The present stage of ICT sector regulation is featured by the regulation integrating broader socio-economic objectives. The purpose of most of the regulatory contexts depicted by the pressure of dynamic and sophisticated technological advancement is the competition across technologies. Despite the contestability created by technology progress, there is still need for the regulatory instruments to tackle the problems of not effective competition (including the

protection of mostly wireline consumers deprived the access to the choice of service provider [1]).

The shift toward regulation maturity means regulatory advancement towards more effective, open and flexible regulatory schemes. Each stage of the advancement of ICT sector regulation embodies the move toward the regulation levels portrayed by more openness, flexibility, and effectiveness. ITU Regulatory Tracker distinction of the areas of regulation boils down to: regulatory authority, regulatory mandate, regulatory regime, and competition framework. The picture of regulatory evolution is designed to indicate that higher openness and flexibility of succeeding levels of regulatory development stand for higher level of regulatory effectiveness.

A regulatory approach is considered more open, flexible and effective (therefore, more mature):

1. the more financially, structurally and decisively independent is the regulatory authority;
2. the more accountable is the regulatory authority, that is – reporting requirements, responsibility for the budget, appointment of the board /head of the regulator are assigned to different governmental bodies;
3. the more diversified and less influential are the sources of regulator's annual budget;
4. if public consultations are obligatory before regulatory decisions;
5. the more enforcement power the regulator has;
6. the stronger sanctions and penalties the regulator can enforce;
7. the clearer the dispute resolution system exists;
8. the clearer and more detailed procedures for appealing the regulator's major dispute resolution decisions are introduced;
9. if a competition authority exists;
10. if enforcement of quality of service obligation measures and service quality monitoring is performed by independent regulator;
11. if regulatory authority is in charge of authorization policies, interconnection rates, prices regulation, spectrum management, universal service, broadcasting (technology and content), Internet (technology and content), resolving consumer complaints, providing tariff information, guiding consumers (educating);

12. the more unified licensing, general authorization and simpler notification enabling more competitive environment or license exemption function;

13. if a standard offer (information relating to price, terms and conditions) is published, interconnection agreements are made public, measurement of quality service is required, infrastructure-sharing (network-sharing, site-sharing/co-location) for mobile operators is permitted, mandated and required, unbundled access is required, secondary spectrum trading and band migration are allowed, number portability is available, voice over Internet (VoIP) is allowed to individual users;

14. if national plan including broadband is adopted;

15. if the competition exists in local and long-distance, fixed line services markets, in International Mobile Telecommunications (IMT) services, in cable modem, DSL, fixed wireless broadband, in leased lines, in International Gateways;

16. if the main fixed line operator is fully privatized;

17. if the concept of significant market power (SMP) is incorporated into the national law, and is diversified in the criteria of contributing the SMP;

18. the looser the control of foreign capital participation in ownership of facility-based, spectrum-based, local service, long-distance service, and international service operators, as well as of Internet Service Providers and of value-added service providers [2].

The essence of the integrated approach to ICT regulation and its identified levels

The integrated approach to ICT regulation is perceived as the generator of regulation to nurture the factors recognized to be important for the growth of digital economy and for exploiting of the potential of mobile technology and broadband network access (productivity, investment, competition, human capital, institutions, and various forms of technological innovation).

The nature of this stage of ICT sectoral regulation is focused on cumulative effect of sound regulatory practices within a whole-of-government approach on economic and social performance through the adoption of a general-purpose ICT technology. It is the composite of policy design aimed at allowing for Internet's economic potential to be fulfilled while protecting society [13]. The overall tendency of ICT regulatory levels assessed by International Telecommunication Union within ITU Regulatory Tracker for 2007 – 2017 [2] highlights significant diversity of regulation levels all over the world. On the one hand, there are countries such as Andorra, Bolivia, Belarus, Cuba, Eritrea, Ethiopia, Libya, Niger, Tajikistan,

Turkmenistan, Yemen, which are still characterized by regulated public monopolies. And, on the other hand, there are the countries which are featured by the sectoral regulation resulting in competitive markets and coherence with socio-economic objectives [3].

