Net Neutrality and 5G in India: A Policy Delphi Survey

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Abstract

[Purpose] The debate over Net Neutrality (NN) that dominated discussion in the domain of Internet and telecommunications for over two decades, has largely been settled in favour of the principle of an open, non-discriminatory regime for all traffic travelling over networks. The rapid commercialisation of 5G mobile telecom technologies in telecom markets, however, draws regulatory attention once again, to aspects of NN regimes in apparent conflict with the requirements of the new technology. The emerging discussion has prompted reviews of NN policies in many countries.
[Methodology] This paper uses a policy Delphi to assess expert and stakeholder opinion on the likely impact of 5G of the NN regime in India and what, if any, modifications and alterations are required to enable proliferation of 5G services in the country.
[Findings] The paper arrives at a set of policy recommendations for management of the NN regime in India in the context of 5G technology, markets and services.

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[Practical Implications and Value] These recommendations would be of practical utility to regulators and administrators in other countries as 5G is adopted in their telecommunications sectors.

Keywords: Net Neutrality and 5G. Net Neutrality in India. Net Neutrality and Network Slicing. Net neutrality and Traffic Management. Net Neutrality and Pricing of Services.

INTRODUCTION

The Internet has completely transformed the world and society. It is the common platform that everyone can connect to, to provide or access information. Concurrently, there has been a paradigmatic shift in the business of telecommunications (hereinafter "telecom') from voice to data. Telecom technologies have immensely changed in the last 50 years (National Research Council, 2006).

Mobile wireless communications have evolved through several generations of technology. New 5G wireless technologies offer high capacity, ultra fast and low latency data transfer for data intensive applications and Internet of Things (IoT), supporting applications in healthcare, education, enery, transportation, agricuture and industry. At the same time, 5G supports a much larger number of devices than on the network than was possible in earlier technologies (Lee, 2019). 5G therefore has strong potential for poverty reduction and improvement in the quality of life for under-served populations across the world by bridging the digital divide and bringing reliable broadband within the reach of all (Cabanillas-Carbonell, Perez-Martinez, & Zapata-Paulini, 2023). What it implies is access to life-saving medical services and transport, empowerment through skill-building and employment opportunities and enhanced productivity. This is especially significant since wireless devices and smartphones are frequently the only access to Internet in many marginalised communities (Lee, 2019). In India, out of a total telephone subscription of 1185.73 million as on 30th November 2023, 1154.17 million were mobile wireless subscribers. Out of these, 858.82 million have access to broadband leaving a large uncovered populace (https://www.trai.gov.in/release-publication/reports/telecom-subscriptions-reports).

5G needs significant investment (Forge & Vu, 2020) (UN ECLAC, 2021) by network service providers. A supportive regulatory structure can greatly reduce the costs of 5G deployment. Oughton et al estimate that costs can be almost halved through appropriate regulatory and policy choices (Oughton, Comini, Foster, & Hall, 2022). It is in this context that we consider the regulatory and policy approaches towards NN and 5G proliferation in India.

Today, networks are built in layers, starting from the physical layer (the mechanical, electrical and optical facilities), to the data and transport layer (which transports, routes and manages data transfer between end-to-end connections), to the application layer (which provides specific functionalities and interfaces with the user). The term OTT (Over-The -Top) refers to applications and services (content) which are accessible over the Internet and ride on operators' networks offering Internet access services (Telecom Regulatory Authority of India, 2015). Since transport is separated from content in Internet networks, OTT content and application service providers can deal directly with end users. The network telecom service providers realize revenues solely from the increased data usage of the Internet-connected subscribers when they use the applications (apps). OTT providers make use of the network service providers' infrastructure to reach their customers and offer products/services that not only make money for them but also compete with the traditional services offered by telecom service providers. Further, the OTT applications have created an increasing demand for faster broadband speed, which translates into a need for investments in network up-gradation by the network service providers. Telecom service providers use various pricing and data-usage restrictions to meet the challenges posed by OTTs. This situation presents a complex regulatory dilemma. On the one hand, there are the arguments for a robust and open Internet, innovation in services at the edges of the network, better customer satisfaction and economic growth. Net Neutrality (herein after NN) is the regulatory principle that the telecom service providers must treat all Internet traffic on an equal basis, without regard to type, origin, or destination of the content or the means of its transmission (Telecom Regulatory Authority of India, 2017), so that content and application providers can reach their end users without the intermediation of the network provider. On the other hand, there are the arguments that strict NN will weaken incentives to invest in networks and stunt telecom growth. This is the crux of the NN debate. This debate has largely been settled in the past decade in favour of an open Internet in which everyone has equal access to information. Most telecom administrations have put in place NN rules that govern access to the Internet.

