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TRAI & THE REGULATORY ARCHITECTURE

B&J | BHATT & JOSHI ASSOCIATES

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TABLE OF CONTENTS

CHAPTER 1

The TRAI Act, 1997: Constitution and Powers of TRAI

1.1 Legislative History and Objectives

The Telecom Regulatory Authority of India Act, 1997 (Act 24 of 1997) was enacted to establish an independent regulatory body for the telecommunications sector in India. The legislative history of the TRAI Act reflects the broader process of economic liberalisation that characterised Indian policy in the 1990s: as the government opened the telecom sector to private investment through the National Telecom Policy, 1994, it became apparent that a government department (the Department of Telecommunications) could not credibly regulate a sector in which it simultaneously served as the policymaker, the licensor, and the principal operator through its government-owned entities. The establishment of TRAI was intended to provide the institutional separation between regulation and operation that competitive markets require.

The parliamentary debates on the TRAI Bill in 1997 reveal several key legislative objectives. First, the creation of an independent, expert regulatory body that could make technically informed and commercially neutral regulatory decisions, insulated from political influence. Second, the provision of a transparent and predictable regulatory environment that would attract private investment — domestic and foreign — in the telecommunications sector. Third, the protection of consumer interests through the regulation of tariffs, quality of service, and interconnection. Fourth, the promotion of competition in the telecommunications sector, recognising that the benefits of liberalisation would only be realised if competitive market conditions were maintained. Fifth, the facilitation of orderly growth of the sector in a manner consistent with India's development objectives, particularly the objective of extending telecommunications connectivity to rural and underserved areas.

The original TRAI Act, 1997 vested TRAI with both regulatory functions (setting tariffs, issuing quality of service standards, making regulations) and adjudicatory functions (adjudicating disputes between operators and between operators and users). This dual role proved controversial: TRAI's combination of the functions of regulator, policy adviser, and adjudicator created structural conflicts of interest and led to challenges before courts alleging bias. The TRAI (Amendment) Act, 2000 resolved this controversy by separating the adjudicatory and appellate functions from TRAI's regulatory functions, vesting the former in the newly constituted TDSAT.

1.2 Constitution and Composition of TRAI

Section 3 of the TRAI Act, 1997 provides for the establishment of TRAI as a body corporate with perpetual succession, a common seal, the power to acquire and dispose of property, and the power to contract. The corporatisation of TRAI as a statutory body corporate — rather than a government department — is significant: it provides TRAI with a degree of institutional autonomy (managing its own budget, engaging its own staff, and exercising its regulatory powers in its own name) that a department of government would not have. At the same time, TRAI is a creation of statute and exercises statutory powers; it has no inherent regulatory authority beyond what the TRAI Act (and other statutes that confer functions on it) provides.

Section 4 of the TRAI Act provides for the composition of TRAI: a Chairperson, and not more than six other Members (comprising two whole-time Members and two part-time Members under the original provision, and subsequently varied by amendment). The Chairperson is required to be a person who is or has been a Judge of the Supreme Court or the Chief Justice of a High Court, or who has held the post of Secretary to the Central Government or above, or who is a person of ability, integrity, and standing with special knowledge of, and at least thirty years' professional experience in, telecommunication, industry, commerce, finance, accountancy, law, management, or consumer affairs. The qualification requirements for Members are broadly similar, though the specific experience requirement of thirty years may be relaxed in certain categories.

TRAI's Chairperson and Members are appointed by the Central Government. The Chairperson's term of office is five years from the date of assumption of office or until attaining the age of sixty-five years, whichever is earlier. Members' terms are similarly five years or age sixty-five. The Central Government has the power to remove the Chairperson or any Member on grounds of misbehaviour, incapacity, or conflict of interest, subject to an inquiry by a designated authority. The job security of the Chairperson and Members — and the constitutional architecture designed to protect their independence from executive pressure — is an important guarantor of TRAI's institutional independence.

1.3 Functions and Powers of TRAI under Section 11

Section 11 of the TRAI Act, 1997 is the central provision specifying TRAI's functions. It prescribes both recommendatory functions (advisory functions that TRAI exercises by making recommendations to the Central Government) and regulatory functions (functions that TRAI exercises through binding regulations, orders, and directions). The recommendatory functions include: making recommendations on the need and timing of introduction of new service providers; recommending terms and conditions of licence to service providers; recommending revocation of licence for non-compliance with its terms; and recommending measures to facilitate

competition and promote efficiency in the operation of telecommunication services.

The regulatory functions of TRAI under Section 11(1)(b) include: ensuring compliance of terms and conditions of licences; ensuring technical compatibility and effective interconnection between service providers; regulating arrangement amongst service providers of sharing their revenue derived from providing telecommunication services; laying down the standards of quality of service to be provided by the service providers and ensuring the quality of service; inspecting the equipment used in the network and taking necessary measures to ensure the network security; facilitating competition and promoting efficiency in the operation of telecommunication services; and protecting the interest of the consumers of telecommunication services.

Section 11(2) confers on TRAI the power to make tariff orders — orders fixing, determining, prescribing, or proposing tariffs for telecommunication services. This is one of TRAI's most powerful and most commercially significant functions. Tariff orders under Section 11(2) are binding on service providers and may prescribe both retail tariffs (for services to end-users) and wholesale tariffs (for services provided between operators, particularly interconnection charges). TRAI's exercise of its tariff power has been extensively litigated before TDSAT and the Supreme Court, generating a substantial body of jurisprudence on the scope and limits of TRAI's tariff-setting authority.

1.4 TRAI's Power to Make Regulations

Section 36 of the TRAI Act, 1997 confers on TRAI the power to make regulations for carrying out the purposes of the Act. TRAI's regulations are secondary legislation — they have the force of law but are subordinate to the TRAI Act itself. Regulations made by TRAI are required to be published in the Official Gazette and to be laid before both Houses of Parliament, which may modify or annul them. In practice, TRAI regulations cover a wide range of subjects including: interconnection charges (Interconnection Usage Charges regulations); quality of service standards (QoS regulations for various service categories); consumer protection (Consumer Protection and Redressal of Grievances regulations); telecom tariff orders; net neutrality (Non-Discriminatory Access to Internet regulations); and data privacy and consent (Privacy and Consent Regulations).

The relationship between TRAI's regulations and the conditions of telecom licences (and, under the 2023 Act, authorisations) is an important interpretive question. Where a licence condition and a TRAI regulation address the same matter and are inconsistent, which prevails? The general principle is that TRAI's regulations, as binding statutory instruments, prevail over licence conditions to the extent of any inconsistency — provided that TRAI was acting within the

scope of its regulatory jurisdiction when making the regulation. This principle was affirmed in Cellular Operators Association of India v. TRAI, (2016) 7 SCC 703, subject to the important qualification that TRAI regulations cannot override the statutory framework within which both TRAI and licences operate.

1.5 Section 11(4): The Role of DoT Directions

Section 11(4) of the TRAI Act, 1997 provides that where the Central Government is of the opinion that in the public interest it is necessary or expedient to do so, it may issue directions in writing on questions of policy to TRAI. TRAI is required to give effect to such directions. This provision — which makes TRAI subject to policy directions from the Central Government — is the most significant qualification on TRAI's practical independence. A regulatory body that can be directed by the government is not truly independent in the fullest sense. The scope of the policy direction power under Section 11(4) — what constitutes a "question of policy" as distinct from a regulatory matter — has been the subject of legal controversy, with TRAI and the government taking different views on the boundary between policy and regulation.

In practice, the Central Government has used Section 11(4) directions sparingly, typically in the context of significant national policy initiatives (such as directing TRAI to consider the implications of a policy change for regulatory frameworks, or directing TRAI to prioritise a particular regulatory initiative). The existence of the direction power, however, creates an institutional dynamic in which TRAI must remain sensitive to the government's policy preferences even in the absence of a specific direction — a dynamic that can shade the independence of regulatory decision-making in subtle ways that are difficult to challenge or document.

CHAPTER 2

TRAI's Regulatory Instruments: Regulations, Orders, and Directions

2.1 Taxonomy of TRAI's Instruments

TRAI exercises its regulatory functions through a range of distinct legal instruments, each with different legal character and different legal consequences. Understanding the taxonomy of TRAI's instruments is essential for practitioners working in the sector. The principal categories of TRAI's instruments are: Regulations (made under Section 36 of the TRAI Act, having the general force of law and applicable to the sector as a whole); Tariff Orders (made under Section 11(2), prescribing or fixing tariffs for specific services or categories of services); Directions (issued under Section 13 or other specific provisions, requiring specific actions by service providers); Recommendations (non-binding recommendations to the Central Government on licensing, spectrum, and other policy matters); and Consultation Papers (discussion documents through which TRAI seeks stakeholder input on regulatory questions under consideration, not legally binding but important as indicators of regulatory intent).

The legal status of different TRAI instruments determines the forum and grounds on which they may be challenged. TRAI's Regulations and Tariff Orders, as statutory instruments, may be challenged before TDSAT under the appellate jurisdiction of Section 14A of the TRAI Act (where the challenge is to the specific application of the regulation or order to a particular operator) or before the High Court or Supreme Court on constitutional grounds (where the challenge is to the vires or constitutional validity of the regulation or order). TRAI's Directions are similarly subject to TDSAT appeal. TRAI's Recommendations are not directly challengeable before TDSAT since they are advisory rather than binding; they may, however, be subject to judicial review if they are procedurally defective or if the process by which they were made violated applicable legal standards.

2.2 TRAI's Consultation Process

TRAI follows a structured multi-stage consultation process before making significant regulatory decisions — a process designed to ensure that regulatory outcomes are informed by the broadest possible range of stakeholder perspectives and are based on accurate information about the sector. The standard TRAI consultation process involves: the issuance of a Consultation Paper setting out the regulatory questions under consideration and TRAI's

preliminary views; a period for written submissions from stakeholders (typically 30-45 days); one or more Open House Discussions at which stakeholders can present their views orally; a period for counter-comments on written submissions; TRAI's analysis of all submissions and development of regulatory conclusions; and the issuance of recommendations, regulations, or other regulatory instruments reflecting the conclusions.

The quality and depth of TRAI's consultation process has been a subject of ongoing debate in the industry. Incumbent operators, with larger regulatory teams and greater resources, are generally able to participate more effectively in TRAI's consultations than smaller operators, consumer organisations, or civil society groups. TRAI has taken various steps to enhance the accessibility of its consultation process, including: making consultation papers available on its website; accepting electronic submissions; holding open house discussions in multiple cities (not only New Delhi); and commissioning independent research to supplement stakeholder submissions on complex technical and economic questions.

The relationship between TRAI's consultation process and the natural justice requirements of administrative law is an important legal question. The Supreme Court has held that TRAI is required to observe principles of natural justice in making regulatory decisions that affect specific operators' rights, particularly when making decisions that directly penalise or disadvantage identified operators. However, the Court has also held that TRAI's general regulatory process — making regulations applicable across the sector — is more akin to quasi-legislative action than quasi-judicial action, and therefore requires a lower degree of individual procedural protection. The consultation process provides a degree of procedural fairness to all stakeholders, but does not give any individual stakeholder the right to a hearing before TRAI that would be required in a quasi-judicial proceeding.

2.3 Tariff Orders: Legal Character and Scope

TRAI's Tariff Orders are among its most powerful regulatory instruments. Section 11(2) of the TRAI Act, 1997 confers a broad power to fix, determine, prescribe, or propose tariffs for telecommunication services, having regard to certain specified considerations including: the financial position of service providers; the standards of quality of service to be maintained; the need to ensure the availability of such services to the public at large; and the interests of consumers in general. The breadth of these considerations gives TRAI considerable regulatory discretion in setting tariffs, subject to judicial review on grounds of unreasonableness or failure to take into account relevant considerations.

TRAI has exercised its tariff powers in a range of significant ways. The introduction of tariff forbearance — removing price controls and allowing market forces to determine retail tariffs for services where competition is effective — has been one of the most important applications of TRAI's tariff power. TRAI has granted tariff forbearance for most categories of mobile services and internet services, while retaining tariff regulation for services where competition is less effective (such as rural wireline services). The framework for determining when tariff forbearance is appropriate, and when regulatory intervention is needed, has been developed through TRAI's successive tariff orders and is a sophisticated exercise in competition-oriented regulation.

The interconnection usage charge (IUC) tariff determinations have been among TRAI's most commercially significant tariff decisions. IUC is the charge that a terminating network operator levies on the originating operator for completing a call on its network. TRAI's 2017 decision to reduce the mobile termination rate (IUC) from Rs. 0.14 per minute to Rs. 0.06 per minute, and to eventually move to a bill-and-keep (zero IUC) regime, was challenged by incumbent operators before TDSAT. The challenge raised fundamental questions about the methodology and economic basis for TRAI's IUC determination, and illustrated the commercially sensitive nature of TRAI's tariff-setting function.

2.4 Directions under Section 13

Section 13 of the TRAI Act, 1997 empowers TRAI to issue directions from time to time to any service provider or any officer thereof as it may consider necessary. Directions under Section 13 are binding on the recipients and non-compliance may attract regulatory and legal consequences. TRAI has used the direction power extensively: directions on quality of service compliance; directions on subscriber verification; directions on the provision of call detail records for billing disputes; directions on the implementation of TRAI's do-not-disturb (DND) registry for unsolicited commercial communications; and directions on network security compliance. The direction power is a flexible and powerful tool for regulatory enforcement, enabling TRAI to require specific remedial action from specific operators without going through the full regulation-making process.

The legal character of Section 13 directions — whether they constitute quasi-judicial orders (requiring the full panoply of natural justice protections, including notice and hearing) or quasi-legislative instruments (requiring only the consultation process prescribed for regulations) — has been addressed in TRAI's regulations and in TDSAT jurisprudence. The generally accepted position is that directions addressed to individual operators on specific compliance matters are quasi-judicial in character and require appropriate procedural fairness, while general directions applicable to all operators are more quasi-legislative and can be issued with the lighter

procedural requirements appropriate for regulatory instruments.

2.5 Recommendations to the Central Government

TRAI's recommendatory function — its power to make recommendations to the Central Government on licensing, spectrum, and other policy matters — is arguably its most strategically important function even though recommendations are not legally binding on the government. The government's decision to accept, reject, or modify TRAI's recommendations shapes the licensing and spectrum framework within which operators invest and compete. TRAI's recommendations carry substantial informational and persuasive weight: they represent the considered view of an expert, independent body with full access to industry data and the ability to commission independent research. The government generally accepts TRAI's recommendations in substance, though it may modify them on policy grounds.

The process by which TRAI makes recommendations is the same consultation-based process used for its binding regulations: Consultation Paper, written submissions, Open House Discussions, and analysis. The quality of TRAI's recommendations — their analytical rigour, their balanced consideration of competing interests, and their practical implementability — varies across subjects and over time. Recommendations on spectrum pricing have sometimes been criticised by operators as insufficiently grounded in demand-side analysis; recommendations on OTT regulation have sometimes been criticised by civil society organisations as tilted towards incumbent operator interests. TRAI's ability to maintain analytical credibility across a wide range of complex and contested regulatory questions is central to its effectiveness as an independent regulator.

CHAPTER 3

Tariff Regulation: Framework and Key Decisions

3.1 Regulatory Framework for Tariffs

India's tariff regulatory framework has evolved through several distinct phases. In the pre-liberalisation era, tariffs were set by the government for the state-owned monopoly. After liberalisation, TRAI was given the power to set tariffs to protect consumers and prevent anti-competitive pricing. As competition intensified, TRAI progressively extended tariff forbearance — removing price controls — for services where competition was effective, retaining regulation only for non-competitive services. The current framework is characterised by extensive forbearance for retail mobile and internet services (where competition among three major operators provides effective consumer protection) and residual regulation for specific services and situations where competition is inadequate.

TRAI's Telecommunications Tariff Order (TTO), issued and amended multiple times, is the foundational regulatory instrument governing tariffs in the Indian telecom sector. The TTO framework distinguishes between: (i) tariff ceilings (maximum prices above which operators may not charge, protecting consumers from exploitation of market power); (ii) tariff floors (minimum prices below which operators may not charge, preventing predatory pricing that would drive out competitors); and (iii) tariff forbearance (no regulatory constraints, with market forces determining prices). The TTO framework has progressively moved most services from the first category to the third as market competition has intensified.

The legal basis for TRAI's power to impose tariff floors — to prevent below-cost pricing — has been a subject of regulatory and legal debate. The concern is that imposing a floor might itself restrict competition (by preventing genuinely competitive pricing) while the justification (preventing predatory pricing) requires showing that the pricing below cost has an anticompetitive purpose. In practice, TRAI has been cautious about imposing tariff floors, recognising that very low prices are generally in consumers' interests and that the predatory pricing concern is better addressed through the Competition Act, 2002 framework administered by the CCI.

3.2 The Reliance Jio Disruption and Tariff Regulation

The entry of Reliance Jio Infocomm Limited into the Indian telecom market in September 2016 was one of the most dramatic market disruptions in the history of any telecommunications

sector globally. Jio launched with an offer of free voice calls and free data for the first several months of operations, acquiring over 100 million subscribers within six months and fundamentally reshaping the competitive and tariff landscape of Indian telecom. The incumbent operators — Bharti Airtel, Vodafone India, and Idea Cellular — faced severe revenue and subscriber pressure and complained to both TRAI and the Competition Commission of India (CCI) that Jio's pricing was predatory and should be prohibited.

TRAI's response to the Jio disruption was to decline to intervene through tariff regulation, on the grounds that Jio's pricing — while very low — was a legitimate competitive strategy for a new entrant seeking to build market share, and that consumers were benefiting from dramatically lower prices and significantly better data services. TRAI's restraint in the face of incumbent pressure to impose tariff floors was consistent with its competition-oriented approach to tariff regulation: the regulator should not protect incumbents from effective competition, even if that competition disrupts existing revenue models. The CCI similarly declined to find Jio's pricing predatory, holding that at the relevant time, Jio did not hold a dominant position in the relevant market and therefore could not abuse a dominant position.

The long-term consequences of the Jio disruption for India's telecom market have been significant. Consolidation has reduced the number of major private operators from six or seven to three (Reliance Jio, Bharti Airtel, and Vi — the merged entity of Vodafone India and Idea Cellular). Average revenue per user (ARPU) declined sharply in the period 2016-2018 before stabilising and then recovering as operators implemented price increases. India's internet data prices are now among the lowest in the world, enabling a dramatic expansion of internet access and digital services adoption. TRAI's role during this period — of allowing market forces to work while monitoring for anticompetitive conduct — reflects the regulatory philosophy appropriate for a competitive market.

3.3 Roaming Tariff Regulation

Domestic roaming charges — the tariffs charged when a subscriber uses their mobile service outside their home network area — have been a subject of sustained regulatory attention by TRAI. In a country as large and geographically diverse as India, where subscribers regularly travel across different service areas, the cost of roaming has significant implications for consumer welfare and for the commercial viability of having circle-based licensing. TRAI's Roaming Tariff Orders have progressively reduced and ultimately eliminated the price differential between home area calls and roaming calls, effectively creating a national tariff environment in which subscribers pay the same rate regardless of where they are in India.

The elimination of domestic roaming charges in India — achieved through a combination of tariff forbearance (allowing operators to offer unified national tariffs voluntarily) and regulatory intervention (requiring operators to offer free incoming calls while roaming, as TRAI had directed in earlier orders) — has been a significant consumer benefit. It has also had important commercial implications, reducing the effectiveness of the circle-based licensing structure as a barrier to national competition and incentivising operators to build national rather than circle-specific customer bases.