Out of the countries under analysis in the period 2007 – 2017, 61 achieved G4 level of regulation in 2017 (out of 190 countries in 2017), i.e. integrated regulation. The majority of these sectors were from European, North and South American countries, as well as Australia. The array of economies whose ICT sector was featured by G3 level of regulation maturity (the level of regulation stimulating the investment-, innovation- and access-friendly; 30% of the totally analyzed countries in 2017) was composed mainly of African and South and East Asian countries. Level G2 of regulation (basic reforms undertaken such as partial liberalization and privatization) characterized 24% countries in majority from Asia and Africa. The least advanced regulation of ICT sector was identified in 27% of analyzed sectors, mostly in Africa and Pacific island countries.

The generation of regulation of the particular interest within the paper is generation named *G4 – Integrated regulation*, ranked between 85 and 100 score within ICT Regulatory Tracker.

After broad analyses of the countries in terms of their ICT sector regulatory generation adopted in 2017, the characteristics of the countries featured by G4 regulation is held in reference to regulatory authority, regulatory mandate, regulatory regime, and competition framework. To present the economies whose ICT sectors were regulated within the G4 regulatory standards, three groups of the countries were drafted (Table 1). The first group of the countries was the one with the scores 85-90, the second one with the scores 91-95, and the third one with 96-100 score levels.

Table 1

The Characteristics of the Countries Featured by G4 Regulation of ICT Sector in 2017 in terms of Particular Clusters (number of maximal cluster scores in relation to overall score)

| cluster / range of score | 85-90 | 91-95 | 96-100 |
|--------------------------|-------|-------|--------|
| regulatory authority | | | |
| regulatory mandate | | | |
| regulatory regime | | | |
| competition framework | | | |

Source: [2].

The majority of the countries with the G4 rank of ICT sector regulation performed best within the cluster called competition frameworks (black row). The ICT sectors of the countries within G4 regulation with the highest levels of regulation (score 96-100) were recognized as progressive within clusters of regulatory authority, regulatory mandate and regulatory regime (black column).

Italy and Ireland achieved the highest score within ICT Regulatory Tracker reaching the level of 97,33 and 97 respectively. The regulation of their ICT sector was classified as the most mature (the most open and flexible, and the most effective). Table 2 sheds some light on the main figures featuring their position within the highest achievable so far level of ICT sector regulation with respect to the openness and flexibility as well as effectiveness.

Table 2

Presentation of the Openness and Flexibility, and Effectiveness of ICT regulation in Italy and Ireland, latest available data for 2016, 2017 and 2018

| openness and flexibility | | effectiveness | |
|---|---|---|-------|
| Italy (97,33) | | | |
| regulator autonomous in decision making | yes | fixed-telephone subscriptions per 100 inhabitants | 34,9 |
| sources of regulator's budget and % financed from each source | 65.6% regulated operators (0.14% of operator revenue), 34.4% other regulated sectors (TV, postal services, refunds) | mobile-cellular subscriptions per 100 inhabitants | 141,3 |
| entity in charge of: interconnection rates, price regulation, technical standards settings, type of approval, service quality monitoring, quality of service standards setting, enforcement of quality of service obligations | regulator | fixed-broadband subscriptions per 100 inhabitants | 24,1 |
| entity in charge of: licensing, radio frequency allocation and assignment, spectrum monitoring | sector ministry and regulator | | |

| | | | |
|--|--|---|-------|
| enforcement, numbering, universal service, broadcasting | | | |
| entity in charge of broadcasting content | other ministry or government body, and regulator | mobile-broadband subscription per 100 inhabitants | 87,9 |
| regulation of Internet content | none | households with a computer (%) | 64,3 |
| level of competition in the markets of: local fixed line services, domestic fixed long distance, international fixed long distance, mobile, Wireless Local Loop, DSL, leased lines, international gateways, Internet services, VSAT | full competition | households with Internet access at home (%) | 71.7 |
| | | individuals using the Internet (%) | 61.3 |
| level of competition in the markets of: IMT (3G, 4G), fixed wireless broadband, mobile satellite services, | partial competition | | |
| Ireland (97) | | | |
| regulator autonomous in decision making | yes | fixed-telephone subscriptions per 100 inhabitants | 38,7 |
| sources of regulator's budget and % financed from each source | 59% licence fee; 32% spectrum fee, 9% regulated operators (2% of operator revenue) | mobile-cellular subscriptions per 100 inhabitants | 102,9 |
| entity in charge of: licensing, interconnection rates, price regulation, radio frequency allocation and assignment, spectrum monitoring enforcement, numbering, type of approval, service quality monitoring, universal service, quality of service standards setting, enforcement of quality of | regulator | fixed-broadband subscriptions per 100 inhabitants | 26,9 |