The NN debate has not remained static due to the ever-changing nature of telecom technology. 5G is bringing in capabilities that logically imply the flowering of tailored solutions for various use cases which will require differential treatment of different kinds of traffic flowing over the network (Agiwal, Roy, & Saxena, 2016), (Yoo & Lambert, 2019), (Kantola, 2019). Network slicing will permit a physical network to be separated into multiple virtual networks (logical segments). Rather than having network resources allocated to individual providers for extended lengths of time, network slicing allows network resources to be placed into new configurations on-the-fly in response to end users' immediate

needs. These slices can be created and priced on demand. Users can access networking resources on transactional basis as and when required (Andrews & etal, 2014) (Kantola, 2019). Network resources, scarcer in mobile than in fixed networks, will have to be more smart, flexible and scalable (Frias & Martinez, 2018). Innovative services will be provided in network layer rather than in the application layer (Taleb, Ksentini, & Jantti, 2016). NN will have to deal with the existence of new players, business models and market developments (Pujol, Elayoubi, Markendahl, & Salahaldin, 2016). Edge computing can use network function virtualization and allow special treatment for some applications or services. NN imposes challenges to introduction of edge computing since only one programme can run on the compute platform for all users and all services, whether or not they benefit from it (Kantola, 2019). Rigid NN will stand in the way of interdependent, complementary innovation by preventing emergence of marketplace that allows experimenting with new models, services and business/technical innovations (Bauer & Bohlin, 2018).

In response to the apparent contradictions of an NN regime and the requirements of new 5G services, some countries have undertaken a review of their NN policies. Japan has revised its NN regulations post 2019 so that Internet Service providers (ISPs) no longer have to comply with strict NN principles; instead NN violations are examined by the government on a case-by-case basis (Garrett, Setenareski, Peres, Bona, & Duarte Jr, 2022). The United States in 2018, repealed the FCC NN rules of 2015 classifying ISPs as Title II services. ISPs were restored to Title I non-common-carrier status and hence outside purview of FCC regulation (Bauer & Bohlin, 2018). A review of the NN framework by Ofcom in the UK has recently resulted in the issue of clarifications whereby ISPs are allowed to offer specialised services and zero-rating offers as well as resort to traffic management measures to manage their networks[1]. In 2020, BEREC, the EU regulator, opened a public consultation to inform a revised version of its NN guidelines published in 2016 (Stocker, Smaragdakis, & Lehr, 2020). South Korea has tailored its NN regime to bring in checks and balances between ISPs and content providers. In 2016, it implemented the Sending Party Network Pays (SPNP) Rule which provides that payments are based on volume of traffic delivered to the ISP, for which ISPs can charge fees from content providers (Analysys Mason, 2020). In 2020, the Telecommunications Business Act was amended to strengthen the SPNP regime (Garrett, Setenareski, Peres, Bona, & Duarte Jr, 2022) and permit network slicing and zero rating.

[1] Statement: Net Neutrality Review: <https://www.ofcom.org.uk/consultations-and-statements/category-1/net-neutrality-review#:~:text=The%20current%20net%20neutrality%20rules,how%20ISPs%20should%20follow%20them>.

India's NN policy regime for NN has taken shape in phases. In February 2016, the Telecom Regulatory Authority of India (TRAI) issued the Prohibition of Discriminatory Tariffs for Data Services Regulations, 2016 by which service providers were prohibited from offering or charging discriminatory tariffs for data services on the basis of content. (Parsheera, 2018). In 2018, based on recommendations made by the TRAI, rules for other aspects of NN such as blocking, throttling and preferential treatment of content were incorporated into telecom licences by the Government of India. The 2018 rules restrict access service providers from any sort of discrimination in Internet access based on content, protocols or user equipment including practices like blocking, degrading, slowing down or granting preferential speeds or treatment to any content. Specialised services, optimised for specific content, protocols or user equipment, and where optimisation is necessary to meet specific quality of service requirements, are exempt. However, such services cannot be offered as a replacement for Internet Access Service and their provision cannot be detrimental to the availability and overall quality of Internet Access Service. IoT, as a class of services, is not excluded from the scope of the restrictions (TRAI, 2017).