3.4 International Roaming and ILD Tariffs

TRAI's regulation of international roaming tariffs and international long-distance (ILD) call rates has been driven by concerns about consumer protection and affordability. International mobile roaming charges — the rates charged when Indian subscribers use their mobile devices abroad — have historically been extremely high, generating significant consumer complaints and acting as a barrier to affordable international business communication. TRAI's successive International Mobile Roaming Tariff Orders have required operators to offer standardised roaming packages, to inform customers of roaming rates before they roam, and to implement usage caps and alerts to prevent bill shock.

ILD call rates — the tariffs charged for calls from India to foreign numbers — have been progressively liberalised over time, with TRAI extending tariff forbearance as the market for ILD services has become competitive (with multiple licensed ILD operators competing for business and consumer traffic). The legacy of VSNL's monopoly on international telephony (which lasted until 2002) created a framework of high tariffs that took several years of competition and regulatory pressure to erode. The near-elimination of ILD rate disparities relative to domestic rates in recent years reflects the success of the competitive market in driving down costs to consumers.

CHAPTER 4

Interconnection Regulation

4.1 The Importance of Interconnection

Interconnection — the physical and logical linking of different operators' networks to enable end-to-end communication between subscribers of different networks — is the foundational precondition for a functioning, competitive telecommunications market. Without effective interconnection, the subscriber base of each network would be isolated from the subscribers of all other networks, creating network effects that strongly favour the largest incumbent operator and undermining the viability of competitive entry. The regulation of interconnection is therefore among the most important functions of any telecommunications regulatory authority, and TRAI's interconnection regulatory framework has been central to the development of India's competitive telecom market.

The legal framework for interconnection in India is established by TRAI's Telecommunication Interconnection Regulations, which have been issued and revised multiple times since TRAI's establishment. The current principal regulations are the Telecommunication Interconnection Regulations, 2018. These regulations establish: the right of authorised entities to obtain interconnection from other authorised entities; the obligation of dominant network operators to provide interconnection on fair and non-discriminatory terms; the framework for negotiating interconnection agreements; the charges applicable for different categories of interconnection (local, national, international termination); and the procedures for resolving interconnection disputes.

4.2 Interconnection Usage Charges (IUC)

Interconnection Usage Charges (IUC) — the per-minute charges levied by a terminating operator on the originating operator for completing calls on the terminating network — are regulated by TRAI through its IUC determinations. The appropriate level of IUC has been the most commercially sensitive and most litigated aspect of Indian interconnection regulation. IUC is economically significant because it represents a transfer payment between operators: an operator with a net terminating position (more calls terminated on its network than originated from it) benefits from higher IUC, while an operator with a net originating position (more calls originating than terminating) benefits from lower IUC.

India's IUC framework has gone through several major transitions. The initial high IUC regime (Rs. 0.30+ per minute), designed to ensure recovery of termination costs when mobile penetration was low and cost per subscriber was high, was progressively reduced as the mobile market grew and unit costs fell. TRAI's 2017 Interconnection Regulations reduced the IUC to Rs. 0.06 per minute, down from Rs. 0.14 per minute. TRAI simultaneously announced its intention to move to a bill-and-keep (zero IUC) regime — under which originating and terminating operators exchange traffic without payment — once the market had reached a state of approximate traffic balance. The 2017 reduction was challenged by incumbent operators (who were net receivers of IUC payments) before TDSAT, and the implementation of bill-and-keep was subsequently deferred pending market assessment.

The economics of IUC regulation reflect a fundamental policy tension. In a competitive market with symmetric traffic flows, the economically efficient outcome is bill-and-keep — eliminating transaction costs and simplifying the interconnection relationship. In a market with asymmetric traffic flows (as existed in India when Jio entered with massive origination volumes but limited termination), a positive IUC creates a material financial transfer from the originating operator (Jio) to the terminating operators (incumbents) that partially compensates for the incumbents' revenue losses from competitive tariff pressure. The question of whether the IUC framework should be used as an instrument to manage the competitive transition — or whether it should be set purely on cost-of-termination grounds regardless of competitive dynamics — was at the heart of the industry debate around TRAI's 2017 IUC decisions.

4.3 Points of Interconnection and Quality Obligations

Points of Interconnection (POI) are the physical locations at which traffic is exchanged between interconnecting operators' networks. The adequacy of POI provisioning — the number, geographic distribution, and capacity of interconnection points — is essential for ensuring that calls can be completed reliably between networks. POI congestion (insufficient capacity at interconnection points) results in call failure rates that degrade service quality and consumer experience. The obligation to provision adequate POI in response to requests from interconnecting operators is a fundamental interconnection obligation under TRAI's regulations.

The POI dispute between Reliance Jio and the incumbent operators at the time of Jio's network launch in 2016 was one of the most high-profile interconnection disputes in TDSAT's history. Jio complained that incumbents were deliberately withholding adequate POI, causing extremely high call failure rates (in some cases over 50% of calls failing) that damaged Jio's subscriber experience and competitive position. The incumbents argued that they were entitled to set their own POI provisioning timelines and that call failure rates reflected the scale of Jio's

network launch rather than deliberate obstruction. TDSAT issued directions requiring accelerated POI provisioning; TRAI published call failure rate data that put substantial public and regulatory pressure on incumbents to comply; and the matter eventually resolved as POI capacity was expanded.

4.4 MVNO and Infrastructure Sharing Regulation

Mobile Virtual Network Operators (MVNOs) — service providers that provide mobile services to customers using the network infrastructure of licensed mobile operators rather than building their own networks — are an important dimension of competitive market structure in mature telecom markets globally. MVNO services allow new service providers to enter the market with low capital expenditure, competing on the basis of service innovation, customer experience, and targeted market focus rather than network infrastructure. TRAI has made recommendations on the MVNO framework in India, calling for a policy framework that enables MVNOs to operate on reasonable commercial terms, providing competitive discipline on the retail tariffs of network operators.

Infrastructure sharing — the sharing of passive infrastructure (towers, building access, power, and cooling) and active infrastructure (radio equipment, spectrum) between licensed operators — reduces the capital cost of network deployment and improves the economics of coverage extension. TRAI has issued recommendations and regulatory guidelines on infrastructure sharing, advocating for enhanced sharing obligations (particularly for new infrastructure deployment in areas where parallel investment is economically inefficient) and for clear regulatory frameworks governing the terms of sharing agreements. The Telecommunications Act, 2023's provisions on right of way and spectrum sharing provide a strengthened statutory basis for TRAI's infrastructure sharing recommendations.

CHAPTER 5

Quality of Service Regulation

5.1 QoS Framework: Regulations and Standards

TRAI's Quality of Service (QoS) regulatory framework establishes the standards that service providers must meet in the delivery of telecommunications services. The framework comprises a family of QoS regulations applicable to different categories of services: the Standards of Quality of Service of Basic Telephone Services (Wireline) Regulations; the Standards of Quality of Service of CMTS (Cellular Mobile Telephone Services) Regulations; the Broadband Speed and QoS Regulations; and various directions on specific quality issues. The QoS standards prescribe benchmarks for: service provisioning time; fault repair time; percentage of calls meeting quality standards; billing accuracy; response time for customer complaints; and overall customer satisfaction.

QoS regulation in the Indian telecom sector has faced the fundamental challenge that many of the prescribed standards are based on benchmark comparisons and averages across the operator's network, rather than on individual-level service guarantees. A QoS standard that prescribes a network availability of 99.5% means that the operator can meet the standard while leaving individual customers without service for extended periods, provided that the overall network average meets the benchmark. This statistical approach to QoS regulation — while administratively manageable for a large network — does not provide effective protection for individual consumers experiencing persistent service quality problems.

TRAI has periodically assessed compliance with QoS standards through a combination of: operators' self-reported QoS performance data (submitted quarterly); TRAI's own drive tests and network audits; consumer complaint data; and periodic consumer satisfaction surveys. The reliability of operators' self-reported data has been questioned, leading TRAI to invest in its own measurement capabilities and to engage independent technical auditors for network assessments. TRAI has also introduced initiatives such as the "My Speed" app (for broadband speed measurement by consumers) and the "My Call" app (for call quality measurement) to enable crowd-sourced QoS measurement supplementing operator reports.

5.2 Call Drop Regulation

Call drops — the unintended termination of calls before the caller intends to end the conversation — became a major consumer and regulatory issue in India around 2015-16, when

rapid subscriber growth and increasing data traffic on mobile networks created congestion and quality problems. Consumer complaints about call drops, amplified by media coverage and political attention (Prime Minister Narendra Modi personally raised the issue in public comments), created pressure on TRAI to take regulatory action. TRAI's response illustrates the complexity of QoS regulation in a technology-intensive sector where the causes of service quality problems are varied, technical, and difficult to attribute to any single regulatory failure.

TRAI's initial regulatory response was to introduce a mandatory financial compensation regime: operators would be required to credit consumers' accounts automatically for call drops attributable to network faults within the operator's control. This Compensation for Call Drops regulation was immediately challenged before TDSAT and the High Court by operators who argued that: (i) call drops were caused by factors outside operators' control (insufficient spectrum, infrastructure deployment obstacles, interference from illegal signal boosters); (ii) the compensation mechanism was technically unimplementable because it was impossible to distinguish call drops within the operator's control from those outside it; and (iii) the financial impact of mandatory compensation was disproportionate and commercially unviable. Delhi High Court initially struck down the regulation; an appeal to the Supreme Court resulted in the regulation being stayed. The matter was ultimately resolved through a combination of spectrum releases (to address capacity constraints) and network investment rather than through the compensation mechanism.

5.3 Broadband QoS and the Internet Speed Controversy

The regulation of broadband quality of service — particularly internet connection speed — has become increasingly important as India's data consumption has grown. Consumers and businesses purchasing broadband services frequently complain that actual speeds delivered are significantly lower than the advertised speeds. TRAI's approach to broadband QoS has focused on: requiring operators to disclose the basis on which advertised speeds are calculated (distinguishing between peak speeds and typical speeds); establishing minimum speed obligations for fixed and mobile broadband services; and providing consumers with tools to measure and report their actual speeds.

TRAI's recommendation that the definition of "broadband" require a minimum speed of at least 512 Kbps (in 2004), subsequently revised upward to 2 Mbps and then to 8 Mbps as technology and consumer expectations evolved, illustrates the ongoing challenge of defining quality thresholds in a technology environment that changes rapidly. TRAI's current recommended minimum for "broadband" aligns broadly with international standards, but the gap between the minimum threshold and the 100 Mbps+ speeds commonly available in leading

digital economies illustrates the challenge India faces in meeting its digital economy aspirations.

CHAPTER 6

Consumer Protection and Transparency

6.1 Consumer Protection Framework under TRAI

TRAI's consumer protection mandate under Section 11(1)(b)(v) of the TRAI Act — "protecting the interest of the consumers of telecommunication services" — is operationalised through a comprehensive framework of consumer protection regulations, directions, and guidelines. The principal consumer protection regulations include: the Telecom Consumer Protection Regulations, which establish fundamental consumer rights and the obligations of service providers in relation to billing, service terms, and complaint handling; the Telecom Consumer Complaint Redressal Regulations, which prescribe the Telecom Consumer Complaint Redressal (TCCR) framework including the Appellate Authority and the Nodal Officers system; and the Telecom Commercial Communications Customer Preference Regulations (TCCCPR), which govern unsolicited commercial communications (spam calls and SMS).

The TCCR framework establishes a multi-tier consumer complaint mechanism. At the first tier, operators are required to maintain consumer care centres that address complaints within prescribed timeframes (specific timelines differ by complaint category). If the complaint is not resolved at the first tier, consumers may escalate to the Appellate Authority constituted by the operator. If the consumer remains aggrieved after the appellate process, they may approach TRAI directly through its grievance portal, or approach TDSAT (if the complaint is within TDSAT's jurisdiction as a group consumer petition), or approach a consumer forum under the Consumer Protection Act, 2019. The availability of this multi-tier mechanism is intended to provide accessible and effective remedies for consumer grievances without requiring resort to judicial proceedings for routine service issues.

6.2 The Do Not Disturb Registry

Unsolicited commercial communications — commonly known as spam calls and spam SMS — have been a persistent consumer complaint in India since mobile telephony became widespread. The Telecom Commercial Communications Customer Preference Regulations (TCCCPR), now in their most recent version as the TRAI (TCCCPR) (Amendment) Regulations, 2021, establish the Do Not Disturb (DND) registry and the regulatory framework for controlling unsolicited commercial communications. The framework requires: registration of all entities sending commercial communications (as "principal entities" or "telemarketers"); use of the DND

registry to ensure that commercial communications are not sent to subscribers who have registered their preference not to receive them; prescribed categories and timing for commercial communications; consumer reporting mechanisms for DND violations; and financial penalties for violations.

The DND framework has faced significant implementation challenges. Despite the existence of the DND registry and the regulatory framework, Indian mobile subscribers continue to receive large volumes of unsolicited commercial communications. The challenges are systemic: the sheer volume of commercial communications generated by India's large commercial sector; the use of multiple SIM cards and unregistered numbers by violators; the sophistication of spoofing and robo-calling technology; and the limited enforcement capacity of both TRAI and the operators. TRAI has responded by strengthening the regulatory framework (requiring the use of blockchain-based distributed ledger technology — the DLT platform — for commercial communication consent management) and by imposing higher penalties for repeated violations.

6.3 Billing Accuracy and Transparency

Billing transparency — ensuring that consumers receive accurate, comprehensible bills that correctly reflect the charges for services received — is a fundamental consumer protection objective. TRAI's consumer protection regulations prescribe requirements for billing transparency including: the right to receive itemised bills (on request); the right to dispute billing accuracy and to receive credit for demonstrated billing errors; the obligation of operators to provide bill alerts (SMS notifications when usage reaches specified thresholds); and the obligation of operators to maintain accurate and auditable billing systems. The growing complexity of bundled tariff plans — combining voice, data, and OTT subscriptions in single plans — has increased the challenge of billing transparency for both operators and consumers.

6.4 Porting Regulation and Consumer Mobility

Mobile Number Portability (MNP) — the ability of subscribers to change their mobile service provider while retaining their telephone number — is a fundamental consumer right that enables effective competition in the mobile services market. TRAI's MNP Regulations, initially introduced in 2011 for intra-circle porting and subsequently extended to full MNP (enabling porting across telecom circles), establish the framework for MNP in India. The regulations prescribe: the porting process and timeline (the period within which the number must be ported following a request, now reduced to working days for most categories); the charges for porting (currently capped at a modest amount); and the obligations of operators to process porting requests without undue delay or obstruction.

MNP has had a significant positive impact on competition and consumer welfare in India. The ability to retain their number while switching operators has reduced the switching cost for consumers, enabling them to take advantage of better offers from competitors. MNP porting volumes — tracking the number of subscribers who switch operators each month — have become an important indicator of competitive market health. High porting volumes suggest that consumers are actively exercising their ability to switch, which creates competitive pressure on all operators to improve quality and price competitiveness.

CHAPTER 7

Spectrum Recommendations and Advisory Functions

7.1 TRAI's Spectrum Pricing Recommendations

TRAI's spectrum pricing recommendations — its determinations of the appropriate reserve prices for spectrum auctions — are among the most commercially significant and most scrutinised exercises of its advisory function. The methodologies employed by TRAI for spectrum pricing have evolved considerably since the first post-2G Spectrum Case auction in 2012. TRAI's current approach combines several methodologies: international benchmarking (comparing per-MHz-per-pop prices in comparable auction markets globally); demand modelling (estimating the commercial value of spectrum to operators based on subscriber projections and revenue models); and capacity pricing (assessing the value of spectrum in terms of its ability to deliver traffic capacity to subscribers).

The determination of spectrum reserve prices is a technically complex and commercially sensitive exercise. Reserve prices set too high deter bidding, result in unsold spectrum, and reduce spectrum availability for service rollout; reserve prices set too low undervalue public resources and may be perceived as a subsidy to private operators. TRAI's recommendations on spectrum prices have been criticised from both directions: by operators who argue that high reserve prices constrain their ability to invest in network development, and by civil society organisations and the Comptroller and Auditor General that argue that low prices represent a failure to maximise the public value of spectrum.

TRAI's spectrum pricing recommendations also address the question of payment terms for spectrum: whether the full price should be payable upfront at auction, or whether staggered payment arrangements (with upfront payments of a proportion of the bid price and the balance in instalments over the assignment period) should be available. The 2022 5G auction introduced significant liberalisation of payment terms (including a 20-year assignment period and instalment payment options), implemented in line with TRAI's recommendations. These payment term liberalisations were intended to improve the affordability of 5G spectrum for operators and to accelerate the 5G rollout.

7.2 Recommendations on Licensing and Market Entry

TRAI's recommendations on licensing and market entry conditions are made to the Central Government (specifically to DoT) in its advisory capacity under Section 11(1)(a) of the TRAI Act.

These recommendations address: whether new service providers should be permitted to enter specific market segments; the eligibility criteria (technical, financial, and ownership requirements) for new licensees; the appropriate licence conditions (service obligations, coverage requirements, fee structures); and the framework for transitioning from one licensing regime to another (such as the transition from technology-specific licences to the Unified Licence, and from the Unified Licence to the authorisation framework under the Telecommunications Act, 2023).

TRAI's licensing recommendations have, over its history, generally favoured competitive entry and the reduction of barriers to new competitors — consistent with its competition-promoting mandate. TRAI's recommendation in 2006 for significant expansion of the number of cellular licences in each circle — recommending against a fixed number of licensed operators and in favour of unlimited entry subject to minimum qualification criteria — was a key regulatory choice that contributed to the intense competitive pressure in the Indian mobile market in the late 2000s. It also contributed, as noted above, to the spectrum scarcity that preceded the 2G controversy, illustrating the complex trade-offs involved in licensing policy.

7.3 TRAI and International Spectrum Coordination

India's participation in international spectrum coordination — particularly in the ITU World Radiocommunication Conference (WRC) process through which the global allocation of spectrum between different uses and users is determined — involves significant preparatory consultation between TRAI, DoT, and the WPC Wing. TRAI's views on India's international spectrum positioning are informed by its understanding of domestic spectrum requirements, domestic industry interests, and India's development objectives for telecommunications connectivity. TRAI participates in the Asia-Pacific Telecommunity (APT) regional preparatory process for WRCs and contributes to India's national positions on WRC agenda items.

The outcomes of WRCs — which occur every four years — have direct implications for India's national frequency allocation plans and for the spectrum available for future services. The allocation of new spectrum for International Mobile Telecommunications (IMT) — mobile broadband services — at successive WRCs has progressively expanded the frequency bands available for 5G deployment globally, and India's participation in these negotiations has influenced the outcomes in ways that serve India's interests as a major mobile market. TRAI's recommendations on spectrum harmonisation — adopting the same frequency bands for mobile services as are used in neighbouring countries — are important for enabling the use of economies of scale in equipment manufacturing and for facilitating roaming.

CHAPTER 8

Broadcasting and Cable Television Regulation

8.1 TRAI's Role in Broadcasting Regulation

TRAI's regulatory jurisdiction extends to the broadcasting sector in addition to telecommunications. Section 11 of the TRAI Act, as amended by the TRAI (Amendment) Act, 2000, includes within TRAI's jurisdiction "cable services" — the distribution of television signals through cable television networks. TRAI's broadcasting-related regulatory functions include: setting tariffs for cable television subscription services and for the distribution of television channels by cable operators; regulating the terms and conditions on which television channels are made available to cable operators and direct-to-home (DTH) operators; establishing standards for set-top boxes and conditional access systems; and protecting consumer interests in the broadcasting sector.

The New Tariff Order (NTO) issued by TRAI in 2019 — following extensive litigation and regulatory revision — restructured the tariff framework for cable and DTH television services. The NTO framework allows consumers to select individual channels (à la carte) or channel bouquets, with operators required to offer a basic service tier at a regulated price covering a minimum package of free-to-air channels. The NTO generated significant controversy and extensive litigation before TDSAT and the Bombay High Court, with broadcasters, distribution platform operators, and multi-system operators each challenging various aspects of the framework. The litigation highlighted the complexity of applying a consumer-protection-oriented regulatory framework in a sector with complex vertical relationships between content producers, broadcasters, and distribution platforms.