| | | | |
|---|-----------------------------------|---|------|
| service obligations, broadcasting, broadcasting content | | | |
| entity in charge of technical standards setting | other ministry or government body | mobile-broadband subscription per 100 inhabitants | 102 |
| regulation of Internet content | none | households with a computer (%) | 84 |
| level of competition in the markets of: local fixed line services, domestic fixed long distance, international fixed long distance, mobile, IMT (3G, 4G), Wireless Local Loop, DSL, cable modem, fixed wireless broadband, leased lines, international gateways, Internet services, cable television, fixed satellite services, mobile satellite services, VSAT | full competition | households with Internet access at home (%) | 89 |
| | | individuals using the Internet (%) | 84.5 |

Source: [3].

Italy and Ireland represented the results of the regulation dominated by the full competition in the ICT service markets, relatively open methods of regulation, as well as consequently successful effects in terms of some of other important indicators of ICT sector development. Only such measures as fixed-telephone subscriptions per 100 inhabitants, mobile-cellular subscriptions per 100 inhabitants, fixed-broadband subscriptions per 100 inhabitants or individuals using the Internet (%) remained significantly higher for Italy and Ireland than for the world (respectively 13,15; 104,49; 13.76; 45.8% [11]).

3. Data and Methodology

The aim of the further analysis is to investigate the degree to which the levels of integrated regulation correlate with sectoral performances in order to devise the possible tracks to follow for ICT sectors and the economy as a whole. The research question is related to whether factors

including levels of integrated regulation in different areas of the regulation correlate with sectoral and economy performance.

In order to solve the analytical problem, the research objectives are to:

–present the economies assessed by ICT Regulatory Tracker as reaching the overall “G4” regulatory level (integrated regulation)in 2017, as well as at each of the surveyed areas – regulatory authority, regulatory mandate, regulatory regime, competition framework [2] (chapter 2);

–summarize the ICT sectoral achievements of the economies²;

–identify analyzed economies in terms of GNI per capita (constant 2010 USD).

The hypotheses are formulated as follows:

H1: higher regulatory level at G4 in terms of regulatory authority implies:

H1.1: more mobile-cellular subscriptions

H 1.2: more fixed broadband subscription

H2: higher scores at G4 regulation in terms of regulatory mandate imply:

H 2.1: more mobile-cellular subscriptions

H 2.2: more fixed broadband subscription

H3: more advanced regulation in terms of regulatory regime implies:

H 3.1: more mobile-cellular subscriptions

H 3.2: more fixed broadband subscription

H4: higher scores at G4 in terms of competition framework imply:

H 4.1: more mobile-cellular subscriptions

H 4.2: more fixed broadband subscription

H5: the higher the G4 overall score, the higher GNI per capita [more aggregated correlation].

The main data are derived from ICT Regulatory Tracker and World Bank resources [12]. The data on regulatory advancements are drawn from International Telecommunication Union database, ICT Regulatory Tracker. The *evidence-based tool* serves as possible benchmark to identify the trends of regulatory developments in ICT sector and upgrade of its regulatory frameworks. The ICT Regulatory Tracker consists of 50 indicators, grouped into clusters,

² Out of many indicators of sectoral performance, mobile cellular subscriptions and fixed broadband subscription were selected as two most important for the sector development [5, 6].

covering the regulatory conditions in ICT sectors of even 190 countries in the period 2007 – 2017 [2]. Each cluster is scored to the maximum level, which for the cluster regulatory authority is 20, cluster regulatory mandate is 22, regulatory regime is 30, and competition framework is 28 [2]. The areas explored within the clusters of indicators are: the state of regulatory entity bearing the responsibility of ICT regulation, the diversified issues of ICT regulation potentially within the mandate of ICT regulator, the regulatory frameworks imposed on the specific ICT sector matters, and competition rules in specified market segments. The main information for building the indicators is provided yearly via *ITU's World Telecommunication Regulatory Survey* [10].