5G technology and services have made their appearance in the Indian telecom market. No studies could however be located on the potential contradictions and possibilities for reconciliation between India's current approach to NN and the special features of 5G technologies such as network slicing and network function virtualization, and the special requirements of emerging 5G markets for new services in a variety of industries and sectors with different requirements in terms of speed, capacity and latencies.

This paper seeks to address the research gap. Specifically, it tries to address the following research question:

What adjustments may be required in India's recently instituted NN policy, balancing the need to preserve non-discriminatory access to all kinds of data with the requirements of discriminatory pricing and quality of service for the new 5G services?

The analysis uses the methodology of a policy Delphi. It relies mainly on primary data sources i.e., opinions of expert stakeholders and practitioners in India. Supplementary documentary sources such as policy notifications, regulatory orders, consultations, surveys and recommendations of statutory authorities, academic journal articles and published books were also referred to.

The structure of the paper is as follows. Section 2 lays out the methodology and stages of the Delphi survey. Section 3 discusses survey findings. Section looks at regulatory and policy implications. Section 5 concludes.

RESEARCH METHODOLOGY: STAGES OF THE POLICY DELPHI SURVEY

Linstone and Turoff characterize a Delphi survey as "a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem" (Linstone & Turoff, 2002). The main purpose of the method is "to acquire the most reliable consensus of a group of experts' opinion by .... a series of intensive questionnaires combined with controlled opinion feedback" (Habibi, Sarafrazi, & Izadyar, 2014)[2]. The Delphi technique is based upon the premise that a collective opinion is likely to be much better informed than an individual viewpoint. It follows an iterative process to facilitate knowledge building.

A policy Delphi is a type of Delphi survey which concentrates less on trying to build a consensus of expert opinion around a technical topic, and more on generating a range of views on a policy issue and its potential resolutions, by consulting informed advocates and referees (Turoff, 2002). Although the goal is not consensus generation, participants are given the opportunity to view opinions of other participants and re-evaluate their own positions at different stages (Manley, 2013).

In this research, the participants are experts and stakeholders in India who are preparing for and implementing the technological transition to 5G. We assess their opinion on regulatory policy actions required for adapting the extant NN regime to meet 5G requirements. The policy Delphi is chosen as the research tool for the purpose, as it is well-suited to synthesize the views and insights of the sectoral experts. The number of rounds in which a Delphi survey must be conducted is not rigidly laid down. Zartha Sossa et al observed in their recent review of papers using the Delphi technique, that 25 of the 57 papers they analyzed corresponded to applications of two rounds or less (Zartha Sossa, Halal, & Zarta, 2019). Since the main objective is not to arrive at a consensus but rather to put together a comprehensive array of expert opinion on resolutions to policy issues (Turoff, 2002), the survey is conducted in 2 rounds.

We adopt a 6-stage Delphi method broadly based on a recent Delphi study in marine science (Cunha, Marques, Dias, Cotera, & Triantaphyllidis, 2022). The stages are as depicted in Figure 1 below:

[2] Quoting Dalkey and Helmer (1963)