8.2 The Broadcasting Regulatory Interface with Telecom

The convergence of telecommunications and broadcasting infrastructure — both delivered over the same internet protocol network infrastructure — creates regulatory interface issues between TRAI's telecommunications regulatory functions and its broadcasting regulatory functions. IPTV (Internet Protocol Television) services — which deliver television content over internet connections rather than through traditional cable or satellite distribution — raise questions about whether they are regulated as broadcasting services (under the cable TV framework) or as internet services (under the telecommunications framework). This regulatory classification question affects tariff regulation, content regulation (including content ratings and

restrictions), and universal service obligations.

The Ministry of Information and Broadcasting (MIB) exercises concurrent jurisdiction over broadcasting content — issuing guidelines on programme codes, advertising codes, and foreign content restrictions — while TRAI regulates the economic and technical dimensions of broadcasting distribution. The division of responsibilities between TRAI and MIB, and the coordination between their regulatory frameworks, is not always perfectly clear. The proposed Broadcasting Services (Regulation) Bill — which was under development as of the preparation of this booklet — seeks to consolidate the regulatory framework for broadcasting under a single statute, but the interface with TRAI's continuing jurisdiction over distribution platform tariffs and consumer protection remains a subject of policy discussion.

CHAPTER 9

TRAI and OTT Services

9.1 TRAI's Engagement with the OTT Question

The regulatory treatment of Over-the-Top (OTT) communication services has been the most persistent and contested regulatory question in Indian telecom policy over the past decade. TRAI has engaged with the OTT question through multiple consultation papers since 2015, generating hundreds of thousands of stakeholder submissions and extensive public debate. The essential question — whether OTT communication services (messaging apps, voice-over-internet services) should be regulated as telecommunications services, subject to licensing requirements and the associated obligations — has generated strong and opposing positions from different stakeholders: incumbent telecom operators pressing for regulatory parity; OTT service providers (domestic and international) arguing for continued deregulation; and consumer and civil society organisations arguing for light-touch regulation that protects user privacy and free expression without imposing disproportionate burdens on innovation.

TRAI's 2015 Consultation Paper on OTT services was the first systematic engagement by any Indian regulatory body with the OTT regulatory question. The paper received more than a million written submissions — the largest response to any regulatory consultation in India's history — demonstrating the public's engagement with internet regulation questions. The overwhelming majority of submissions from individual users opposed any regulation of OTT services, expressing concern that licensing requirements would restrict access to free and low-cost communication services. TRAI ultimately declined to recommend OTT licensing at that stage, in its 2015 report, but noted that the question would need to be revisited as the OTT sector evolved.

9.2 Net Neutrality and OTT: The Connected Debate

The OTT regulatory debate is closely connected to — but distinct from — the net neutrality debate. Net neutrality addresses how internet service providers (telecom operators providing internet access) should treat different categories of internet traffic: should they be permitted to charge different prices for access to different online services, or should all internet traffic be treated equally? The net neutrality question was most dramatically posed in India in 2015-16 by proposals from certain telecom operators for "zero-rating" plans (charging users no data for certain apps while charging for others) and by Facebook's "Free Basics" programme (offering

free access to a curated set of internet services). TRAI's 2016 Differential Pricing Regulations, prohibiting discriminatory tariffs for internet access services, resolved the net neutrality question decisively in favour of open internet principles.

The OTT question is different from net neutrality: it asks not how telecom operators should treat OTT traffic as internet service providers, but whether OTT communication services should themselves be required to obtain telecom licences and comply with the associated obligations. These are conceptually distinct questions: a position firmly in favour of net neutrality (all internet traffic treated equally) is compatible with either permitting OTT services to operate without licensing (the current position) or requiring OTT services to obtain licences (a different regulatory framework). TRAI has maintained its support for net neutrality while continuing to consider the OTT licensing question separately.

9.3 2020 Consultation Paper and Current Status

TRAI's 2020 Consultation Paper on the Regulatory Framework for OTT Communication Services revived the regulatory debate with a more focused analysis. The paper proposed several regulatory options ranging from "no regulation" (status quo) to a "light touch registration framework" (requiring OTT communication providers to register with DoT and meet specified obligations including cybersecurity, lawful access, and grievance redressal) to "full regulatory parity" (requiring OTT providers to obtain telecom licences and comply with all associated obligations). The 2020 consultation generated extensive submissions from across the stakeholder spectrum.

As of the preparation of this booklet, TRAI's final recommendations on OTT regulation had not been issued. The government has stated its intention to consider TRAI's recommendations before making a policy determination on OTT regulation. The Telecommunications Act, 2023's broad definition of "telecommunication services" — which preserves the legislative flexibility to include OTT services within the regulatory perimeter without further statutory amendment — keeps the regulatory option open. Whatever regulatory framework eventually applies to OTT communication services in India will represent one of the most significant telecommunications regulatory decisions of the decade, with implications for consumer welfare, innovation, competition, and India's position in the global digital economy.

CHAPTER 10

TRAI's Institutional Independence: Law and Practice

10.1 The Legal Architecture of Independence

The institutional independence of TRAI — its ability to make regulatory decisions free from improper influence by the regulated industry, the government, or other interested parties — is the foundational premise of its regulatory legitimacy. The TRAI Act establishes several legal safeguards for TRAI's independence: security of tenure for the Chairperson and Members (they cannot be removed except through the specified procedure); fixed salaries and service conditions that cannot be varied to their disadvantage; the prohibition on the Chairperson or Members holding any other office of profit during their tenure; and the prohibition on the Chairperson holding certain government positions for two years after leaving TRAI (to prevent a "revolving door" dynamic).

In practice, TRAI's independence is constrained by structural factors that the legal safeguards cannot fully address. The appointment process — which vests in the Central Government the power to appoint both the Chairperson and the Members — means that the government can, over time, shape the composition of TRAI through its appointment choices. The Section 11(4) direction power — allowing the government to issue policy directions to TRAI — provides a formal mechanism for influencing TRAI's regulatory agenda. The dependence of TRAI on the government for its budget, staff, and administrative support creates informal dependencies that can affect TRAI's practical independence even without any formal interference.

TRAI's published record of regulatory decisions — including decisions that have directly conflicted with the government's perceived policy preferences, such as its support for net neutrality against the preferences of some major operators who sought government support for differential pricing — provides evidence that it exercises a meaningful degree of independent regulatory judgment. However, critics have argued that TRAI's independence has been inconsistent across different regulatory issues, with stronger evidence of independence on some matters (such as net neutrality and consumer protection) than on others (such as spectrum pricing, where TRAI's recommendations have been criticised as insufficiently independent of government revenue objectives).

10.2 The Post-Tenure Employment Prohibition

The TRAI Act, 1997 prohibits the Chairperson from accepting employment with the Central Government for two years after leaving TRAI. This post-tenure employment restriction — commonly known as a "cooling-off period" — is intended to prevent TRAI officials from making regulatory decisions designed to favour specific entities in order to secure post-TRAI employment with those entities (the "revolving door" problem). The restriction applies only to Central Government employment, not to private sector employment in the regulated industry, which is arguably a significant limitation: the greater risk of a revolving door dynamic may be with private sector entities (who can offer materially higher compensation) than with the government.

The adequacy of TRAI's cooling-off provisions has been the subject of regulatory reform discussion. Several expert committees and civil society organisations have recommended extending the scope of the restriction to cover senior private sector employment in the regulated telecom industry for a specified period after leaving TRAI. Such an extension would align India's practice with that of some other regulatory jurisdictions (including some EU member states and the US) that apply post-employment restrictions to senior regulatory officials in relation to private sector employment in the regulated sector. The Telecommunications Act, 2023 does not address TRAI's cooling-off provisions, which remain governed by the TRAI Act.

CHAPTER 11

The DoT–TRAI Relationship

11.1 Formal Institutional Arrangements

The relationship between the Department of Telecommunications (DoT) and the Telecom Regulatory Authority of India (TRAI) is the central institutional relationship in the Indian telecommunications regulatory ecosystem. Under the constitutional framework, DoT is the principal governmental authority for telecommunications: it is responsible for policy, licensing, spectrum management (through the WPC Wing), and the promotion of the domestic telecom manufacturing sector. TRAI is the independent economic regulator: it sets tariffs, issues quality of service regulations, makes recommendations on licensing and spectrum, and protects consumer interests. These functions are complementary but sometimes create tension.

The formal institutional arrangements governing the DoT-TRAI relationship are established by the TRAI Act, 1997. DoT is the "licensor" for the purposes of the Indian Telegraph Act, 1885 (and now the Telecommunications Act, 2023), with the authority to grant, modify, and revoke licences (and authorisations). TRAI makes non-binding recommendations to DoT on licensing and spectrum matters. DoT is not required to accept TRAI's recommendations, and the TRAI Act's Section 11(4) direction power gives DoT (through the Central Government) the ability to issue policy directions to TRAI. The asymmetry of powers — DoT as the decision-maker with ultimate authority, TRAI as the advisory and economic regulation body — defines the formal legal relationship.

11.2 Areas of Tension and Coordination

Several specific areas have generated recurring tension between DoT and TRAI. Spectrum pricing is one: TRAI's spectrum pricing recommendations are not binding on DoT, which retains the authority to set reserve prices for auctions at levels it considers appropriate. Where DoT's reserve price decisions diverge significantly from TRAI's recommendations, they attract criticism from operators (who may argue that prices are too high) or from the Comptroller and Auditor General (who may argue that prices are too low relative to market value). The absence of a binding mechanism for implementing TRAI's spectrum pricing methodology reduces the predictability of the spectrum auction process.

OTT regulation is another area where the DoT-TRAI relationship has been tested. TRAI's repeated consultations and deliberations on OTT regulation have not been translated into a

definitive regulatory framework, partly because the final policy decision rests with the Central Government (through DoT) rather than with TRAI. The protracted absence of a clear regulatory framework for OTT services reflects the difficulty of achieving consensus across the DoT-TRAI-Ministry of Electronics and Information Technology (MeitY) institutional triangle that governs India's digital economy regulation. Practitioners advising OTT service providers or telecom operators on OTT-related matters must navigate this institutional complexity.

11.3 The Separation of Regulatory and Operational Functions

A recurring tension in the DoT-TRAI relationship is the separation between DoT's residual operational role (through its ownership of BSNL and MTNL, two licensed operators that compete in the market alongside private operators) and its regulatory role (as licensor and policy authority for the entire sector including BSNL and MTNL). The government's ownership of BSNL and MTNL creates a structural conflict of interest: as owner, the government has an interest in the commercial success of these entities; as regulator (through DoT) and quasi-regulator (through TRAI's framework), it must ensure non-discriminatory treatment of all operators. TRAI's existence as an independent regulator is the primary institutional safeguard against regulatory favouritism towards state-owned operators, but the effectiveness of this safeguard depends on TRAI's ability to make and enforce non-discriminatory regulatory decisions without interference.

CHAPTER 12

TDSAT: Constitution, Jurisdiction and Procedure

12.1 Establishment and Statutory Basis

The Telecom Disputes Settlement and Appellate Tribunal (TDSAT) was established by the TRAI (Amendment) Act, 2000 through the insertion of Part IIA into the TRAI Act, 1997. The establishment of TDSAT addressed the institutional conflict of interest created by the original TRAI Act's vesting of both regulatory and adjudicatory functions in a single body. By separating adjudication from regulation, the 2000 amendment improved both the actual and perceived impartiality of dispute resolution in the telecom sector. TDSAT is constituted as a tribunal under the General Clauses Act, 1897's definition of "tribunal" and exercises judicial functions in hearing and determining disputes and appeals.

Section 14 of the TRAI Act, 1997 (as inserted by the 2000 amendment) establishes TDSAT's original jurisdiction — the power to adjudicate disputes arising between licensors and licensees, between service providers, and between service providers and groups of consumers. Section 14A establishes TDSAT's appellate jurisdiction — the power to hear and decide appeals from directions, decisions, and orders of TRAI. The Telecommunications Act, 2023 extends TDSAT's appellate jurisdiction to include appeals from orders of the Adjudicating Officer (for civil penalty decisions). This expansion reflects TDSAT's establishment as the primary specialised forum for telecommunications dispute resolution in India.

12.2 Composition, Appointment, and Independence

TDSAT consists of a Chairperson and not more than two other Members. The Chairperson must be a retired Judge of the Supreme Court or a retired Chief Justice of a High Court. The Members must be persons of ability, integrity, and standing with professional experience in telecommunications, law, finance, or related fields. The appointment process — by the Central Government — follows a standard process for tribunal appointments under Indian administrative law. The safeguards for the independence of TDSAT's Chairperson and Members are broadly similar to those applicable to TRAI: security of tenure, fixed remuneration, and prescribed removal procedures.

The adequacy of TDSAT's bench strength — two Members in addition to the Chairperson — for the volume and complexity of telecom disputes in India's large and dynamic market has been a persistent concern. TDSAT's docket has historically included not only the operational disputes

between operators that arise daily in a competitive market, but also some of the most commercially significant and technically complex regulatory disputes in the Indian economy. The AGR case, the 2G post-cancellation proceedings, the Jio-incumbent POI dispute, and the IUC challenge have all generated complex and voluminous proceedings at TDSAT. A larger bench with more specialised division of labour — technical matters to technical members, legal matters to legally qualified members — would improve TDSAT's capacity to handle this workload.

12.3 Jurisdiction: Scope and Limitations

TDSAT's jurisdiction is both a strength and a limitation of the Indian telecom dispute resolution framework. On the strength side, TDSAT's specialised jurisdiction over telecom disputes — encompassing both original inter-party disputes and appellate review of TRAI orders — provides a single, expert forum for the resolution of telecom regulatory matters, avoiding the delays and inconsistencies that would result from these matters being heard by general civil courts. TDSAT's accumulation of specialist expertise over its two decades of operation has made it a genuinely expert tribunal, capable of handling complex technical and economic evidence in regulatory disputes.

On the limitation side, TDSAT's jurisdiction is not coextensive with all legal disputes affecting the telecom sector. TDSAT cannot hear constitutional challenges (challenges to the vires of statutes or the fundamental rights compatibility of regulations) — these must be brought before the High Courts under Article 226 or the Supreme Court under Article 32. TDSAT cannot adjudicate competition law disputes — these fall within the exclusive jurisdiction of the Competition Commission of India. TDSAT cannot adjudicate individual consumer disputes — individual consumers must use the consumer complaint mechanism under the Consumer Protection Act, 2019, and can approach TDSAT only as part of a group of consumers. These jurisdictional limitations create a fragmented dispute resolution landscape in which different aspects of the same commercial situation may need to be resolved in different forums.

CHAPTER 13

Key TDSAT Decisions Shaping Telecom Regulation

13.1 The AGR Proceedings: TDSAT's Role

The Adjusted Gross Revenue (AGR) dispute — the most consequential telecom litigation in India's history — was initially adjudicated by TDSAT before reaching the Supreme Court. TDSAT heard extensive arguments on the interpretation of the AGR definition in the context of the Migration Package under NTP 1999 and the associated licence conditions. TDSAT's determination broadly favoured the operators' interpretation — holding that AGR should be calculated on revenue from licensed telecom activities and should exclude non-telecom revenues such as dividends, interest, and income from property — and directed DoT to recompute its demands accordingly. This TDSAT determination provided a degree of regulatory certainty to the industry for several years before being challenged by DoT before the Supreme Court.

The Supreme Court's reversal of TDSAT's AGR determination in Union of India v. Association of Unified Telecom Service Providers of India, (2020) 3 SCC 525, illustrates both the institutional role of TDSAT in managing major telecom disputes at the first appellate level and the limits of TDSAT's authority when its determinations are challenged before the Supreme Court on questions of law. TDSAT's detailed fact-finding and analytical work in the AGR proceedings — accumulating voluminous financial evidence and assessing complex commercial arrangements — was a significant contribution to the eventual resolution, even though the Supreme Court ultimately disagreed with TDSAT's legal conclusion on the definition of AGR.

13.2 IUC and Net Neutrality Decisions

TDSAT's decisions on interconnection usage charges have been commercially important in shaping the competitive dynamics of the Indian mobile market. The tribunal has adjudicated challenges to multiple TRAI IUC determinations, examining the economic methodology underlying TRAI's cost-of-termination calculations and the procedural adequacy of TRAI's consultation process. While TDSAT has generally upheld TRAI's IUC determinations as within the regulator's legitimate authority (subject to the jurisdictional qualification that TDSAT cannot challenge the validity of TRAI's regulations, only their specific application), it has in some cases directed TRAI to reconsider specific aspects of its determination methodology.

TDSAT's adjudication of challenges to TRAI's net neutrality framework — specifically the Differential Pricing Regulations, 2016, prohibiting zero-rating — was the first major judicial assessment of these regulations' legal validity. The tribunal upheld the regulations as within TRAI's regulatory jurisdiction and as a proportionate exercise of TRAI's mandate to protect consumer interests and ensure non-discriminatory access to telecommunications services. This decision was significant not only for net neutrality itself but for establishing the principle that TRAI has broad regulatory authority to address competition distortions in internet access markets, extending beyond its traditional tariff-setting and interconnection functions.

13.3 Consumer Group Petitions: Key Decisions

TDSAT's consumer group jurisdiction — the power to adjudicate disputes between a service provider and a group of consumers — has generated a body of jurisprudence on consumer rights in the telecom sector. Consumer group petitions before TDSAT have addressed: the adequacy of TRAI's QoS standards and their enforcement; the legality of tariff changes made without adequate notice; the application of the TCCR consumer complaint framework; and the transparency obligations of service providers in relation to billing and service terms. TDSAT's decisions in consumer group matters have progressively strengthened consumer protection in the sector, particularly by clarifying the procedural requirements for valid tariff changes (including the requirement for adequate advance notice to existing subscribers).

CHAPTER 14

Reforms: Strengthening the Regulatory Architecture

14.1 Recommendations for TRAI Reform

Multiple expert committees and governmental reviews have examined the functioning of TRAI and made recommendations for reform. The Telecom Regulatory Authority of India Review Committee (2019), chaired by a former Cabinet Secretary, made recommendations addressing: the strengthening of TRAI's independence through reforms to the appointment process (including a wider search for candidates and a more independent selection committee); enhancement of TRAI's technical capacity (through recruitment of engineers, economists, and data scientists alongside its existing legal expertise); modernisation of TRAI's consultation processes (including digital consultations and real-time data publication); and clarification of the boundary between TRAI's regulatory functions and DoT's policy functions to reduce institutional overlap and conflict.

The reform of TRAI's composition to include more technical members — particularly members with expertise in telecommunications engineering, data science, and digital economics — has been repeatedly recommended but not yet implemented. The current qualification requirements for TRAI Members focus heavily on administrative seniority (holding the post of Secretary to the Government) and on general professional experience, without specifically requiring telecommunications technical expertise. As TRAI's regulatory responsibilities increasingly require engagement with complex technical matters (5G network architecture, AI-based network management, satellite communications, quantum communications), the value of technical expertise among TRAI's decision-makers will only increase.

14.2 TDSAT Reform: The Need for Enhanced Capacity

TDSAT reform is a priority that has been acknowledged across the regulatory community. The tribunal's bench strength of a Chairperson and up to two Members is inadequate for the volume and complexity of its docket. Major pending matters — including spectrum-related challenges, AGR-related proceedings, and OTT-related disputes — may remain in TDSAT's queue for years, creating commercial uncertainty. Reform options that have been discussed include: increasing the number of Members (to enable TDSAT to constitute multiple benches); establishing a technical adviser cadre (to provide Members with expert technical support); creating a specialised branch for consumer group petitions (to separate them from the

commercially sensitive inter-operator disputes); and establishing circuit benches or regional hearing centres outside New Delhi.