Results of sectoral performance are part of the World Development Indicators databases (last updated 30.01.2019). Levels of GNI per capita are from World Bank national accounts data and OECD National Accounts data files, lastly updated on 21.03.2019.

The following analysis concerns 61 countries that attained the G4 level of ICT regulation, i.e. integrated regulation of their ICT sector in 2017.

4. Results and Discussion

The summary of correlations between level of integrated regulation of ICT sector and the ICT sectoral achievements, as well as the identification of the relation between integrated regulation of ICT and level of GNI per capita is shown in table 3.

Table 3

The Results of Hypotheses Testing

| H | Factors [2] | Correlation coefficients for particular number of countries | Verification of the hypotheses ³ |
|------|---|---|---|
| H1.1 | regulatory authority and mobile-cellular subscription | for 28 more than 0,5 for 20 less than 0,5 for 13 incalculable | reject |
| H1.2 | regulatory authority and fixed broadband subscription | for 39 more than 0,5 for 9 less than 0,5 for 13 incalculable | accept |

³ Correlation coefficient more than 0,5 for the majority of the countries means acceptance of the hypothesis.

| | | | |
|------|--|---|--------|
| H2.1 | regulatory mandate and mobile- cellular subscription | for 38 more than 0,5 for 19 less than 0,5 for 4 incalculable | accept |
| H2.2 | regulatory mandate and fixed broadband subscription | for 53 more than 0,5 for 4 less than 0,5 for 4 incalculable | accept |
| H3.1 | regulatory regime and mobile- cellular subscription | for 46 more than 0,5 for 15 less than 0,5 | accept |
| H3.2 | regulatory regime and fixed broadband subscription | for 61 more than 0,5 | accept |
| H4.1 | competition framework and mobile- cellular subscription | for 35 more than 0,5 for 14 less than 0,5 for 12 incalculable | accept |
| H4.2 | competition framework and fixed broadband subscription | for 46 more than 0,5 for 3 less than 0,5 for 12 incalculable | accept |
| H5 | overall regulatory advancement at G4 and GNI per capita | for 36 more than 0,5 for 23 less than 0,5 for 2 incalculable | accept |

Source: Author's calculations.

Hypothesis 1.1:

Since correlation coefficients are more than 0,5 for less than half of the analyzed countries, the hypothesis 1.1 is rejected. accepted/rejected. The conclusion is drawn that better results in separation of powers, autonomy, accountability, enforcement power, etc. of sectoral regulator do not imply more mobile-cellular subscriptions.

Hypothesis 1.2:

Since correlation coefficients are more than 0,5 for more than half of the analyzed countries, the hypothesis is accepted. The conclusion is drawn that the more autonomous

regulator, more diversified funding, more public consultations, etc., the more fixed broadband subscription is reported.

Hypothesis 2.1:

Since correlation coefficients are more than 0,5 for more than half of the analyzed countries, the hypothesis 1.1 is accepted. The conclusion is drawn that the more enforcement of quality of service obligation measures and service quality monitoring is performed by independent regulator, more in charge of authorization policies, interconnection rates, prices regulation, spectrum management, universal service, broadcasting (technology and content), Internet (technology and content), resolving consumer complaints, providing tariff information, guiding consumers (educating) the regulatory authority is, the more mobile-cellular subscriptions are purchased.

Hypothesis 2.2:

Since correlation coefficients are more than 0,5 for more than half of the analyzed countries, the hypothesis is accepted. The conclusion is drawn that the more enforcement of quality of service obligation measures and service quality monitoring is performed by independent regulator, more in charge of authorization policies, interconnection rates, prices regulation, spectrum management, universal service, broadcasting (technology and content), Internet (technology and content), resolving consumer complaints, providing tariff information, guiding consumers (educating) the regulatory authority is, the more fixed broadband subscriptions are purchased.

Hypothesis 3.1:

Since correlation coefficients are more than 0,5 for more than half of the analyzed countries, the hypothesis is accepted. The conclusion is drawn that the more unified licensing and general authorization, simpler notification enabling more competitive environment or license exemption function, as well as more pressure on publishing a standard offer (information relating to price, terms and conditions), making public interconnection agreements, measuring of quality service, infrastructure-sharing (network-sharing, site-sharing/co-location) for mobile operators, requiring unbundled access etc., the more mobile-cellular subscription is observed.