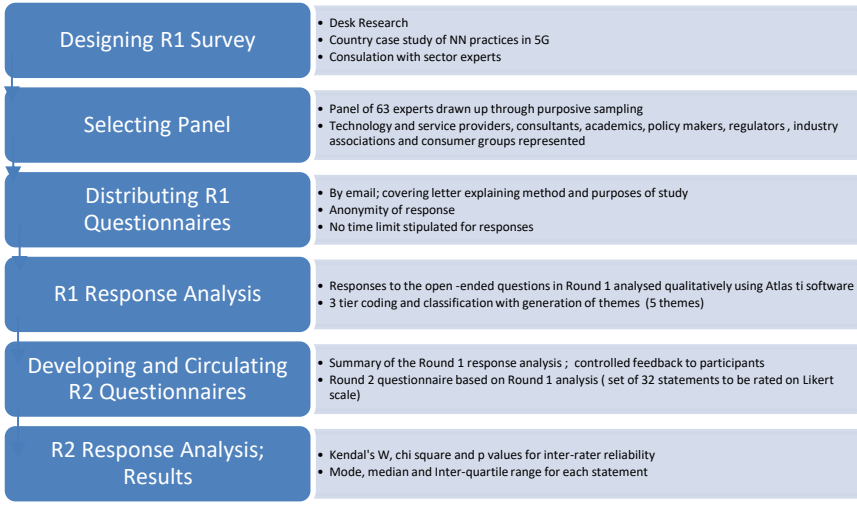

Figure 1 – Delphi Process Stages

Stage 1: Designing the Round 1 (R1) Questionnaires

Based on desk research to understand current thinking on compatibility of NN regimes and 5G, and to study the approaches taken by other telecom administrations in the management of their NN regimes in a 5G environment, a preliminary questionnaire was drawn up and circulated to sector experts. Based on their feedback, the R1 questionnaire was finalised. It had 6 questions covering the appropriateness of the extant NN framework in India for 5G services, traffic management and pricing. The questions were open-ended and called for descriptive answers.

Stages 2&3: Selecting the Panel*;* Distributing the R1 Questionnaires

The participants in a policy Delphi must be stakeholders in the domain, affected by the policy in different ways, understand the subject matter and be able to answer the questions in a detailed and reasoned manner (Manley, 2013). We used non-probability purposive sampling to recruit participants who met the inclusion criteria (Vogel, Zwolinsky, Griffiths , & et al, 2019). For heterogeneity (Yaniv, 2011), diversity and range in panel participants, representatives from amongst policy makers and regulators, telecom service providers and hardware manufacturers, service provider associations, app developers and providers, sector consultants and advisers, research organisations, academicians, and telecom consumer organisations in India were included. Professional networks and databases were used to identify participants; selection criteria included writings

and publications, technical specialization, professional positions held, and interest in the research area.

The number of participants in a Delphi study is not laid down and panels could range from 10 members only to 100 members (Avella, 2016). The number would depend on study scope, how much heterogeneity is sought, and availability of experts (Loo, 2002); as also their willingness to participate (Cunha, Marques, Dias, Cotera, & Triantaphyllidis, 2022). The panel that was drawn up for this study consisted of 63 members.

The R1 questionnaire was e-mailed to the panel participants with a cover letter explained the objectives and methods of the study. The panellists were assured of anonymity of their responses. Instead of specifying a time limit for completing the questionnaire, the progress in answering the questions was regularly followed up with each participant over the next few months. Since the questions required long and detailed answers, some of the panellists were not able to progress much and ultimately dropped out of the survey. Finally, the R1 response rate in respect of completed questionnaires was 30 % (19 out of 63 panellists gave their inputs). In view of the specialised and niche nature of the research domain, we decided to proceed with the responses from the 19 responses panellists.

Stages 4&5: R1 Response Analysis; Developing and Circulating Round 2 (R2) Questionnaires

Qualitative analysis of the R1 questionnaire responses was carried out using Atlas ti software. The objective was to identify action and decision areas and overarching themes. 3 tier coding was done with initial codes at the first level, grouping of the initial codes into code categories at the second level and identification and definition of themes at the third level. The outputs of the qualitative data analysis are presented in Table 1:

Questionnaire	No of Initial Codes	No of Code Categories	No and Description of Themes
NN Policies in 5G in India	**60**	**6**	**5**
			Current NN Framework and 5G
			5G Network Slicing and NN
			5G Traffic Management and NN
			5G Pricing and Prohibition of Discriminatory Tariffs for Data Services Regulation 2016
			Other Suggestions for NN Policy Administration in 5G

Table 1 – Outputs of R1 Qualitative Data Analysis

For insights into commonalities and divergences in the views of the participants, frequency analysis of the codes was carried out. The R2 questionnaires were created based on this analysis. The R2 questionnaire was prefaced with a summary of the R1 results, as feedback for the participants. In R2, a set of 32 statements grouped under 5 themes, all emanating from the R1 analysis, had to be rated by the participants on a 5-point Likert scale. Participants had to indicate the extent of their agreement or disagreement with the various statements. Their options were to strongly disagree, disagree, neither agree nor disagree, agree or strongly agree with each statement. The R2 questionnaire had 32 statements under 5 themes. Responses from 19 participants were received.

R2 RESPONSE ANALYSIS AND SURVEY FINDINGS

There was a two stage analysis of the R2 responses.