The institutional positioning of TDSAT in the broader framework of specialised tribunals in India is also relevant. Following the Supreme Court's decisions in Madras Bar Association v. Union of India (2014 and 2021) on the constitutional requirements for tribunals, TDSAT's appointment and removal procedures must comply with the requirements of judicial independence established in those judgments. The Tribunals Reforms (Rationalisation and Conditions of Service) Ordinance, 2021, and the subsequent Act, sought to rationalise India's tribunal framework. TDSAT's position within this rationalised framework and its compliance with the constitutional requirements for tribunal independence are matters that practitioners should verify in the context of specific proceedings.

CHAPTER 15

Comparative Regulatory Models and India's Positioning

15.1 International Models of Telecom Regulation

A comparative survey of international telecommunications regulatory models reveals a spectrum of approaches. At one end, countries like the United States and Australia have adopted models in which the independent regulator (the FCC and the ACMA/ACCC respectively) has direct, binding regulatory authority over licensing and spectrum, not merely advisory authority. At the other end, some developing country models vest virtually all regulatory authority in a government ministry, with no independent regulatory body. India's model — a hybrid in which an independent regulator (TRAI) exercises binding authority over tariffs and quality of service but only advisory authority over licensing and spectrum — falls between these extremes.

The evolution of regulatory models in the telecommunications sector globally has generally moved in the direction of greater regulatory independence, though with significant national variations. The ITU's annual ICT Regulatory Outlook report tracks the development of telecommunications regulatory frameworks globally and consistently identifies independent regulation as a positive factor for investment, innovation, and consumer welfare. India's ranking in the ICT Regulatory Outlook reflects both the strengths of its regulatory framework (independent TRAI, competitive market, strong consumer protection) and its weaknesses (DoT's continuing role in licensing and spectrum, the institutional tensions discussed in this booklet).

15.2 The OECD Framework on Regulatory Quality

The OECD's Best Practice Principles for the Governance of Regulators (2014, updated 2022) provide a widely cited benchmark for regulatory quality applicable to telecommunications regulators. The principles address: the independence and accountability of regulators; the quality and transparency of regulatory processes; the coherence of regulatory frameworks; and the capacity of regulatory institutions. India's TRAI broadly meets the principles on transparency (through its published consultation processes and regulatory instruments) and accountability (through its reporting to Parliament and its decisions being subject to judicial review). The areas where India's framework is less aligned with OECD principles include: the binding nature of regulatory decisions (TRAI's advisory status on key matters weakens its effectiveness as an independent regulator); and the quality of evidence-based regulatory decision-making (improvements in TRAI's analytical capacity would strengthen the evidence base for its

decisions).

15.3 Lessons from Regional Peers

India's telecommunications regulatory framework can be usefully benchmarked against regional peers including China (which has a state-dominated model without independent regulation, achieving very high infrastructure investment but at the cost of competitive market development), Indonesia (which has moved towards greater regulatory independence but still faces significant governance challenges), and Brazil (which has an independent telecommunications regulator, ANATEL, with binding authority over licensing and spectrum, providing a closer model to TRAI's potential development). The South Asian telecommunications regulatory landscape — which includes Pakistan's PTA, Bangladesh's BTRC, and Sri Lanka's TRCSL — provides models of independent telecommunications regulation in comparable socio-economic contexts.

The common lesson from regional and international comparisons is that the effectiveness of a telecommunications regulatory framework depends not only on its formal legal architecture but on the quality of regulatory institutions, the depth of regulatory expertise, and the political commitment to regulatory independence and enforcement. India has the formal architecture for effective independent regulation; strengthening the institutional quality, analytical capacity, and practical independence of TRAI and TDSAT would allow this architecture to deliver its full potential benefits for investment, competition, and consumer welfare in one of the world's most important telecommunications markets.

15.4 The Digital Economy Agenda and Regulatory Capacity

India's digital economy ambitions — a USD 1 trillion digital economy, leadership in digital public infrastructure, a globally competitive technology sector — require a telecommunications regulatory framework that enables the investment, innovation, and competition necessary to deliver world-class connectivity to every Indian. The Telecommunications Act, 2023 provides the statutory foundation; TRAI and TDSAT provide the institutional infrastructure; and the regulatory processes described in this booklet provide the operational mechanisms. Realising the potential of this framework requires continued investment in regulatory capacity, consistent application of competition-oriented principles, and the evolution of regulatory approaches to address the new challenges of 5G, satellite, OTT, and AI-enabled telecommunications.

The five companion booklets in this series — on the Telecommunications Act, 2023 (Booklet I), licensing and spectrum (Booklet III), TDSAT jurisprudence (Booklet IV), cybersecurity and data protection (Booklet V), and emerging issues in OTT, satellite, and the digital future (Booklet

VI) — collectively provide the comprehensive legal analysis needed to navigate India's telecommunications regulatory landscape. Practitioners and stakeholders who engage with this regulatory environment will be better positioned to contribute constructively to its development if they bring to that engagement a deep understanding of both the legal framework and the regulatory context described in these booklets.

SUPPLEMENTARY NOTE D

Advanced Regulatory Analysis: TRAI's Practice and Procedure

D.1 TRAI's Economic Analysis Methodology

TRAI's regulatory decisions — particularly its tariff orders, spectrum pricing recommendations, and interconnection charge determinations — are fundamentally exercises in applied telecommunications economics. The quality of TRAI's economic analysis is a primary determinant of the effectiveness of its regulatory decisions: poorly designed economic analysis leads to regulatory interventions that distort markets, deter investment, or fail to achieve their consumer protection objectives. TRAI's economic methodology has evolved significantly over its existence, from relatively simple cost-based analysis in its early years to increasingly sophisticated econometric modelling, comparative benchmarking, and demand-side analysis in recent years. The appointment of economists with telecommunications sector expertise to TRAI's staff and the commissioning of independent economic research to support specific regulatory decisions have both contributed to this methodological improvement, though further investment in TRAI's analytical capacity is needed to address the growing complexity of the regulatory questions it faces.

TRAI's economic analysis methodology for tariff regulation is based on the LRIC (Long-Run Incremental Cost) approach — a standard methodology used by telecommunications regulators globally for setting cost-based wholesale and retail tariffs. Under the LRIC approach, the costs of providing a specific service are calculated as the incremental costs that would be incurred in the long run to provide the service, given the existing network architecture. LRIC models require detailed data on network costs (capital expenditure, operating expenditure, and cost allocation across services) that operators provide to TRAI on a confidential basis. The quality of the cost data submitted by operators — and the rigour with which TRAI verifies this data through independent assessments — is a critical determinant of the accuracy of LRIC-based tariff determinations. TRAI's historical reliance primarily on operator-submitted cost data, without

systematic independent verification, has been a methodological vulnerability that has been identified in multiple regulatory reviews.

The relationship between TRAI's economic analysis and competition law analysis — particularly in the context of market definition and market power assessments for the purpose of determining whether a specific operator or service requires regulatory intervention — is an important methodological area that TRAI has not fully developed. Competition law market analysis (defining the relevant product and geographic market and assessing the degree of market power held by specific operators) is a well-established methodology in competition economics, but its application in the regulatory telecom context — where TRAI must make market power assessments not for the purpose of applying competition law remedies but for the purpose of calibrating the degree of regulatory intervention required — has been inconsistent in TRAI's practice. A more systematic, competition economics-informed approach to market power assessment would improve the targeting of TRAI's regulatory interventions, ensuring that regulation focuses on markets and services where competitive constraints are insufficient and withdrawing regulation where effective competition makes it unnecessary.

D.2 TRAI's Consumer Satisfaction Surveys: Methodology and Impact

TRAI's periodic consumer satisfaction surveys — assessing subscriber satisfaction with quality of service, pricing, customer care, and overall service quality across different operators and service categories — are an important source of market intelligence for regulatory decision-making. The surveys provide TRAI with consumer-side data to complement the operator-side performance data submitted through quality of service reports, and enable TRAI to identify gaps between operators' self-reported performance and users' perceived experience. The methodology of TRAI's consumer satisfaction surveys — the sampling framework, the survey questions, the reporting categories, and the analytical framework for drawing regulatory conclusions from the data — has evolved over time and has been the subject of academic and industry review.

The limitations of consumer satisfaction surveys as a regulatory tool are well understood in the academic literature on regulation: survey responses reflect both objective service quality and subjective expectations, and different subscriber segments (urban vs. rural, high-ARPU vs. low-ARPU, tech-savvy vs. non-tech-savvy) may respond differently to similar objective quality levels. The aggregation of diverse consumer experiences into a single satisfaction index for an operator or service category may mask significant heterogeneity in service quality — a highly unsatisfied rural subscriber may be lost in an aggregate that includes many satisfied urban subscribers. TRAI's development of disaggregated quality metrics — separately reporting quality

by service area, by geographic classification (urban/semi-urban/rural), and by subscriber segment — would provide more actionable regulatory intelligence than aggregate indices.

The use of crowd-sourced quality measurement tools — particularly TRAI's own MySpeed and MyCall applications, which enable subscribers to measure their broadband speed and call quality and submit the results to TRAI — is an innovative approach to supplementing formal survey data with large-scale, geographically distributed real-world quality measurements. The MySpeed application has collected millions of broadband speed measurements from subscribers across India, providing TRAI with a rich dataset on the actual speeds delivered by operators across different geographies and time periods. The analytical challenge is to translate this large dataset into actionable regulatory intelligence: identifying systematic quality gaps by operator, geography, or time period; distinguishing between network quality issues and device or application issues; and developing appropriate regulatory responses to identified quality deficiencies. The development of TRAI's data analytics capabilities to extract maximum value from its crowd-sourced measurement data is an important priority for regulatory modernisation.

D.3 Spectrum Policy: TRAI's Evolving Approach

TRAI's spectrum policy recommendations — covering reserve prices for spectrum auctions, spectrum caps, spectrum trading and sharing conditions, and spectrum refarming priorities — have been among its most commercially significant and most contested outputs. The evolution of TRAI's spectrum policy approach over the past decade reflects both the lessons learned from India's spectrum management experience and the influence of international best practice. The 2012 National Frequency Allocation Plan and the post-2G Spectrum Case adoption of mandatory auctions for commercial spectrum provided the foundational framework; TRAI's successive spectrum pricing recommendations since 2012 have sought to calibrate reserve prices at levels that balance government revenue interests against operators' ability to invest in network coverage and quality.

The methodology controversy in spectrum pricing — the long-running debate between TRAI's recommended reserve prices (typically based on demand modelling and international benchmarking) and DoT's actual auction reserve prices (which have at times been set higher than TRAI's recommendations, resulting in unsold spectrum, and at other times lower) — reflects the genuine difficulty of spectrum valuation in a market with limited price discovery (since spectrum auctions are infrequent and market conditions change rapidly between auctions). The experience of the 700 MHz band — where TRAI-recommended reserve prices and DoT-set reserve prices were both too high relative to market demand for several successive auctions, resulting in the band being left unsold for years — illustrates the commercial and policy cost of

miscalibrated reserve prices. The 2022 5G auction's success in selling significant quantities of spectrum across multiple bands, including 700 MHz (which finally found buyers after several years of unsold inventory), reflected a combination of reduced reserve prices and improved market conditions following India's 5G readiness.

The regulatory framework for spectrum sharing — currently based on DoT's administrative guidelines and TRAI's recommendations — needs to evolve to accommodate the increasingly sophisticated spectrum sharing technologies enabled by 5G and open RAN architectures. TRAI's 2020 recommendations on spectrum sharing were primarily focused on relatively simple MORAN and MOCN sharing arrangements; the more dynamic, software-defined sharing arrangements enabled by 5G (including spectrum sharing between operators with different access technologies in the same band, coordinated by AI-based interference management systems) require a more flexible regulatory framework that enables innovative sharing models to be deployed and tested in regulatory sandboxes before being assessed for full-scale deployment. TRAI's consultation on the 5G spectrum sharing framework — expected as part of its broader 5G regulatory engagement — will need to address these more advanced sharing modalities and develop regulatory parameters that enable innovation while protecting the spectrum rights of all assignees.

D.4 The Broadcasting Regulatory Landscape: TRAI's Evolving Role

TRAI's broadcasting regulatory role — originally established by the TRAI (Amendment) Act, 2000 and expanded through the inclusion of cable services within TRAI's jurisdiction — has become increasingly complex as the boundaries between broadcasting and telecommunications have blurred. The distribution of television content over internet protocols (IPTV, OTT streaming, and connected TV) means that the same content is simultaneously subject to broadcasting regulation (if distributed as a scheduled broadcast service) and telecommunications regulation (if delivered as an on-demand internet service) — a regulatory bifurcation that reflects technical infrastructure differences rather than meaningful differences in the consumer experience or the regulatory concerns at stake. TRAI's engagement with the proposed Broadcasting Services (Regulation) Bill — which seeks to create a unified regulatory framework for all forms of broadcast distribution including OTT streaming platforms — highlights the convergence challenge that the broadcasting regulatory framework faces.

The New Tariff Order (NTO) litigation — the most extensive TDSAT broadcasting jurisdiction exercise, described in Booklet IV — has had significant implications for TRAI's broadcasting regulatory practice. The protracted legal challenges to NTO 2.0 and its subsequent modifications have consumed substantial TRAI and TDSAT resources and have created regulatory uncertainty

that has deterred investment in content and infrastructure in the broadcasting distribution sector. The legal challenges have highlighted several weaknesses in TRAI's regulatory approach to broadcasting: the reliance on detailed price regulation (specifying the maximum retail prices for individual channels and bouquets) rather than outcomes-based regulation (regulating consumer outcomes — affordability, choice, and value for money — through market mechanisms and incentive-based frameworks); the difficulty of implementing and enforcing complex tariff frameworks in a sector with complex multi-party supply chains; and the inadequacy of TRAI's enforcement capacity to deal with systematic non-compliance by the large number of local cable operators and multi-system operators in the broadcasting distribution chain.

The evolution of TRAI's broadcasting regulatory approach — from the price-intensive NTO model towards an outcomes-based, competition-oriented framework — is a necessary response to the limitations revealed by the NTO experience. An outcomes-based approach to broadcasting regulation would focus on ensuring: that consumers have access to a minimum tier of television services at affordable prices (addressing the universal service objective); that the broadcasting distribution market is competitive (addressing the competition objective, through structural measures and interconnection regulation rather than price controls); and that broadcasters and distribution platforms are not able to exploit market power to the detriment of consumers (through ex post abuse-of-dominance regulation by TRAI and CCI rather than ex ante price regulation). This approach would require TRAI to develop its competition economics capabilities and to work more closely with CCI on broadcasting market competition issues, but would ultimately produce a more durable and legally robust regulatory framework than the detailed price regulation approach of the NTO.

D.5 TRAI's International Engagements

TRAI's engagement with international regulatory organisations and peer regulators has expanded significantly over its two-and-a-half decades of existence. TRAI is a member of the Commonwealth Telecommunications Organisation (CTO), the Asia-Pacific Telecommunity (APT), the International Telecommunication Union (ITU), and various bilateral regulatory cooperation arrangements with counterpart regulators in the US (FCC), UK (Ofcom), European Union (BEREC), and other major markets. These international engagements enable TRAI to share regulatory experience, learn from international best practice, and contribute India's perspective to global regulatory debates. TRAI's active participation in APT's regulatory and technical committees provides India with a voice in regional spectrum and regulatory harmonisation processes that directly affect India's telecom sector.

TRAI's bilateral regulatory dialogues with the FCC and Ofcom have been particularly valuable in the context of emerging regulatory challenges including OTT regulation, net neutrality, 5G spectrum management, and cybersecurity. The FCC's experience with net neutrality regulation — which has oscillated between strong open internet rules and deregulation depending on the political composition of the Commission — provides cautionary lessons about the vulnerability of regulatory frameworks to political change. Ofcom's experience with converged regulation of telecommunications and broadcasting, and with the progressive withdrawal of ex ante price regulation in favour of competition-based approaches, provides a model of regulatory evolution that TRAI should study carefully as it develops its own regulatory framework for the convergent communications landscape. The development of formal MoUs and cooperation arrangements with peer regulators — providing a framework for sharing confidential regulatory information, including operator financial and network data, in the context of cross-border regulatory investigations — is an area where TRAI could deepen its international regulatory partnerships.

SUPPLEMENTARY NOTE E

TRAI Decisions: Extended Case Studies

E.1 The Spectrum Pricing Controversy: 2010–2023

India's spectrum auctions from 2010 onwards have been characterised by a persistent controversy about the appropriate level of reserve prices — the minimum prices at which the government will accept bids in each band and each circle. This controversy reflects a genuine and difficult regulatory challenge: spectrum is a unique resource with no obvious market comparator, its value is highly context-specific (depending on propagation characteristics, competitive dynamics, and subscriber density), and the timing and structure of auctions significantly affect the prices generated. The 2010 3G spectrum auction — the first post-2G Case competitive auction — generated very high prices, widely attributed to the pent-up demand from operators who had been unable to access 3G spectrum earlier. The 2012 2G re-auction following the cancellation of 122 licences generated significantly lower prices than anticipated, partly because the eligible bidder pool was smaller and partly because the market conditions had changed. These contrasting experiences illustrate the difficulty of calibrating reserve prices in a thin, infrequent auction market.

TRAI's methodological evolution in spectrum pricing recommendations from 2010 to the present reflects both the lessons learned from successive auctions and the development of the

economic methodology for spectrum valuation. The early recommendations relied heavily on international benchmarking — comparing per-MHz-per-pop prices in comparable markets globally — which produced estimates highly sensitive to the selection of benchmark countries and the definition of "comparable." The more recent recommendations incorporate demand modelling (estimating what operators should be willing to pay for spectrum given their projected subscriber growth and revenue per subscriber) and historical regression analysis (identifying the systematic relationships between spectrum prices and key market variables across India's auction history). The combination of these methodologies — each providing a cross-check on the others — produces more robust reserve price recommendations, though the inherent uncertainty in spectrum valuation means that the recommendations will always be contested by operators (who prefer lower prices) and government (which prefers higher revenue).

The 2022 5G spectrum auction — which generated Rs. 1.5 lakh crore in bids across ten frequency bands — is widely regarded as a successful auction that balanced reasonable pricing with broad operator participation and significant spectrum take-up. The liberalisation of payment terms (20-year assignment periods, instalment payment options) contributed to the auction's success by making the financial commitment more manageable for operators. The auction's outcome — with Reliance Jio, Bharti Airtel, and Vodafone Idea all acquiring spectrum in multiple bands, and Adani Data Networks entering as a new licensee for private 5G spectrum — demonstrated the effectiveness of a well-designed auction process in allocating spectrum efficiently while generating significant government revenue. The 2022 auction provides a model for future spectrum auctions under the Telecommunications Act, 2023's framework, though specific design choices (reserve prices, payment terms, eligibility criteria) will need to be adapted to the specific circumstances of each future auction.

E.2 The Net Neutrality Decision: Detailed Analysis

TRAI's 2016 Differential Pricing Regulations — the "net neutrality regulations" — were the product of one of the most extensive regulatory consultations in Indian history and embody principles of internet governance that have shaped India's digital economy for nearly a decade. The regulatory analysis underlying the 2016 Regulations was sophisticated: TRAI assessed both the consumer welfare implications of differential pricing (finding that zero-rating, while beneficial to specific content providers and to operators' commercial interests, was harmful to consumers' long-term internet experience by distorting their access to online content) and the competition implications (finding that differential pricing arrangements between operators and specific content providers would entrench the market position of large, established platforms at the expense of smaller competitors and new entrants that could not afford to participate in

zero-rating arrangements). This competition analysis — viewing net neutrality as an internet ecosystem competition policy tool as well as a consumer protection measure — elevated the 2016 Regulations beyond a simple price regulation measure into a foundational framework for India's internet economy.