Hypothesis 3.2:

Since correlation coefficients are more than 0,5 for all of the analyzed countries, the hypothesis is accepted. The conclusion is drawn that the more unified licensing and general authorization, simpler notification enabling more competitive environment or license exemption function, as well as more pressure on publishing a standard offer (information relating to price, terms and conditions), making public interconnection agreements, measuring of quality service, infrastructure-sharing (network-sharing, site-sharing/co-location) for mobile operators, requiring unbundled access etc., the more fixed broadband subscription is observed.

Hypothesis 4.1:

Since correlation coefficients are more than 0,5 for more than half of the analyzed countries, the hypothesis is accepted. The conclusion is drawn that if the competition exists in local and long-distance, fixed line services markets, in International Mobile Telecommunications (IMT) services, in cable modem, DSL, fixed wireless broadband, in leased lines, in International Gateways, if the main fixed line operator is fully privatized, if the concept of significant market power (SMP) is incorporated into the national law, and is diversified in the criteria of contributing the SMP, if the control of foreign capital participation in ownership of facility-based, spectrum-based, local service, long-distance service, and international service operators, as well as of Internet Service Providers and of value-added service providers is looser, there are more mobile-cellular subscriptions.

Hypothesis 4.2:

Since correlation coefficients are more than 0,5 for more than half of the analyzed countries, the hypothesis is accepted. The conclusion is drawn that if the competition exists in local and long-distance, fixed line services markets, in International Mobile Telecommunications (IMT) services, in cable modem, DSL, fixed wireless broadband, in leased lines, in International Gateways, if the main fixed line operator is fully privatized, if the concept of significant market power (SMP) is incorporated into the national law, and is diversified in the criteria of contributing the SMP, if the control of foreign capital participation in ownership of facility-based, spectrum-based, local service, long-distance service, and international service operators, as well as of Internet Service Providers and of value-added service providers is looser, there are more fixed broadband subscriptions.

Hypothesis 5:

Since correlation coefficients are more than 0,5 for more than half of the analyzed countries, the hypothesis is accepted. The conclusion is drawn that the more mature the regulation of ICT sector, the more GNI per capita is performed.

5. Conclusions

The importance of ICT sector development in the process of triggering countries' comparative advantages in areas already active or waiting to be explored [9, p. 330 – 331] has been getting clearer-cut. Such sectors as ICT require the assistance of public regulation, although the consequences of such involvement are not unambiguous. The visualization of the possible results of ICT regulation on sectoral performance as well as, more in aggregate, on GNI per capita, is presented by the quantitative assessment that measures both the direction and the strength of the tendency of sectoral performance and the overall economy performance together with highly matured regulation of ICT sectors in the world.

Among 61 countries with the most mature regulation (with the overall G4 level in 2017) in ICT sector:

1. the positive correlation is strongly visible between regulatory regime and fixed broadband subscriptions for all analyzed countries;
2. much more countries are identified as exercising significant positive correlations between fixed broadband subscriptions and different areas of regulation than mobile-cellular and different areas of regulation;
3. the aggregate measure of GNI per capita correlated positively with the overall regulatory measure for less than 40 countries.

Generally, mobile subscription demonstrated significant positive correlation with regulatory regime, regulatory mandate, competition framework, whereas, fixed broadband subscription appeared to correlate positively and strongly with regulatory authority, regulatory regime, regulatory mandate, competition framework.

The evident impact of mobile subscriptions and fixed broadband subscriptions on economic results can be tracked to some extent through the positive and significant correlation between GNI per capita and overall G4 regulation. Meaning that, regulation can be an important factor of economic stimulation in respect to ICT sector. Within that, when stimulating fixed broadband subscriptions, particular attention should be paid to the more unified licensing,

general authorization and simpler notification enabling more competitive environment or license exemption function, making public standard offer (information relating to price, terms and conditions), interconnection agreements, measurement of quality service, infrastructure-sharing (network-sharing, site-sharing/co-location) for mobile operators, mandated and required, unbundled access, secondary spectrum trading and band migration, number portability, voice over Internet (VoIP) to individual users, national plan including broadband.

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