First, inter-rater reliability (IRR) for the 19 participants in R2 was assessed under each theme, using Kendall's coefficient of concordance "W." We tested the null hypothesis that agreement between the raters was due to chance, as against the alternative hypothesis that agreement between the raters was not due to chance, using the p values of Kendall's W. The p-value gives the evidence against the null hypothesis; lower p-values mean stronger evidence against the null hypothesis. At level of significance p= <0.05, the theme -wise results in Table 2 show that while absolute values of Kendall's "W" are low to moderate, all p values are below 0.05. Thus, the results are statistically significant for all the themes, leading to the conclusion that the agreement between the raters for all 5 themes is not due to chance.

	Theme	**Kendall's W**	**P Value**
R2 Questionnaire on NN	Current NN framework and 5G	.277	*->0.00*
	5G network slicing and NN	.300	*->0.00*
	5G traffic management and NN	.475	*->0.00*
	5G pricing and Prohibition of Discriminatory Tariffs for Data Services Regulation 2016	.164	*->0.00*
	Other suggestions for NN policy admn. in 5G	.184	*->0.00*

Table 2 – Outputs for IRR Calculations R2: Kendall's 'W' with p Values (19 Raters)

Second, responses for each statement under the 5 themes were analysed using descriptive statistics i.e., frequency and measures of dispersion. The outputs are summarised in Table 3.

#	Theme	Gist of Statement	Agree[3]	Disagree	Neutral	IQR[4]
1	Current NN framework and 5G	No need for overhaul of current NN rules in India	13/19	5/19	1/19	3
		Current rules flexible; allow carve outs and exceptions; no contradictions with 5G	12/19	7/19	0/19	3
		Current NN framework is inadequate	8/19	8/19	3/19	2
		Requirements of no discrimination in content, protocols and user equipment will impede 5G; specialised services provision not sufficient	8/19	9/19	2/19	2
		NN is primary democratic principle for ensuring competition in downstream Internet markets	17/19	1/19	1/19	1
		NN rules are technology agnostic	13/19	3/19	3/19	2
		NN may not be possible in the 5G era	2/19	16/19	1/19	0
		Variety of supply in 5G makes NN unnecessary	4/19	14/19	1/19	1
		NN is about access in B2C services; not applicable for 5G B2B services	6/19	8/19	5/19	2
2	5G network slicing and NN	Slicing not a violation of NN; each slice a separate service	14/19	1/19	4/19	1

[3] For ease of presentation, gradings of "Strongly Agree" (Likert Rating 5) and "agree" (Likert Rating 4) are termed agreement; gradings of "Strongly Disagree" (Likert Rating 1) and "Disagree" (Likert Rating 2) are termed disagreement.

[4] Inter Quartile Range (IQR) calculated based on 5-point grading, not on clubbed gradings of "Agree" and "Disagree". With likert scale ranging from 1 to 5, IQR of 1 or < 1 for a statement taken to indicate convergence of opinion.

		Slicing is used for B2B services; NN does not apply	10/19	3/19	6/19	1
		Slicing does violate NN	5/19	9/19	5/19	1
3	5G traffic mgt. and NN	For different grades of service, 5G will require traffic management and priority traffic routing	18/19	0/19	1/19	1
		5G traffic management possible within existing rules thro' reasonable exemptions, recognizing service grades and interpreting what is reasonable and transparent traffic mgt.	16/19	2/19	1/19	1
		Regulator should build up repository of Traffic Mgt. Practices (TMPs), and monitor regularly	12/19	3/19	4/19	1
		Difficult to prescribe traffic mgt. framework for 5G	5/19	11/19	3/19	2
4	5G pricing and Prohibition of Disc. Tariffs for Data Services Regulation 2016	NN could come in the way of setting differential prices for 5G services	4/19	11/19	4/19	1
		Differential pricing possible under current NN rules	13/19	5/19	1/19	2
		Price differentiation should not be allowed for the same service	10/19	8/19	1/19	2
		Prohibition of Discriminatory Tariffs for Data Services Regulation 2016 (PDT) can	6/19	6/19	7/19	2