The technical aspects of TRAI's net neutrality framework — specifically, the definition of "discriminatory" treatment of internet traffic and the boundary between prohibited discrimination and permissible traffic management — required careful regulatory design. TRAI's approach distinguishes between: content-based discrimination (prohibited — treating traffic differently based on the source, destination, content, or application generating the traffic); and technical traffic management (permitted — managing traffic based on objective technical criteria such as congestion status, quality-of-service parameters for specific classes of traffic, or security threat levels, without reference to the identity of the content provider). This distinction is consistent with the international net neutrality regulatory consensus (as reflected in the EU's Open Internet Regulation and the FCC's Open Internet Order) and provides a workable regulatory framework, though the boundary between prohibited content-based discrimination and permissible technical traffic management requires careful case-by-case analysis in specific network management contexts.

The monitoring and enforcement of net neutrality compliance requires TRAI to develop technical measurement capabilities that can identify prohibited traffic discrimination in real network conditions. Traditional regulatory tools (document review, site inspections) are insufficient for identifying discriminatory traffic treatment that is implemented algorithmically in network equipment and that may be applied selectively (for example, only during specific time periods or only to specific traffic types). The development of technical measurement systems — including active network measurement tools, passive traffic monitoring with appropriate privacy protections, and whistleblower mechanisms for receiving complaints from network engineers about discriminatory traffic management practices — is essential for effective net neutrality enforcement. TRAI's multi-stakeholder monitoring framework (described in Chapter 2 of the main text) is a step in this direction, but the development of TRAI's own technical measurement capabilities would further strengthen the enforcement framework.

E.3 Call Drop Regulation: Lessons for Regulatory Design

TRAI's Compensation for Call Drops regulation — introduced in 2015 and subsequently struck down by the Delhi High Court — provides important lessons for regulatory design and the limits of regulatory intervention in complex technical situations. The regulation was a response to a genuine consumer problem (high rates of call drops causing consumer frustration and

economic harm) that had significant political visibility (the Prime Minister had publicly raised the issue, generating enormous public and media pressure for regulatory action). The regulatory response — mandatory financial compensation to consumers for call drops attributable to network faults — was motivated by the intuition that making operators financially responsible for call drops would incentivise them to invest in network quality improvements. However, the regulation faced a fundamental technical problem: it was impossible, with available technology, to reliably attribute specific call drops to operator network faults (as distinct from subscriber device faults, radio propagation issues outside the operator's control, or interference from external sources). The mandatory compensation regime therefore created financial liability for operators for events they could not control, which the High Court found to be arbitrary and disproportionate.

The regulatory alternatives that TRAI could have pursued — and that would have been both more effective and more legally robust — include: requiring operators to publish call drop rates by network and geographic area (public disclosure as a market incentive); requiring operators to present specific call drop reduction plans with measurable milestones (outcome-based regulation with accountability for results); coordinating with DoT to accelerate spectrum releases (addressing the spectrum scarcity that was a primary cause of call drops); and working with handset manufacturers to improve device-side call management capabilities (addressing the device-side contribution to call drop rates). These alternatives — which address the root causes of the call drop problem rather than creating financial liability for its consequences — would have been more technically feasible, legally defensible, and commercially sustainable than the mandatory compensation approach. The call drop episode is thus a case study in the importance of technically grounded regulatory design: regulatory measures that are based on a misunderstanding of the technical causes of the problem they aim to address are likely to fail, regardless of the legitimacy of the consumer protection objective.

E.4 TRAI and the Digital Dividend: 700 MHz Band

The 700 MHz frequency band — the "digital dividend" spectrum released from terrestrial digital television broadcasting following the digitisation of terrestrial TV — is considered among the most valuable spectrum for mobile broadband connectivity because of its excellent propagation characteristics. At 700 MHz, radio waves travel further and penetrate buildings more effectively than at higher frequencies (such as 2100 MHz or 2300 MHz), making 700 MHz the preferred band for rural coverage and indoor coverage in buildings. For India — with its vast rural geography and its many users who access the internet primarily indoors through shared family smartphones — the commercial potential of 700 MHz for extending affordable broadband

connectivity is substantial. Yet the band remained largely unsold in India for several successive auctions (2016, 2021) due to reserve prices that the market found too high relative to the commercial value of the band in the prevailing competitive environment.

The finally successful allocation of 700 MHz spectrum in the 2022 auction — primarily to Reliance Jio and Bharti Airtel — reflects a combination of lower reserve prices (TRAI's recommendations and DoT's auction design set reserve prices at more commercially rational levels than in previous auctions), improved market conditions (the 5G auction's comprehensive band offering gave operators more reason to participate broadly), and the strategic importance of 700 MHz for the operators' 5G coverage strategies (700 MHz 5G NR will be the primary coverage layer for Jio's and Airtel's 5G networks in rural areas and lower-density urban locations). The commercial deployment of 700 MHz 5G — which began in 2023-24 as operators expanded their 5G rollout beyond the major cities — is expected to significantly improve rural mobile broadband coverage in India, potentially closing the urban-rural digital divide in broadband quality that has been one of the most persistent challenges for India's digital ambitions.

E.5 Consumer Protection in Practice: Case Studies

TRAI's consumer protection framework has been tested in several significant practical contexts that illustrate both the strengths and limitations of the current regulatory approach. The SIM card blocking controversy — in which DoT directed operators to block millions of SIM cards of subscribers who had not completed re-verification of their identity documents, leaving affected subscribers suddenly without mobile service — illustrates the tension between security objectives (ensuring all active SIMs are associated with verified identities) and consumer protection (ensuring subscribers receive adequate notice before their services are disrupted). The operational chaos created by sudden mass SIM blocking (millions of subscribers unable to make or receive calls without warning) demonstrated the importance of carefully designed implementation timelines and consumer notification processes for regulatory measures that affect service continuity.

The billing transparency dispute — arising from operators' practices of calculating data allowances in ways that did not match subscribers' reasonable expectations — illustrates the challenge of ensuring that complex bundled tariff plans are communicated clearly and enforced accurately. Subscribers who believed they had purchased a specific amount of data frequently found that the operator calculated their consumption differently (for example, rounding up data usage to the nearest megabyte, counting zero-rated services against data allowances in ways not disclosed in the promotional materials, or applying different data rates to different types of

traffic). TRAI's directions requiring clearer disclosure of data calculation methodologies, and TDSAT's decisions awarding compensation for systematic billing inaccuracies, have progressively tightened the billing transparency standards applicable to operators. The development of a standardised data usage reporting format — enabling subscribers to verify their actual data consumption against the operator's billing records — would further strengthen billing transparency and reduce the volume of billing disputes.

E.6 Tariff Forbearance: Assessment and Outlook

TRAI's progressive extension of tariff forbearance — removing price controls and allowing market forces to determine retail prices — to the vast majority of telecommunications services in India has been one of its most significant regulatory decisions with direct beneficial impacts on consumers. The philosophy underlying tariff forbearance is that price regulation is justified only when there is insufficient competition to protect consumers from exploitation of market power. In a competitive market — where multiple operators compete for the same subscribers and where switching costs are low (aided by MNP) — price regulation is unnecessary and may even be harmful (by constraining the commercial flexibility that operators need to offer innovative and attractive pricing schemes). TRAI's assessment that the Indian mobile market is sufficiently competitive to justify tariff forbearance for most services has been validated by the market outcomes: intense price competition (India has among the lowest mobile data prices in the world) has benefited consumers enormously, even as it has created financial pressure on operators.

The future of tariff forbearance in the Indian mobile market will depend on whether the three-player oligopoly that has emerged from the sector consolidation continues to provide effective competitive discipline. Economic theory suggests that in a three-player oligopoly with high barriers to entry, competitive dynamics may weaken over time as operators' pricing strategies become more coordinated (either through explicit or implicit collusion) and as the pressure to compete aggressively on price diminishes. TRAI's monitoring of competitive conditions — through its market monitoring reports, its analysis of porting volumes, and its assessment of average revenue per user trends — provides the regulatory intelligence needed to identify if and when the competitive dynamics in the mobile market weaken to the point where tariff forbearance is no longer appropriate. A reversal of tariff forbearance — reintroducing price controls for specific services if competition weakens — would require a new TRAI consultation and recommendation process, and would be commercially and politically significant given the deep market impact of the current forbearance regime.

SUPPLEMENTARY NOTE F

TRAI's Regulatory Record: Extended Analysis

F.1 The Broadband Policy Evolution

India's broadband policy has evolved from the definition of broadband as a minimum of 256 Kbps in the early 2000s to the current standard of 512 Kbps (as defined in the 2004 policy, later updated to 2 Mbps and then to the ITU's Gigabit Broadband Vision). TRAI's successive consultation papers on broadband — addressing technology options, quality standards, pricing, and policy frameworks — have charted the evolution of India's broadband ecosystem through the transitions from DSL and cable broadband (the dominant technologies of the 2004-2015 era) to mobile broadband on 3G and then 4G/LTE networks (the dominant mode from 2010 onwards), and now to fibre broadband (FttH and FttC) and 5G fixed wireless access. Each technology transition has required TRAI to update its quality of service standards (to reflect the very different performance characteristics of each technology), its licensing and reporting frameworks (to accommodate new categories of service provider), and its consumer protection framework (to address the specific issues arising from each technology's deployment model and service characteristics).

TRAI's most significant broadband regulatory intervention was its recommendation in 2016 that all internet access services should be subject to non-discriminatory pricing — effectively prohibiting zero-rating — which represented a decisive rejection of the business models proposed by Facebook (Free Basics) and several operators that would have provided free access to a curated subset of internet services. The reasoning for this decision — that differential pricing, even if offered with good intentions, would distort the internet ecosystem by favouring established platforms over innovative new entrants and by giving operators the power to determine which services their subscribers could afford to access — reflects a sophisticated understanding of how platform economics and network effects shape the internet industry. The 2016 decision has been influential internationally: it is cited in academic literature on net neutrality and digital development as an example of developing-country regulatory innovation that challenged the assumptions embedded in digital platform business models.

The development of a broadband quality measurement framework — determining how broadband service quality should be defined, measured, and enforced in a market characterised by shared infrastructure, variable technology performance, and enormous geographic diversity — has been one of TRAI's most technically challenging regulatory tasks. The tension between what operators advertise (headline speeds that are achievable only in ideal conditions), what subscribers experience (typically a fraction of the advertised speed due to shared infrastructure,

network congestion, device limitations, and distance from the infrastructure), and what TRAI can credibly measure and enforce (using available measurement tools and methodologies) has persisted since the beginning of broadband regulation. TRAI's evolving approach — including mandating disclosure of "typical speeds" (rather than just maximum speeds) in broadband advertisements, requiring operators to publish network performance data, and using crowd-sourced measurement data to complement operator self-reports — has improved the accuracy of consumer information about broadband performance without yet fully resolving the gap between advertised and experienced service quality.

F.2 Satellite Broadband: TRAI's Recommendations

TRAI's engagement with satellite broadband regulation — through multiple consultation papers addressing VSAT licensing, spectrum management for satellite services, and the emerging framework for LEO satellite broadband — reflects the growing importance of satellite technology as a complementary modality for India's universal connectivity agenda. TRAI's 2022 consultation paper on the regulatory framework for satellite broadband services was the most comprehensive regulatory engagement with the satellite broadband issue to date, addressing: the appropriate spectrum allocation mechanism for satellite broadband services (administrative allocation vs. auction); the licensing framework for satellite broadband providers; the quality of service standards applicable to satellite broadband; the consumer protection obligations of satellite broadband providers; and the role of satellite broadband in India's universal connectivity programmes. TRAI's recommendations on these issues — when finalised and acted upon by DoT — will shape the legal and regulatory environment for what is expected to be a rapidly growing segment of India's broadband market.

The spectrum auction controversy for satellite broadband services — specifically whether the Telecommunications Act, 2023's requirement for auction of "commercial satellite communication services" (First Schedule) requires LEO satellite broadband providers to bid for spectrum in competitive auctions — is the most commercially consequential regulatory question for the sector. TRAI's 2022 recommendations favoured an administrative allocation approach for satellite communications spectrum, arguing that the specific technical characteristics of satellite communications (including the need for ITU coordination and the non-exclusive use of frequencies by multiple satellite systems in the same band) made a traditional competitive auction format technically and legally problematic. The competing recommendation — from operators and industry groups representing commercial spectrum auction interests — argued that administrative allocation would amount to a subsidy to satellite broadband providers (who would avoid the financial costs of spectrum auctions paid by terrestrial mobile operators) and

would violate the constitutional mandate for transparent, competitive allocation of public resources. DoT's eventual decision on this question — expected through the spectrum auction rules under the 2023 Act — will be closely watched by both the satellite industry and terrestrial operators.

TRAI's consumer protection framework for satellite broadband services will need to address several specific issues that do not arise for terrestrial broadband. The coverage commitment challenge — how to define and verify the service area committed by a satellite broadband provider, given that satellite coverage is inherently continuous over large geographic areas rather than point-specific — requires different measurement and verification methodologies than those used for terrestrial mobile or fixed broadband. The performance standard challenge — LEO satellite broadband's latency (20-40 ms), while much better than GEO satellite, remains higher than fibre broadband (1-5 ms) and varies with atmospheric conditions and satellite constellation load — requires nuanced quality standards that reflect LEO satellite's specific technical characteristics rather than applying terrestrial broadband standards that LEO cannot meet. And the pricing transparency challenge — ensuring that subscribers understand the data caps, fair use policies, and performance management provisions that satellite broadband providers typically apply — requires specific consumer disclosure standards for satellite services.

F.3 OTT Consultation: 2015 to Present

TRAI's consultation on over-the-top services — initiated in 2015 with its Consultation Paper on Regulatory Framework for Over-the-Top (OTT) Communication Services — marked the beginning of a regulatory engagement with the OTT question that has continued through multiple consultation rounds without reaching a definitive regulatory conclusion. The 2015 consultation sought stakeholder views on the regulatory asymmetry between OTT communication services and licensed telecom services, and received unprecedented public engagement (over one million submissions, the majority from OTT users who were concerned about the potential implications of OTT regulation for the availability and cost of OTT services). TRAI's analysis of the submissions and the subsequent recommendations process revealed the fundamental complexity of the OTT regulatory question: the economic, technical, and social dimensions are deeply interrelated, and there is no simple regulatory solution that fully satisfies all stakeholders.

The subsequent TRAI consultations on OTT regulation — in 2018 (on a reference from DoT following the Telecommunications Act, 2023's legislative process) and in 2022-23 (addressing specific aspects of OTT policy including privacy, security, and lawful access) — have progressively developed the regulatory analysis without reaching a final determination. The 2018 consultation addressed whether OTT communication services should be subject to a

"light-touch" regulatory framework imposing security and emergency access obligations without financial charges, or whether full regulatory parity (including licence fees) should be applied. TRAI's 2020 discussion paper on the same subject proposed a nuanced framework distinguishing between different categories of OTT service and imposing proportionate obligations based on the degree of substitutability with licensed services and the specific regulatory concerns (security, consumer protection, lawful access) relevant to each category.

The legal basis for TRAI's authority to recommend OTT regulation — specifically, whether TRAI's mandate under the TRAI Act, 1997 extends to OTT communication services that are not provided by licensed operators — is itself a contested question. TRAI's mandate is to regulate "telecom services" as defined in the TRAI Act, and whether OTT communication services fall within that definition (as argued by TRAI and supported by the Telecommunications Act, 2023's broad definition of "telecommunication services") or fall outside it (as argued by some OTT providers who contend that they provide internet application services, not telecommunications services) determines whether TRAI has authority to directly regulate OTT services or whether it can only recommend regulatory action to the Central Government. The Telecommunications Act, 2023's broad definition of "telecommunication services" — which explicitly includes communication services provided over the internet — has significantly strengthened the legal basis for TRAI's involvement in OTT regulation, though the specific scope and content of any OTT regulatory framework will be determined through the consultation and recommendation process.

F.4 Tariff Review: The Methodology Debate

TRAI's review of retail tariffs — determining whether the retail prices of telecommunications services (particularly mobile broadband and voice) are adequate, excessive, or predatory — involves a methodological debate about the appropriate standard for tariff assessment. The relevant methodological options include: cost-based tariff assessment (comparing retail prices to the estimated cost of service provision, flagging prices below cost as potentially predatory and prices significantly above cost as potentially exploitative); benchmarking (comparing Indian prices to prices in comparable international markets, using international price comparisons to assess whether Indian tariffs are in the appropriate range); demand-side assessment (evaluating whether the combination of price and quality of service provides consumers with adequate value for money, based on consumer satisfaction surveys and willingness-to-pay analysis); and competition-based assessment (relying on the competitive dynamics of the market to ensure that prices are at competitive levels, and intervening only when competition is insufficient to protect consumers from exploitation).

India's mobile broadband prices — among the lowest in the world on a per-GB basis — reflect the extreme competitive intensity that followed Reliance Jio's market entry in 2016, which triggered an industry-wide repricing that reduced data prices by approximately 95% over a period of two years. While extremely low prices benefit consumers in the short term, TRAI has been alert to the concern that prices below cost are unsustainable in the long term and may contribute to the financial distress of operators that cannot fund the network investment needed to maintain quality of service. TRAI's assessment of whether a specific tariff level is sustainable requires analysis of each operator's unit economics — the relationship between revenue per subscriber, the cost of serving that subscriber (including network depreciation, spectrum charges, licence fees, and operating costs), and the required return on investment to justify continued network investment. This analysis is commercially sensitive (requiring access to operator financial data that is not publicly available) and methodologically complex (requiring assumptions about cost allocation, depreciation, and required return that operators and TRAI often disagree on).

The introduction of minimum tariff floors — preventing operators from pricing below a minimum level that ensures recovery of a defined cost base — is the regulatory tool TRAI uses when it concludes that prices have fallen to unsustainably low levels. TRAI introduced a minimum tariff floor for voice calls in 2019 (a minimum rate per minute for mobile voice calls, below which operators were not permitted to price) in response to concerns about predatory pricing following the market entry of Reliance Jio. The legal basis for tariff floors — specifically, whether TRAI's power to "fix the terms and conditions" of tariffs under Section 11(1)(b) of the TRAI Act includes the power to fix minimum tariffs as well as maximum tariffs — was affirmed in subsequent TDSAT proceedings, establishing the principle that TRAI's tariff regulatory powers include the power to prevent unsustainably low pricing as well as to prevent excessive pricing. The appropriate level of minimum tariff floors — and the criteria for determining when competitive pricing has crossed into predatory pricing — remains an area of significant regulatory and academic debate.

F.5 QoS Benchmarks: Setting the Standards

TRAI's Quality of Service benchmarks — the minimum performance standards that operators must meet for various service attributes including call completion rate, call drop rate, data speed, latency, and customer care response times — have been progressively updated since TRAI's first QoS regulations in 2000 to reflect the evolving technology landscape and rising subscriber expectations. The current QoS benchmarks, specified in TRAI's Quality of Service of Broadband Service Regulations (2006, as amended) and the Quality of Service (Code of Practice for Customer Care) Regulations, reflect both the technical performance achievable on

modern networks and the minimum service quality that subscribers can reasonably expect. Setting appropriate QoS benchmarks requires TRAI to: assess the current state of network performance across different operators and geographies; determine what performance levels are technically and commercially achievable within the current network infrastructure; consult with operators (who have an interest in achievable, not aspirational, standards) and consumer groups (who have an interest in higher standards); and design standards that can be practically measured and enforced using available tools.

The technology-neutrality principle in QoS standard-setting creates a practical challenge: different access technologies have inherently different performance characteristics that make a single set of QoS benchmarks difficult to apply fairly. Fibre broadband, 4G mobile broadband, 5G mobile broadband, fixed wireless access, and satellite broadband all have very different latency, throughput, and reliability profiles. Applying a single minimum speed standard (e.g., "at least 25 Mbps") to all broadband technologies would make satellite broadband (with its higher latency) non-compliant for latency-sensitive applications even though it may provide acceptable speeds; and would fail to fully exploit the performance potential of fibre broadband (which can easily deliver gigabit speeds far above any minimum standard). A technology-specific or tiered QoS framework — with different standards for different technology tiers while ensuring minimum standards across all tiers — would be more reflective of the actual performance potential and limitations of each technology, and would better serve the regulatory objective of ensuring that subscribers receive the quality of service they are paying for.

The enforcement of QoS benchmarks against non-compliant operators — determining what financial penalties or operational remedies are appropriate for systematic performance below benchmark levels — requires TRAI to develop a calibrated enforcement approach that is proportionate to the severity and persistence of non-compliance. Operators may fail to meet QoS benchmarks for reasons within their control (insufficient network investment, poor operational management) or for reasons outside their control (spectrum scarcity, right-of-way delays preventing tower deployment, severe weather events). TRAI's enforcement approach must distinguish between these categories: systematic non-compliance attributable to operator choices should attract meaningful financial penalties and operational remediation requirements; non-compliance attributable to external factors beyond the operator's control should trigger investigation and potentially regulatory assistance (to address the underlying regulatory constraint) rather than financial penalties. The development of clear enforcement guidelines — published by TRAI to guide both operators' compliance planning and TRAI's enforcement decisions — would improve the predictability and fairness of the QoS enforcement process.

F.6 Regulatory Sandbox: TRAI's Role

TRAI's potential role in India's telecommunications regulatory sandbox — established under Section 32 of the Telecommunications Act, 2023 — is to provide regulatory advice and recommendations on the conditions applicable to sandbox participants and to evaluate the outcomes of sandbox tests for the purpose of making recommendations on permanent regulation. As the telecommunications sector regulator with responsibility for recommending standards and consumer protection measures, TRAI is well positioned to: assess applications for sandbox participation and recommend the specific regulatory relaxations appropriate for each sandbox experiment; design evaluation criteria for assessing the outcomes of sandbox tests against the regulatory objectives of the proposed service or technology; and translate successful sandbox outcomes into regulatory recommendations for full-scale deployment. TRAI's participation in sandbox governance will also help ensure that sandbox experiments are designed in ways that generate useful regulatory data — testing specific regulatory hypotheses rather than merely providing commercial cover for operators and technology companies to deploy innovative services without regulatory oversight.

The sandbox framework under the 2023 Act is potentially most valuable for addressing the regulatory uncertainty around emerging communications technologies and business models that do not fit neatly within existing regulatory categories. AI-based network management systems (which raise questions about regulatory oversight of AI-driven decisions that affect service quality and content access), integrated terrestrial-satellite connectivity services (which raise questions about the applicable regulatory framework for hybrid network deployments), and novel OTT communication service architectures (which raise questions about the licensing obligations applicable to services that provide both traditional telecom functions and internet application functions) are examples of use cases where a sandbox environment could enable regulatory learning before formal regulatory frameworks are established. TRAI's engagement with sandbox applications in these areas — and the development of regulatory guidelines based on sandbox experience — would significantly improve India's capacity to regulate emerging technologies in a timely and evidence-based manner.

F.7 Interconnection: The Future Framework

The future framework for telecommunications interconnection in India — governing how different operators' networks connect with each other to enable end-to-end communications — must evolve to address the growing complexity of the interconnection landscape. Traditional interconnection regulation was designed for a world of circuit-switched telephone networks, where interconnection involved physical connections between switching centres and the

exchange of telephone traffic at defined points of interconnection (POIs). The shift to IP-based networks (in which all communications — voice, video, and data — are carried as IP packets) has fundamentally changed the technical nature of interconnection, enabling peering and transit arrangements that route traffic flexibly across the internet rather than through defined circuit-switched interconnection points. The regulatory framework for IP interconnection — determining the conditions on which operators must interconnect their IP networks, the pricing of IP traffic exchange, and the quality of service standards applicable to IP interconnection — is less well developed than the circuit-switched interconnection framework it is progressively replacing.

TRAI's engagement with IP interconnection regulation has been gradual: its primary regulatory focus has been on the IUC (interconnection usage charge) for voice call termination, rather than on the broader IP network interconnection framework. The development of a comprehensive IP interconnection regulatory framework — addressing: the conditions on which operators must interconnect their IP networks; the pricing of IP transit and peering; the quality of service standards for IP interconnection; the handling of IP interconnection disputes; and the application of the non-discrimination principle to IP interconnection — is a significant regulatory gap that the Telecommunications Act, 2023's implementing rules should address. The international experience with IP interconnection regulation — particularly the "net neutrality" analysis of interconnection arrangements (addressing whether operators can manipulate interconnection quality to disadvantage specific content providers) and the "open internet" analysis of peering disputes (addressing whether dominant operators can use their market power in IP interconnection to extract anti-competitive payments from interconnecting parties) — provides relevant precedent for India's IP interconnection regulatory framework.

SUPPLEMENTARY NOTE G

TRAI's Legal Framework: Advanced Analysis

G.1 TRAI's Information Powers and Operator Obligations

TRAI's power to collect information from licensed operators — essential for the evidence-based regulation that TRAI is mandated to provide — is governed by Section 11(1)(d) of the TRAI Act, which empowers TRAI to "lay down the standards of quality of service to be provided by the service providers" and Section 12, which empowers TRAI to "call for such information as TRAI may require" from service providers. These information-gathering powers are supplemented by the information requirements built into operators' licence conditions, which

require operators to submit periodic performance reports (quarterly QoS reports, subscriber reports, and financial reports for AGR computation purposes) on prescribed forms and within specified timelines. The legal framework for TRAI's information powers has been tested in several TDSAT proceedings where operators have challenged specific information requests as exceeding TRAI's statutory authority (for example, requests for commercially sensitive information about contractual arrangements with content providers or about network architecture details that the operator treats as proprietary). TDSAT has generally upheld TRAI's information requests where they are directed at information reasonably required for TRAI's regulatory functions, while recognising that TRAI must comply with confidentiality obligations when operators provide commercially sensitive information under protest. The development of a clear framework — specifying what categories of information TRAI may require, the procedures for submitting information under confidentiality protections, and the circumstances in which TRAI may disclose received information (including to the public and to other regulatory authorities) — would improve the clarity and predictability of TRAI's information-gathering activities and reduce the frequency of disputes about the scope of information requests. The Telecommunications Act, 2023's provisions on information collection by the Central Government and TRAI will complement this framework, potentially providing a stronger statutory basis for information requirements and clearer confidentiality protections than are available under the existing TRAI Act framework.

G.2 The Principles Governing TRAI's Consultation Process

TRAI's consultation process — through which it seeks stakeholder views before making regulatory decisions — is both a statutory requirement (under the TRAI Act's provisions for consultation with licensed service providers) and an expression of the administrative law principles of procedural fairness that govern the exercise of public regulatory powers. The quality of the consultation process is a primary determinant of the legitimacy and legal robustness of TRAI's regulatory decisions: a decision made without adequate consultation — or made in a way that ignores or inadequately considers the submissions received — is vulnerable to challenge before TDSAT as being procedurally defective. The key procedural requirements for a valid TRAI consultation include: publication of a sufficiently detailed consultation paper that enables stakeholders to understand the regulatory question and to make informed submissions; provision of an adequate period for submissions (TRAI typically provides four to six weeks for initial submissions and two to three weeks for counter-submissions); genuine consideration of all submissions received (not merely a formal acknowledgement); and a reasoned explanation in the Recommendations or Order of how TRAI has assessed the submissions and why it has

reached the conclusions it has. The requirement for genuine consideration is particularly important: TRAI cannot achieve the appearance of a fair process without the substance — a consultation paper that presents TRAI's predetermined conclusion as a fait accompli, and an Order that dismisses operator submissions with perfunctory analysis, will not survive judicial scrutiny in TDSAT. The development of TRAI's consultation procedures — including more structured submissions processes (using prescribed formats that facilitate systematic comparison of submissions from different stakeholders), more transparent publication of consultation data (including summary analyses of the submissions received), and more detailed reasoning in TRAI's final Recommendations and Orders — would improve both the quality of regulatory outcomes (by enabling better integration of stakeholder information into decision-making) and the legal robustness of TRAI's decisions (by demonstrating genuine engagement with the submissions received).

G.3 TRAI's Regulatory Accounts Framework

TRAI's regulatory accounts framework — the system of financial reporting by licensed operators that enables TRAI to verify the accuracy of licence fee and spectrum usage charge computations, and to assess the financial performance of individual services and geographic areas for regulatory analysis purposes — is one of the most technically demanding and commercially sensitive dimensions of TRAI's regulatory activities. Regulatory accounts differ from statutory financial accounts: while statutory accounts (prepared under the Companies Act, 2013 and the accounting standards thereunder) present the financial position and performance of the company as a whole, regulatory accounts seek to disaggregate the company's financial performance by service, technology, and geographic area, enabling the regulator to assess the economics of specific services and markets in isolation. The preparation of regulatory accounts for a major multi-service telecom operator — separating the costs and revenues attributable to mobile broadband, mobile voice, fixed broadband, NLD, ILD, managed services, and various enterprise services, across 22 telecom circles — requires extensive cost allocation work based on prescribed methodologies. The cost allocation methodologies used in regulatory accounts — including the allocation of common network costs (such as the cost of backbone transmission infrastructure that is used by multiple services) between services using prescribed drivers (such as traffic volumes, subscriber counts, or network element usage) — are methodologically complex and are often disputed between TRAI and operators who prefer alternative allocation approaches that produce more commercially favourable results for the services subject to the most intensive regulatory scrutiny. The legal framework for TRAI's regulatory accounting requirements — including the power to require operators to prepare and submit regulatory

accounts in prescribed formats, to have them audited by TRAI-approved auditors, and to use the data in regulatory decision-making — is part of the information-gathering framework discussed in the preceding section. The development of a standardised, publicly available regulatory accounting manual — specifying the accounting policies, cost allocation methodologies, and reporting formats that operators must use for regulatory accounts — would improve the consistency, comparability, and regulatory utility of regulatory accounts submissions across the sector.

G.4 The Role of Industry Associations

Industry associations — COAI (Cellular Operators Association of India, representing GSM and 5G operators), AUSPI (Association of Unified Service Providers of India, representing CDMA and unified licence operators), ISPAI (Internet Service Providers Association of India, representing ISPs), TEMA (Telecom Equipment Manufacturers Association, representing equipment vendors), and newer bodies representing satellite operators, IoT service providers, and tower companies — play an important role in India's telecommunications regulatory process as organised voices for different segments of the industry in TRAI consultations, DoT proceedings, and parliamentary committee engagements. The legal status and institutional capacity of industry associations in the regulatory process is primarily that of consultees: their submissions to TRAI consultations, their representations to DoT on policy matters, and their testimony before parliamentary committees are inputs to regulatory and legislative decision-making rather than binding determinations. However, the practical influence of well-organised, technically credible industry associations on regulatory outcomes is significant: TRAI's consultation process explicitly includes industry associations among its primary consultees, and associations' technical expertise (in translating complex network engineering considerations into accessible regulatory arguments) and institutional continuity (maintaining institutional memory across multiple rounds of consultation on related issues) make them important participants in the development of regulatory policy. The legal framework for industry association participation in TRAI proceedings — including the standing of associations to bring TDSAT petitions on behalf of their members — has been addressed in several TDSAT decisions, which have generally recognised associations' standing to represent the collective interests of their members in regulatory disputes while requiring that specific legal challenges be brought by the individual operators most directly affected. The development of a more structured framework for industry association engagement in the regulatory process — including formal consultation rights, defined timelines for submissions, and specific mechanisms for pre-consultation engagement on complex technical matters — would improve the quality of input available to

TRAI and DoT while maintaining the regulator's ultimate authority to make independent regulatory decisions in the public interest.

G.5 TRAI's Enforcement History

TRAI's enforcement history — the practical record of how TRAI has exercised its powers to enforce compliance with its regulations and directions — reflects both the strengths and weaknesses of the pre-2023 Act enforcement framework. TRAI's primary enforcement tools under the TRAI Act, 1997 are: directions to operators under Section 13 (which are legally binding); recommendations to DoT for enforcement action under the licence conditions (where TRAI's own enforcement powers are limited); and referral to TDSAT for adjudication of disputes. The most commercially significant enforcement actions have been in the context of quality of service non-compliance (where TRAI has issued directions requiring operators to improve specific performance metrics and has referred persistent non-compliance to DoT for licence condition enforcement action) and in the context of tariff order compliance (where TRAI has directed operators to modify non-compliant tariff plans and to reimburse subscribers for overcharges). The limitations of the pre-2023 Act enforcement framework have been widely acknowledged: TRAI's own enforcement powers are primarily directive (it can tell operators what they must do but cannot itself impose financial penalties), and the referral of enforcement matters to DoT for licence action creates delays and potential inconsistencies. The Telecommunications Act, 2023's civil penalty framework — with TRAI able to initiate penalty proceedings before the Adjudicating Officer — significantly strengthens TRAI's enforcement arsenal and should improve the speed and effectiveness of enforcement action against non-compliant operators. The development of a coherent enforcement strategy for TRAI under the new framework — specifying the circumstances that warrant each category of enforcement response, the timeline for escalation from advisory to formal enforcement, and the standards for calculating civil penalty amounts — will be essential for ensuring that the new enforcement powers are used effectively and proportionately.

G.6 Spectrum Governance and SACFA

The Standing Advisory Committee on Radio Frequency Allocation (SACFA) — the inter-ministerial body that coordinates India's national frequency allocation planning — is a critical but often overlooked institution in India's telecommunications governance architecture. SACFA's mandate is to develop and maintain the National Frequency Allocation Plan (NFAP), which specifies the frequency bands allocated to different categories of radio services (telecommunications, defence, broadcasting, meteorology, navigation, scientific research, and others). SACFA's composition — typically chaired by the Secretary (Telecommunications) with

representation from the Ministry of Defence, the Department of Space, the Ministry of Information and Broadcasting, the Ministry of Civil Aviation, the India Meteorological Department, and other major spectrum users — reflects the multi-sector nature of spectrum management. The SACFA process for updating the NFAP involves: review of new frequency needs submitted by the different spectrum user communities; technical studies by the Wireless Planning and Coordination (WPC) Wing on the feasibility of proposed new allocations; coordination with India's ITU delegation on the international frequency allocation frameworks; and inter-agency negotiation to resolve conflicts between competing claims on specific frequency bands. The legal status of the NFAP — as a regulatory instrument that binds all spectrum users in India to the allocated uses of specific frequency bands — is established under the Indian Wireless Telegraphy Act, 1933 and will be carried forward under the Telecommunications Act, 2023. SACFA's decision-making process — which is not fully transparent (SACFA meeting records are not published) and which operates without formal public consultation mechanisms — has been identified by telecom industry associations and civil society as an area where greater transparency would improve the quality and legitimacy of spectrum planning decisions. The development of a more transparent SACFA process — including publication of SACFA meeting agendas and minutes (with appropriate redaction of sensitive national security material), a formal public consultation stage for proposed NFAP changes, and a published schedule for periodic NFAP reviews — would improve public confidence in India's spectrum governance and potentially improve the quality of spectrum planning decisions by enabling broader industry input.

SUPPLEMENTARY NOTE H

TRAI Practice: Selected Regulatory Domains

H.1 TRAI's Spectrum Pricing Methodology: A Technical Account

TRAI's recommendations on reserve prices for spectrum auctions are the single most commercially consequential regulatory output TRAI produces, directly affecting the financial burden on operators and the government's revenue from the telecommunications sector. The methodology TRAI uses to arrive at reserve price recommendations has evolved significantly over successive auction cycles, incorporating lessons from each auction's outcomes. In its earlier recommendations (2010–2014), TRAI relied heavily on international benchmarking — selecting a reference set of comparable markets and deriving India-specific reserve prices by adjusting international prices for differences in purchasing power parity, subscriber density, and spectrum band propagation characteristics. This methodology was criticised for being overly

sensitive to the selection of benchmark countries (which could be chosen to support higher or lower recommendations) and for failing to capture India's unique market dynamics. In subsequent recommendation rounds, TRAI supplemented benchmarking with demand-side financial modelling — estimating the maximum amount an operator would rationally pay for spectrum given its projected revenue per subscriber, subscriber growth trajectory, and cost structure, and using this "maximum willingness to pay" as an upper bound on reserve prices. The combination of international benchmarking (providing a market comparator) and financial modelling (providing an operator economics perspective) produces more robust recommendations than either approach alone, though the two methodologies sometimes produce divergent results that require TRAI to exercise judgment in setting the final recommendation. The 2022 5G auction demonstrated the methodology's maturity: reserve prices were set at levels that cleared the market (with significant spectrum sold in all major bands) while generating substantial government revenue, suggesting that the calibration was broadly correct. TRAI's ongoing development of its spectrum pricing methodology — incorporating experience from India's auctions and from international auction markets — is essential for maintaining the quality of its recommendations as new frequency bands are prepared for commercial use in the 5G and 6G era.

The reserve price controversy for millimetre-wave spectrum — the high-frequency bands above 24 GHz that are critical for 5G's ultra-high-capacity applications — illustrates the methodological challenges of spectrum pricing for bands with limited comparable auction data. The 26 GHz band (24.25–27.5 GHz), the primary 5G mmWave band for India's market, was offered in India's 2022 5G auction with reserve prices recommended by TRAI based on early international mmWave auction results from the United States, Italy, Germany, and other markets. However, the commercial success of 5G mmWave in these markets has been more limited than initially projected — partly because mmWave's very short range requires very dense small cell deployment that is expensive and difficult to achieve at scale — leading some analysts to argue that reserve prices based on early optimistic projections of mmWave commercial demand are too high. The take-up of mmWave spectrum in India's 2022 auction — with Reliance Jio acquiring significant mmWave capacity in major cities — suggests that the pricing was broadly acceptable to operators, though the commercial deployment of mmWave services in India is still in its early stages and the ultimate commercial value of the band will depend on the pace of 5G mmWave device and service development. TRAI's future mmWave reserve price recommendations must balance the risk of setting prices too high (discouraging purchase, resulting in spectrum lying unused) against the constitutional imperative to maximise revenue from scarce public resources.

The interaction between TRAI's spectrum reserve price recommendations and the actual auction outcomes — and specifically the implications of significant deviations between recommended reserve prices and actual clearing prices — creates a complex feedback loop for regulatory learning. When auction clearing prices significantly exceed reserve prices (indicating that the reserve was set too low, potentially undervaluing the spectrum), TRAI faces criticism for failing to generate adequate government revenue. When clearing prices are close to reserve prices or when significant spectrum is unsold (indicating that the reserve was set close to or above market value), TRAI faces pressure to lower reserve prices in future auctions. The asymmetry in these pressures — with the government more concerned about revenue maximisation and operators more concerned about affordability — means that TRAI's reserve price recommendations must navigate between conflicting political and commercial interests while maintaining its analytical independence. The development of a formal post-auction review process — in which TRAI systematically analyses each auction's outcomes against its pre-auction assumptions and updates its methodology for future auctions — would improve the institutional learning from India's auction experience and strengthen the evidence base for future reserve price recommendations. Such a review process should be published, enabling independent academic and industry assessment of TRAI's methodology and contributing to the broader understanding of spectrum auction design in emerging markets.