		continue in its present form				
		PDT needs incremental modification	11/19	2/19	6/19	1
		PDT was meant for different type of network; should be reviewed	11/19	5/19	3/19	2
		Definitions in PDT should be brought into alignment with NN clauses of telecom licence	12/19	1/19	6/19	1
		PDT should be repealed	3/19	10/19	6/19	1
5	Other suggestions for NN policy admn. in 5G	Reasonable and harmonious interpretation of NN rules will suffice	13/19	3/19	3/19	1
		Carve-outs in NN rules should be allowed but only on a case-to-case basis	11/19	8/19	0/19	2
		More clarity needed on definition of special services	14/19	2/19	3/19	1
		Pro-active monitoring and enforcement of NN rules by regulator required	13/19	4/19	2/19	1
		Incremental adjustments to NN rules may lead to anomalies	9/19	4/19	6/19	1
		Technological changes must be factored into new NN framework	15/19	2/19	2/19	1
		Adaptations of NN network can only be considered at later stage	6/19	7/16	6/19	2
		International experience must be consulted for changing NN regulations	16/19	1/19	2/19	1

Table 3 – Outputs for Frequency and Dispersion Analysis of R2 Responses

IMPLICATIONS FOR POLICY AND PRACTICE

- There is agreement that NN as a primary principle for ensuring competition in Internet markets must continue under 5G. The advent of 5G does not obviate the need for an NN regime. However, at this point, there is no convergence in the views of the experts as to inadequacies, if any, in the current framework (with its requirements of no discrimination in content, protocols and user equipment) in dealing with the new services in 5G. A majority were of the view that an overhaul in the existing NN framework may not be necessary as no contradictions would arise. Whether the existing rules are flexible enough to permit carve-outs and exceptions and whether the extant specialised services provision will be sufficient to cover 5G requirements remains to be seen. On the perspective that NN is about access in B2C services and is not applicable for the new B2B services of 5G, experts are unable to agree.

- While network slicing, prima facie, would appear to be in contradiction to NN, expert opinion converges around the view that slicing may not be a violation of NN if each network slice is viewed as a separate service. On the view that slicing may not be seen as a violation of NN as it is used mainly for B2B services, there is apparent convergence; but this is misleading, as several experts have not expressed any view in the matter.

- There is strong agreement and convergence of views that 5G will require traffic management and some 5G services will require priority traffic routing. Experts agree that this can be done in the present NN framework with a few adjustments in the existing rules including reasonable exemptions, recognition of services of different grades and interpretation of reasonable and transparent traffic management. The regulator should build up a repository of Traffic Management Practices (TMPs), and monitor them regularly to ward against discriminatory practices against contents and applications in the guise of traffic management. The majority of experts did not agree that it is difficult to prescribe a traffic management framework for the new technology and that the regulator had better concentrate on security rather than traffic management.

- Expert opinion converges in the view that NN will not come in the way of setting 5G prices. Also, most experts agree (though views do not converge) that differential pricing is possible under the extant rules. Pricing in India is not covered under the NN clauses of the licence; it is

governed through the Prohibition of Discriminatory Tariffs for Data Services Regulation 2016. Most experts opine, and there is a convergence of views, that the Prohibition of Discriminatory Tariffs for Data Services Regulation 2016 needs incremental modifications. Since the definitions in the Regulation predate the definitions and concepts of NN that have been incorporated into the telecom licences, the definitions in the Regulation should be brought into alignment with the licence.

- Some other suggestions that were strongly supported and on which opinions converged were: (i) A reasonable and harmonious interpretation of the existing rules will meet present need. (ii)There should greater clarity on definition of special services. (iii) Pro-active monitoring and enforcement by the regulator are required. (iv) In the longer run, the new technological changes will need to be incorporated into the NN framework. (v) International experience must be consulted for arriving at changes in the NN regulation.

CONCLUSION

From the policy Delphi exercise, it is evident that expert opinion is not in favour of any drastic overhaul of the NN rules in India. The existing regime has sufficient in-built flexibility to deal with the challenges posed by slicing, traffic management and differential pricing that are characteristic of 5G. There is a need however, to state more clearly the scope of specialised services under the NN rules, as also to bring the definitions in the Prohibition of Discriminatory Tariffs for Data Services Regulation 2016, in line with the those incorporated in the telecom licences. A pro-active role for the regulator is also envisaged, both in oversight of implementation of the NN rules, as well as in evolution of the NN policy to suit technological advancements and in keeping with international practices.

DECLARATION OF CONFLICTING INTERESTS

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