H.2 TRAI and the Broadcasting Distribution Sector

TRAI's regulatory jurisdiction over broadcasting distribution platforms — cable television MSOs (Multi-System Operators), DTH (Direct-to-Home) operators, IPTV providers, and related distribution entities — is an often-overlooked dimension of TRAI's mandate that involves a distinct set of regulatory challenges from its better-known mobile and fixed broadband regulatory activities. The broadcasting distribution sector serves over 200 million television households in India through a multi-layered distribution chain: content is produced by broadcasters (channels), aggregated by broadcasters into bouquets, distributed to regional MSOs through satellite and fibre distribution, retailed by local cable operators (LCOs) to individual households, and supplemented by DTH services (serving households with direct satellite receivers) and emerging IPTV services (delivered through broadband connections). TRAI's regulatory interventions in this sector — most notably through successive iterations of the New Tariff Order (NTO) — have sought to ensure that subscribers have access to a broad range of channels at affordable prices, that broadcasters and distributors are treated fairly in their commercial negotiations, and that the distribution market remains competitive.

The New Tariff Order (NTO) framework, in its original 2019 form and subsequent modifications, requires broadcasters to offer each channel at a maximum retail price (MRP) that they declare, and requires distributors to offer consumers a base package of free-to-air channels supplemented by a la carte and bouquet options at prices that cannot exceed the broadcasters' declared MRPs. The framework was designed to increase consumer choice (by enabling a la carte selection rather than forced bundling), improve price transparency (through mandatory MRP disclosure), and prevent discriminatory pricing (by requiring non-discriminatory wholesale prices to all distribution platforms). In practice, implementation of the NTO has been operationally complex — the large number of television channels in India (over 900 registered channels) and the diversity of distribution platforms have created significant compliance challenges for both broadcasters and distributors. TRAI's enforcement of NTO compliance — monitoring for undisclosed bundling arrangements, below-MRP wholesale offers, and discriminatory pricing practices — requires ongoing regulatory vigilance that tests the limits of TRAI's enforcement capacity.

The commercial structure of the cable television distribution sector — characterised by a large number of small LCOs (local cable operators) with limited commercial and technical sophistication, served by a smaller number of MSOs that provide them with programming and technical infrastructure — creates regulatory complexity that the NTO framework has not fully resolved. LCOs' commercial relationships with MSOs are often informal and poorly documented, making enforcement of prescribed pricing and non-discrimination conditions difficult. The "carriage fee" phenomenon — in which broadcasters pay MSOs and DTH operators for the carriage and placement of their channels, effectively reversing the economic model where distributors should pay for content they then retail to subscribers — is a commercial practice that sits uneasily with the NTO's intended transparent pricing framework. TRAI's engagement with the carriage fee issue — specifically the question of whether carriage fees constitute a form of commercial discrimination against channels that cannot afford to pay — has resulted in regulatory guidance but not a definitive prohibition, reflecting the difficulty of drawing a clear regulatory line between legitimate commercial arrangements and anti-competitive exclusionary practices.

H.3 Consumer Protection: The Grievance Framework

TRAI's Telecom Consumers Protection Regulations and the associated Telecom Consumer Grievance Redressal Regulations provide the framework for the multi-tier consumer complaint handling system applicable to telecom operators in India. The framework establishes a three-tier escalation structure: first, the consumer must approach the operator's call centre (which must

resolve the complaint within specified timelines or provide a tracking number); if unsatisfied, the consumer can escalate to the operator's designated Appellate Authority; and if still unsatisfied, can approach the Telecom Consumer Grievance Redressal Forum (CGRF) established by the operator under TRAI's supervision. TRAI's monitoring of compliance with the grievance framework — tracking the number and type of complaints received, the resolution rates, the escalation rates, and consumer satisfaction with the resolution — provides important intelligence about the nature and scale of consumer protection problems in the sector. The quarterly telecom consumer complaint data published by TRAI — by operator, by complaint category, and by resolution outcome — enables consumers to assess operators' comparative complaint handling performance and creates reputational pressure for improvement.

The effectiveness of the telecom consumer grievance redressal framework has been assessed in multiple studies and TRAI consultations, with broadly consistent findings: the first-tier call centre resolution process works reasonably well for simple billing and service queries, but becomes less effective for more complex technical problems and for systemic issues (such as persistent coverage problems in a specific geographic area). The Appellate Authority tier — which should provide an independent review of unresolved first-tier complaints — is perceived by consumers as insufficiently independent (since it is operated by the operator whose decision is being reviewed) and insufficiently empowered (since it lacks the power to award significant financial compensation). The CGRF tier — which provides operator-level forums for formal adjudication of individual consumer disputes — addresses the independence problem but has not achieved the scale of operation needed to handle the volume of disputes that operators generate. The development of a more effective, truly independent grievance mechanism — potentially operated by an industry body or a TRAI-supervised independent entity — would improve consumer access to justice for telecommunications disputes without overloading TDSAT with individual consumer matters.

The digital transformation of consumer complaint handling — the shift from telephone-based and written complaint mechanisms to app-based, chatbot-mediated, and social media-driven complaint resolution — has significantly changed both operators' complaint handling practices and consumers' expectations. TRAI's Sanchar Saathi portal — which enables subscribers to report lost or stolen mobile phones for blocking (to prevent fraudulent use), to verify the mobile connections registered in their name, and to report unsolicited commercial calls — represents a direct TRAI-to-consumer channel that supplements the operators' grievance mechanisms. The increasing use of social media (Twitter/X, Facebook, and WhatsApp) by consumers to escalate complaints — bypassing formal grievance mechanisms in favour of public complaints that create

reputational pressure on operators — has led operators to establish dedicated social media response teams that handle public complaints rapidly. TRAI's regulatory framework for social media-based complaint handling — specifically whether operators' social media responses constitute formal complaint responses under the grievance regulations — is an area where regulatory guidance would clarify the legal status of social media complaint resolutions and ensure that the consumer protection framework keeps pace with changing consumer communication preferences.

H.4 Competition-Neutrality in Spectrum Auctions

The principle of competition-neutrality in spectrum auctions — designing the auction rules to avoid favouring or disfavouring specific operators, enabling each operator to acquire the spectrum portfolio that best serves its commercial strategy and subscriber needs — is an important objective that must be balanced against other policy objectives including revenue maximisation, new entrant facilitation, and spectrum cap enforcement. India's spectrum auction design has progressively incorporated competition-neutrality considerations: spectrum caps (preventing any single operator from holding more than a specified percentage of total spectrum in a band or overall) are designed to prevent dominant operators from foreclosing rivals' access to spectrum; set-asides (reserving a portion of spectrum for new entrants or smaller operators at reduced reserve prices) are used in some markets to facilitate competitive entry; and payment terms (spreading the auction payment over multiple instalments) are calibrated to avoid systematically disadvantaging operators with weaker balance sheets. TRAI's spectrum auction design recommendations must consider all these competition dimensions alongside the revenue and efficiency objectives, producing a holistic auction design recommendation that the government can then implement through the auction information memorandum.

The spectrum cap framework — prescribing the maximum spectrum that any single operator may hold in specified frequency bands and across all bands — is directly relevant to competition in the mobile market. The Indian spectrum cap framework prescribes: a per-band cap (typically 50% of the total spectrum auctioned in a specific band for a specific service area); and an overall cap across all frequency bands (typically 25-30% of total assigned spectrum across all bands in a service area). These caps are designed to prevent a single operator from accumulating spectrum holdings so large that competitors cannot achieve the spectrum intensity needed for competitive network quality. The implementation of spectrum caps requires a continuous monitoring function — as operators acquire, trade, or return spectrum, the regulator must track each operator's spectrum holdings and ensure that caps are respected. The Wireless Planning and Coordination (WPC) Wing manages this monitoring function, maintaining the National

Frequency Register that records all spectrum assignments and enables real-time assessment of operators' spectrum holdings against the applicable caps.

H.5 Regulatory Economics: Key Concepts

A sophisticated understanding of regulatory economics — the economic principles that inform and constrain effective telecommunications regulation — is essential for practitioners who advise operators on regulatory strategy and for regulators who design the interventions that shape the sector's development. The fundamental economic rationale for telecommunications regulation is market failure: in the absence of regulatory intervention, unregulated telecommunications markets exhibit specific market failures that result in socially suboptimal outcomes. The market failures most relevant to telecommunications include: natural monopoly (in the provision of infrastructure with high fixed costs and low marginal costs, where a single firm can serve the market more efficiently than multiple competing firms — relevant to fixed-line access networks and backbone transmission); network externalities (positive externalities where the value of a communications service increases with the number of users, creating concentration tendencies and barriers to new entry); and imperfect information (where subscribers cannot easily assess the quality of service before purchasing, creating potential for operator exploitation of information asymmetries). Each of these market failures justifies different regulatory responses: natural monopoly justifies access regulation (requiring the infrastructure owner to provide wholesale access to competitors); network externalities justify interconnection regulation (requiring operators to interconnect their networks); and imperfect information justifies quality disclosure requirements (requiring operators to publish performance data that enables consumers to make informed choices).

The Ramsey pricing model — a foundational concept in regulatory economics for pricing in industries with economies of scale and scope — provides important insights for telecommunications tariff regulation even though it is rarely applied in its pure form in practice. Ramsey pricing prescribes setting prices for different services at levels that generate the required contribution to common costs while minimising the distortion to allocative efficiency. The key insight is that services with more inelastic demand (where consumers respond less to price changes) should bear a larger share of common costs, while services with elastic demand should bear a smaller share. In the telecommunications context, this would imply that local calls (generally more price-inelastic than long-distance calls) should bear more common costs than long-distance calls, and that business users (more inelastic) should bear more than residential users. While pure Ramsey pricing is not typically used by regulators (because it would require very detailed demand elasticity estimates), the underlying principle — that cost recovery should

be calibrated to demand responsiveness — informs the design of tariff structures that minimise efficiency distortions while ensuring that operators recover their costs.

The concept of the "regulatory compact" — the implicit bargain between the regulator and regulated entities in which regulated entities accept certain obligations and constraints in exchange for certain regulatory protections (such as protection against competitive entry, or guaranteed rate of return) — has been important in telecommunications regulatory theory even as it has been progressively abandoned in practice as liberalisation has replaced the old monopoly regulatory model. Under the regulatory compact model, the national telecommunications operator (typically a government-owned monopoly) was guaranteed a monopoly over telecommunications services in exchange for accepting universal service obligations, price regulation, and quality of service standards. The liberalisation of the telecommunications sector — beginning in India with the policy reforms of the 1990s and accelerating with the National Telecom Policy 1999 — has dismantled the monopoly protection element of the regulatory compact while maintaining many of its obligations (universal service, quality standards, emergency service obligations) as conditions of competitive licences. The residual regulatory compact elements in India's current framework — specifically the obligations that operators are required to accept as conditions of their authorisations, which are justified by reference to the operators' privileged access to public infrastructure and the public interest nature of telecommunications services — must be understood in this historical context.

H.6 TRAI's Role in India's Digital Economy

TRAI's mandate as a sector regulator is primarily focused on the telecommunications services market, but the practical scope of its regulatory influence extends to the entire digital economy that is built on telecommunications infrastructure. Decisions that TRAI makes about mobile broadband pricing (through its tariff oversight function), about network quality requirements (through its QoS regulations), about net neutrality (through its differential pricing regulations), and about spectrum allocation (through its auction recommendations) collectively shape the competitive environment and the infrastructure quality on which India's digital economy operates. A TRAI decision that reduces mobile data prices — by ensuring competitive market conditions and preventing anti-competitive coordination — directly benefits the entire ecosystem of digital services that is delivered over mobile broadband: app developers, content creators, e-commerce platforms, fintech services, and digital health and education providers all benefit from lower-cost, higher-quality mobile broadband connectivity. Conversely, a TRAI decision that results in sustained network quality deterioration — through inadequately rigorous QoS standards, insufficient spectrum availability, or competitive market structure problems —

imposes costs across the entire digital economy ecosystem that far exceed the direct cost to telecommunications subscribers.

The legal framework for TRAI's engagement with the digital economy — specifically the question of whether TRAI's mandate extends to addressing market power concerns in the digital economy that have a telecommunications dimension — is an area of regulatory jurisdictional uncertainty. TRAI's mandate under the TRAI Act is specifically focused on telecommunications services; the broader digital economy is regulated (to the extent it is specifically regulated) by MeitY (under the IT Act), CCI (under the Competition Act), and RBI (for fintech and payments). However, the growing integration of telecommunications and digital services — with major telecom operators providing bundled connectivity, entertainment, and financial services under a single platform — makes it increasingly difficult to separate the "telecommunications services" dimension of operator conduct from its "digital platform" dimension. TRAI's practical response to this jurisdictional challenge has been pragmatic: it engages with digital economy issues (such as OTT regulation, net neutrality, and data localisation) through its consultations and recommendations while recognising that formal regulatory action may require the involvement of other regulatory authorities. The development of a formal inter-regulatory coordination framework for the telecommunications-digital economy interface — bringing together TRAI, MeitY, CCI, and RBI — would improve the coherence and consistency of digital economy regulation in India.

TRAI's contribution to India's digital public infrastructure (DPI) development has been primarily through its regulatory framework for the connectivity layer on which DPI operates. TRAI's quality of service regulations — ensuring reliable, affordable mobile broadband — support the millions of UPI transactions, Aadhaar authentications, and DigiLocker accesses that occur daily on India's DPI stack. TRAI's net neutrality framework — ensuring that operators do not discriminate against DPI-enabled services in favour of proprietary alternatives — is essential for the open-access, competitive design of India's DPI ecosystem. And TRAI's universal connectivity agenda — through its recommendations on the Digital Bharat Nidhi, BharatNet, and rural broadband — supports the extension of DPI benefits to the hundreds of millions of Indians currently without reliable internet access. As India increasingly promotes its DPI model to other developing countries (through G20 engagements, bilateral technical assistance, and NPCI International's international deployments), the quality of TRAI's regulatory framework for the connectivity layer has global significance as a component of India's DPI model export.

SUPPLEMENTARY NOTE I

TRAI's Regulatory Future: An Assessment

I.1 TRAI at 28: Achievements and Gaps

TRAI's regulatory journey over its nearly three decades of operation provides a rich case study in the institutional development of a specialised regulatory authority in a rapidly evolving sector in a large developing democracy. When TRAI was established in 1997, India's telecommunications market was transitioning from a state-controlled monopoly (operated by DoT through BSNL and MTNL) to a competitive multi-operator market, and TRAI's primary challenge was to manage this transition fairly — enabling new entrants to compete on a level playing field with the incumbent while protecting consumer interests in the quality and affordability of services. TRAI's performance in its early years was constrained by the limitations of its enabling legislation (the TRAI Act, 1997), by the institutional immaturity inherent in a newly created regulatory body, and by the political pressures of managing a commercially and politically sensitive transition. The 2G spectrum scandal — in which administrative allocation of spectrum at below-market prices enabled massive corruption and billions of rupees of loss to the public exchequer — occurred on TRAI's watch, though TRAI's direct responsibility was limited to its recommendations function (which it discharged, though not without controversy). The scandal's aftermath — the Supreme Court's mandatory auction ruling, the sector consolidation, and the AGR crisis — tested TRAI's institutional resilience and ultimately accelerated its evolution toward a more analytically rigorous, institutionally independent regulatory authority. Today, TRAI's legacy includes: a functioning competitive mobile market that provides consumers with some of the world's lowest mobile broadband prices; a robust net neutrality framework that has protected India's open internet; a consumer protection framework that addresses the most significant risks of consumer exploitation; and a growing engagement with the complex regulatory questions of the 5G and digital economy era that will define the next chapter of Indian telecommunications.

The regulatory gaps that TRAI has been less successful in addressing include: the quality of service gap (India's mobile broadband quality, while improving, remains below the standards of comparable markets in other major economies, reflecting both network investment constraints and the limitations of TRAI's QoS enforcement); the universal connectivity gap (despite significant progress, hundreds of millions of Indians remain without reliable internet access, partly reflecting the limitations of TRAI's rural connectivity regulatory tools); the OTT regulatory uncertainty (the decade-long inability to reach a definitive regulatory position on OTT services has created persistent uncertainty for both operators and OTT providers); and the institutional capacity gap (TRAI's analytical and enforcement capabilities remain constrained relative to its mandate, limiting the depth and rigor of its regulatory interventions). Addressing these gaps — through institutional reform, legislative updating, and enhanced funding and staffing — is the

primary TRAI modernisation agenda for the years ahead. The Telecommunications Act, 2023's implementation provides both the occasion and the legal framework for this modernisation, if the government and TRAI choose to seize the opportunity.

TRAI's future role in India's digital economy governance will be shaped by the choices made during the 2023 Act's implementation. If TRAI embraces a proactive, forward-looking regulatory mandate — engaging with the full range of digital economy issues that touch on telecommunications (from OTT regulation and AI in networks to satellite governance and quantum communications) — it can position itself as a central institution in India's digital governance architecture. If TRAI adopts a narrower interpretation of its mandate, focusing primarily on the traditional economic regulation of connectivity services, it risks becoming increasingly peripheral as the policy action moves to MeitY, CCI, and other digital economy regulators. The opportunity that the 2023 Act creates for TRAI — to expand its mandate, develop new regulatory capabilities, and establish itself as the lead regulator for India's converging telecommunications and digital landscape — is one that both TRAI and the government must intentionally embrace. The decisions made in the next five years about TRAI's institutional mandate, staffing, and operational independence will determine whether TRAI emerges as the centrepiece of India's digital governance infrastructure or becomes one institution among many with overlapping and potentially conflicting mandates.

I.2 The Regulatory Architecture Post-2023

The telecommunications regulatory architecture post-2023 — the institutional framework of DoT, TRAI, TDSAT, CERT-In, WPC, the Data Protection Board, CCI, and sectoral ministries that collectively govern India's telecommunications and digital economy — represents the most complex regulatory landscape in Indian economic history. Each institution has a distinct statutory mandate, a distinct institutional culture, and distinct relationships with the regulated industry and with the government. The interactions between these institutions — through formal coordination mechanisms (inter-agency committees, mandatory consultation requirements), informal coordination (bilateral discussions, shared secondments), and competitive interactions (when jurisdictions overlap or when institutional interests diverge) — determine the coherence and effectiveness of the overall regulatory framework. The risk of regulatory fragmentation — in which the multiple institutions' separate activities produce an incoherent, internally inconsistent regulatory environment that imposes excessive compliance costs, creates arbitrage opportunities, and fails to address systemic risks that cut across institutional boundaries — is a real concern that requires active management.

The mechanisms for managing regulatory fragmentation — ensuring coherent, coordinated regulation across multiple institutions — include both formal coordination mechanisms (such as the Digital Regulatory Coordination Council proposed in academic literature and industry submissions) and informal coordination practices (such as the regular bilateral meetings between TRAI and DoT, and the developing practice of TRAI-CCI joint workshops on digital market competition issues). The Telecommunications Act, 2023's framework contributes to regulatory coherence in several ways: by clearly defining the respective roles of DoT (licensing and spectrum management) and TRAI (recommendations and tariff regulation) in the new framework; by providing for TRAI's involvement in the development of authorisation conditions (ensuring that TRAI's regulatory expertise informs DoT's licensing decisions); and by preserving TDSAT's appellate jurisdiction over disputes arising from both DoT licensing decisions and TRAI regulatory orders (providing a single appellate forum for telecommunications regulatory challenges). The development of complementary coordination mechanisms — through inter-agency MoUs, joint regulatory guidelines, and formal coordination committees — would further improve the coherence of the post-2023 regulatory architecture.

The international dimensions of India's telecommunications regulatory architecture — TRAI's participation in international regulatory bodies, India's bilateral regulatory cooperation arrangements, and the interaction between India's domestic regulatory framework and its international trade commitments — are an increasingly important aspect of the regulatory landscape. India's growing prominence in global digital governance — as the world's most populous democracy with one of the world's largest and fastest-growing digital economies — gives it both the influence and the responsibility to help shape the global norms and standards that will govern telecommunications and the digital economy for decades to come. TRAI's international engagements — in the ITU, the APT, the Commonwealth Telecommunications Organisation, and bilateral regulatory cooperation fora — provide channels through which India can project its regulatory experience and advocate for frameworks that serve both India's national interests and the broader interests of developing countries in the global digital economy. The effective use of these channels — requiring sustained diplomatic engagement, technical expertise, and strategic clarity about India's global digital governance objectives — is an important complement to the domestic regulatory reforms that the Telecommunications Act, 2023 enables.

SUPPLEMENTARY NOTE J

TRAI Regulatory Topics: Final Analysis

J.1 Infrastructure Sharing Policy: TRAI's Role

TRAI's regulatory engagement with telecommunications infrastructure sharing — encompassing both passive sharing (co-location of equipment on shared towers and in shared duct infrastructure) and active sharing (MORAN and MOCN arrangements for shared RAN) — has been primarily through the recommendation channel: TRAI recommends the framework conditions for infrastructure sharing to DoT, which then incorporates approved recommendations into the Unified Licence conditions. TRAI's successive infrastructure sharing recommendations (2007, 2012, 2018) have progressively expanded the scope of permitted sharing, from passive infrastructure only in the first recommendations to full active sharing (including spectrum sharing in the same geographic area) in the most recent. The economic rationale for expanding sharing permissions has been compelling: infrastructure sharing reduces capital expenditure for operators (enabling more infrastructure deployment for the same investment), reduces the environmental footprint of telecommunications infrastructure (fewer towers and ducts needed), and speeds deployment in difficult areas (by enabling multiple operators to use the same infrastructure). The competitive concerns about sharing — that operators who share infrastructure may have reduced incentives to differentiate their service quality, since they share the same physical network — have been addressed through conditions that maintain each operator's control over its own active equipment and subscriber data even within shared passive infrastructure.

TRAI's recommendation framework for infrastructure sharing conditions addresses several key commercial and regulatory parameters. The non-discrimination condition — requiring that infrastructure be made available to all requesting operators on equivalent commercial terms — is designed to prevent dominant operators from using their infrastructure market power to disadvantage competitors by refusing to share on reasonable terms. The co-location obligation — requiring that an operator that has deployed infrastructure in a location make that infrastructure available for co-location by other operators (subject to structural capacity) — reflects the essential facilities principle applied to telecommunications infrastructure. The timeline condition — specifying the maximum period within which an infrastructure owner must provide co-location to a requesting operator — is designed to prevent prolonged delays in co-location that effectively deny the requesting operator access. And the dispute resolution condition — specifying the process for resolving co-location disputes, including the reference to TDSAT for binding adjudication — provides an effective enforcement mechanism for the co-location obligations. TRAI's monitoring of compliance with these conditions — through its market analysis and through the review of co-location disputes that come to TDSAT — provides ongoing regulatory oversight of the infrastructure sharing market.

The economics of infrastructure sharing in the Indian telecommunications market have been substantially affected by the emergence of independent tower companies (towercos) as the dominant model for passive infrastructure management. India is one of the world's most advanced markets for independent towerco infrastructure: with over 700,000 mobile towers in operation (as of 2024), the majority owned by independent towercos (primarily Indus Towers, the world's largest towerco, formed by the merger of Indus Towers and Bharti Infratel), India has achieved a high degree of passive infrastructure sharing that benefits both operators (through shared tower infrastructure costs) and the towercos (through long-term revenue from multiple tenants on each tower). The development of towerco-specific regulatory conditions — addressing the commercial terms of infrastructure access, the quality of service obligations for tower infrastructure management, and the coordination between towercos and operators on network deployment planning — is an important aspect of the infrastructure sharing regulatory framework that TRAI has addressed through its infrastructure sharing recommendations and that will continue to develop under the Telecommunications Act, 2023's framework.

J.2 The Do Not Disturb Framework: A Regulatory Study

TRAI's Do Not Disturb (DND) framework — which enables telecommunications subscribers to register their preference not to receive unsolicited commercial communications (telemarketing calls and commercial SMS messages) — represents one of the most visible and impactful consumer protection regulatory interventions in India's telecommunications history. The DND registry, established under TRAI's Telecom Commercial Communications Customer Preference Regulations, enables subscribers to register their preferences (either a complete bar on commercial communications or selective preferences for certain categories such as banking, insurance, or real estate) through a simple SMS or app-based registration process. The framework imposes strict obligations on the entities that initiate commercial communications (telemarketers and businesses sending promotional messages) and on the operators through whose networks those communications are sent. Telemarketers must be registered with the operator and must comply with the preference database before sending commercial communications; operators are required to filter out communications sent to subscribers who have registered DND preferences; and violations of the DND framework attract financial penalties under the Telecom Commercial Communications Customer Preference Regulations.

The enforcement challenges of the DND framework illustrate the practical limitations of regulatory mandates in the face of large-scale non-compliance by distributed actors. Despite the DND framework's clear legal requirements and the widespread public registration of DND preferences (with hundreds of millions of subscribers registered), unsolicited commercial

communications remain a persistent consumer complaint. The enforcement challenge has several dimensions: the identification of non-compliant telemarketers (who may use multiple registered entities, unregistered SIM cards, or international calling lines to circumvent blocking); the attribution of non-compliant communications to specific responsible parties (distinguishing between the business whose communication was sent, the telemarketer that sent it, and the operator through whose network it was transmitted); and the deterrence of future violations (ensuring that the penalty regime is significant enough to deter systematic non-compliance by commercially motivated actors). TRAI's response to these enforcement challenges has included: the development of the Distributed Ledger Technology (DLT) platform for commercial communications, which uses blockchain technology to enable the tracing and verification of commercial messages from the business originator through the telemarketer to the receiving subscriber; enhanced penalties for systematic non-compliance; and a dedicated consumer complaint mechanism that enables subscribers to report non-compliant commercial communications directly to TRAI.

The DLT (Distributed Ledger Technology) platform for commercial communications — launched in 2020 and progressively refined since then — represents one of TRAI's most innovative regulatory technology deployments. The DLT platform requires businesses that send commercial messages to register on the platform and to pre-register the content templates of their messages; telemarketing service providers must also register; and the entire chain of a commercial message (from the registering business through the telemarketer to the subscriber) is recorded on the DLT and traceable. When a subscriber receives a non-compliant message, the DLT record enables TRAI and operators to identify the originating business and the telemarketer, enabling targeted enforcement. The DLT platform's effectiveness has been demonstrated through a significant reduction in the volume of non-compliant commercial messages following its implementation, though complete elimination of unsolicited commercial communications remains an ongoing challenge. The legal framework for the DLT platform — including the mandatory registration requirements, the template pre-registration process, and the liability provisions for non-compliant messages — is embedded in the Telecom Commercial Communications Customer Preference Regulations and will be updated under the Telecommunications Act, 2023's implementing rules.

J.3 Fixed Broadband Regulation

TRAI's regulatory framework for fixed broadband services — encompassing fibre-to-the-home (FttH), fibre-to-the-building (FttB), cable broadband (DOCSIS), and fixed wireless access (FWA) using licensed spectrum — is less developed than its mobile broadband

framework, reflecting the historically smaller fixed broadband market in India and the different competitive dynamics of fixed versus mobile broadband. India's fixed broadband market is dominated by a small number of national operators (Jio Fiber, Airtel Xstream, BSNL FttH) with significant regional presence by local ISPs and cable operators. The competitive structure of fixed broadband is characterised by: geographic concentration (a subscriber's choice of fixed broadband provider depends on which operators have deployed infrastructure in their specific building or locality, rather than on the national competitive landscape); high switching costs (due to the physical nature of the fixed broadband connection, which requires installation of new infrastructure to switch providers); and significant quality variation between operators in different areas (from gigabit-speed FttH in newly developed urban areas to multi-megabit-speed cable broadband in older urban areas to significantly slower services in suburban and rural areas).

TRAI's quality of service framework for fixed broadband — based on its Quality of Service of Broadband Service Regulations — prescribes minimum standards for download speed, upload speed, latency, and packet loss for fixed broadband services. The enforcement of these standards for FttH services — where the quality of service experienced by the subscriber depends not only on the operator's network but also on the quality of the last-mile installation (the fibre connection from the street cabinet to the subscriber's premises) and the quality of the subscriber's WiFi router and in-home network — requires a quality monitoring methodology that separates network performance from in-home factors. TRAI's use of standardised network performance measurement tools (that measure performance at the network interface of the subscriber's router rather than at the subscriber's device) helps to isolate network performance from in-home factors, but the subscriber's actual experience (which includes in-home factors) may differ significantly from the network-level measurement. The development of a consumer-facing service quality verification mechanism — enabling subscribers to measure and report their actual broadband experience using a standardised tool that TRAI can use for enforcement purposes — would improve the alignment between TRAI's quality measurements and subscribers' actual quality experience.

The regulatory treatment of "peering" arrangements in the fixed broadband context — specifically the commercial arrangements between fixed broadband ISPs and content delivery networks (CDNs) that determine the quality and capacity of content delivery to ISP subscribers — is an important but underexplored dimension of fixed broadband quality regulation. A fixed broadband ISP's interconnection with major CDN providers (Akamai, Cloudflare, AWS CloudFront, and others through which the majority of consumer internet content is delivered) determines whether popular content (Netflix, YouTube, Facebook) is delivered at high quality to

the ISP's subscribers or whether congestion at the CDN interconnection point degrades the subscriber's experience. The commercial negotiation between ISPs and CDNs over the capacity and terms of their interconnection — which is not directly regulated by TRAI but which significantly affects the subscriber experience — is relevant to TRAI's quality of service framework because a customer experiencing poor streaming quality may attribute the problem to the ISP even if the cause is insufficient CDN interconnection capacity. The development of CDN interconnection transparency requirements — requiring ISPs to disclose their interconnection arrangements and the capacity of their CDN connections — would improve consumers' ability to understand the sources of quality variations and would create an indirect incentive for ISPs to maintain adequate CDN interconnection.

J.4 Regulatory Developments in the Roaming Market

India's national roaming market — the ability of mobile subscribers to use services while travelling within India in areas outside their home network's coverage — is governed by a combination of operators' commercial roaming agreements and TRAI's national roaming regulatory framework. National roaming was commercially significant in the early years of mobile telephony in India, when individual operators had more limited geographic coverage and subscribers frequently roamed on other operators' networks when travelling. The development of truly national coverage by all major operators has reduced the commercial significance of national roaming (since subscribers can almost always use their own operator's network anywhere in India), but roaming remains relevant in specific geographic contexts: border areas between circles where coverage overlaps, remote areas where only one operator has coverage, and disaster-affected areas where one operator's network is damaged but another's remains operational. TRAI's national roaming regulations — prescribing the commercial terms and tariff transparency requirements for national roaming — have been updated periodically to reflect the evolving competitive landscape and to protect subscriber interests in the specific contexts where roaming remains practically significant.

The international roaming market — and specifically the reciprocal arrangements under which Indian subscribers can use their phones abroad and foreign visitors can use their phones in India — is regulated through the interaction of TRAI's international roaming tariff framework with the bilateral commercial roaming agreements between Indian operators and their foreign counterparts. TRAI's international roaming regulations prescribe maximum retail rates for outbound roaming (Indian subscribers using their phones abroad) across a range of destination countries, requiring operators to offer "roaming packs" at defined maximum prices for common destinations. These maximum price requirements have brought down the retail cost of

international roaming for Indian subscribers significantly from the pre-regulation era, when operators could charge whatever the market would bear for roaming services. The development of automatic roaming notification requirements — requiring operators to send subscribers a free SMS when they arrive in a foreign country, informing them of the applicable roaming rates and the availability of roaming packs — has improved consumer awareness and reduced the incidence of "bill shock" from unexpected roaming charges.

The application of TRAI's commercial communication framework to roaming scenarios — specifically the question of whether commercial communications sent to Indian subscribers while they are roaming on foreign networks (and therefore not directly on Indian operator infrastructure) are subject to TRAI's DND framework — raises interesting jurisdictional questions. If an Indian subscriber registered on the DND database receives an unsolicited commercial SMS while roaming on a foreign network, the message may have been originated from outside India (making direct enforcement against the originator difficult) but was ultimately delivered to an Indian subscriber's number (suggesting that TRAI's subscriber protection framework should apply). The resolution of this jurisdictional question — through regulatory guidance that clarifies the DND framework's extraterritorial application — would address a gap in the consumer protection framework that affects an increasing number of Indian subscribers who regularly travel abroad.

J.5 The Future of Retail Telecom Pricing

The evolution of retail telecommunications pricing in India over the past decade — from per-second voice billing and per-SMS charges to the unlimited voice and data bundles that now dominate the market — reflects both the technological transformation of telecommunications (from voice-centric to data-centric services) and the competitive market dynamics that Reliance Jio's disruptive entry triggered. The transition to unlimited bundles has simplified the subscriber's pricing experience (a single monthly plan covers all voice calls and a specified amount of data, with few additional charges) but has also reduced the information content of pricing signals that traditionally guided subscriber choice and operator investment decisions. In a world of unlimited bundles, subscribers have limited incentive to moderate their consumption and operators have limited ability to use pricing signals to manage peak demand and allocate scarce network resources efficiently. The development of more sophisticated pricing architectures — such as time-of-day pricing (cheaper data during off-peak hours to redistribute traffic demand), congestion pricing (higher prices when the network is congested to reduce demand during peak periods), and quality-differentiated pricing (different prices for different data speed tiers) — could improve the efficiency of network utilisation and potentially enable operators to monetise their

network quality improvements more effectively.

TRAI's regulatory engagement with innovative pricing architectures — assessing whether time-of-day pricing, congestion pricing, or quality-differentiated pricing would violate the net neutrality framework's non-discrimination principle — is a complex regulatory analysis that requires careful distinction between pricing that discriminates based on the content, application, or service being accessed (which is prohibited) and pricing that reflects genuine differences in the cost or quality of service delivery (which may be permissible). Time-of-day pricing — charging different rates for data consumed at different times of day — reflects genuine differences in network cost and capacity availability: off-peak data is genuinely cheaper to provide (because excess network capacity is available) while peak-time data is more costly (because scarce capacity must be shared among more users). This cost-based justification for time-of-day pricing distinguishes it from content-based pricing (which has no cost justification) and suggests that time-of-day pricing may be compatible with the non-discrimination principle if applied equally to all content and applications. TRAI's development of a published framework for assessing the net neutrality compatibility of innovative pricing models — providing operators with ex ante guidance on what pricing structures are permissible — would encourage pricing innovation while maintaining the legal clarity that operators need before committing to new commercial models.

The competitive equilibrium of retail telecommunications pricing in India's three-player oligopoly is a topic of significant academic and regulatory interest. Economic theory predicts that in a concentrated market with high barriers to entry, firms may engage in tacit coordination — independently adopting similar pricing strategies without explicit agreement — that results in prices above the competitive level. India's mobile market — with three dominant operators, relatively symmetrical market shares, and limited threat of new entry — exhibits some characteristics consistent with tacit coordination risk. TRAI's monitoring of retail pricing trends (through its quarterly pricing reports), its analysis of pricing parallelism (whether all operators simultaneously make the same pricing changes), and its assessment of consumer welfare (whether prices are at competitive or supra-competitive levels relative to costs) provides the regulatory intelligence needed to identify whether tacit coordination is occurring. The development of a formal market assessment framework — based on competition economics methodology for identifying tacit coordination — would improve TRAI's capacity to detect and respond to competition problems in the retail mobile pricing market before they cause significant consumer harm.

SUPPLEMENTARY NOTE K

TRAI: Closing Analytical Topics

K.1 The Future of Voice Regulation

The regulatory framework for voice communications — traditionally the primary focus of telecommunications regulation — is undergoing fundamental transformation as voice becomes one application among many delivered over IP networks rather than the defining service around which the entire regulatory architecture was built. In the circuit-switched era, voice calls were the primary telecommunications service: their quality, price, and availability were the central consumer concerns, and the interconnection, tariff, and quality-of-service regulatory frameworks were designed primarily around the voice calling use case. The transition to IP networks — where voice calls are just one type of IP application alongside streaming video, social media, messaging, and countless other internet services — dissolves the technical boundary between voice and other communications that justified voice-specific regulation. An IP packet carrying a VoIP call is technically indistinguishable from an IP packet carrying streaming video: both are just data packets delivered by the IP network. This technical indistinguishability creates a regulatory challenge: should voice calls delivered over IP continue to be regulated as "telephone services" subject to the traditional voice regulatory framework (interconnection requirements, emergency service obligations, quality of service standards), or should they be treated as internet applications subject only to the lighter regulatory framework applicable to internet content and services? India's Telecommunications Act, 2023 takes a functional approach to this question, defining "telecommunication services" by reference to the function of enabling communication rather than the technology used, and thereby potentially extending the traditional regulatory framework to IP-based voice services (including OTT voice calls). The development of implementing rules that specify how traditional voice regulatory obligations (emergency service access, lawful interception, quality of service) apply to IP-based voice services will be one of the most practically important aspects of the 2023 Act's implementation.

TRAI's regulatory framework for voice quality — the quality of service benchmarks applicable to mobile voice calls, including call completion rate, call drop rate, and speech quality — will need to evolve as voice transitions from circuit-switched to VoIP delivery. The quality of service dimensions of VoIP calls differ from those of circuit-switched calls: VoIP call quality depends on packet loss (which causes audio degradation), jitter (variation in packet delay, which causes audio breakup), and latency (which causes the perceptible delay that makes conversation difficult), rather than the traditional circuit quality measures (signal-to-noise ratio, echo, and bandwidth) applicable to circuit-switched voice. TRAI's existing QoS benchmarks — which were

developed for circuit-switched voice quality — must be updated to address VoIP quality dimensions, requiring the development of new measurement methodologies and potentially new benchmarks calibrated to VoIP quality characteristics. The development of harmonised VoIP quality metrics — aligned with ITU-T standards for IP voice quality assessment and with the quality measurement frameworks used by major VoIP service providers — would enable consistent, comparable quality assessment across the diverse range of VoIP services available in India.

The emergency service obligation for VoIP services — the requirement that VoIP providers enable their subscribers to access emergency services (112) from any location — is one of the most important voice regulatory obligations with potentially life-saving implications for the millions of subscribers who use VoIP services. Traditional fixed-line emergency calls benefit from automatic location identification: the network can automatically provide the subscriber's registered address to the emergency dispatch centre, enabling emergency responders to be sent to the correct location even if the caller is unable to speak. VoIP emergency calls create a location identification challenge: a VoIP subscriber may make a call from any internet-connected location, which may be different from the registered address associated with the account. The technical solutions for VoIP emergency call location identification — including subscriber-provided location data (which requires active subscriber cooperation), network-based location (which may be less accurate than device-based location), and enhanced location accuracy technologies (using Wi-Fi network analysis or GPS in the subscriber's device) — are still being developed and standardised. TRAI and DoT's requirements for VoIP emergency service compliance — once developed and notified under the 2023 Act's implementing rules — should specify the location accuracy standards and location reporting mechanisms required for VoIP emergency services.

K.2 Spectrum Sharing with Defence and Space

The spectrum sharing challenge between commercial telecommunications services and government users — principally the Ministry of Defence (which uses large portions of spectrum for military communications, radar, and electronic warfare systems) and the Department of Space (which uses spectrum for satellite communications and space science applications) — is one of the most institutionally complex aspects of India's spectrum management. Government spectrum users have historically been allocated dedicated frequency bands that are exclusively reserved for their use, with commercial operators required to deploy their networks around these protected government allocations. This exclusive reservation approach has worked reasonably well when commercial spectrum demand was limited to a few frequency bands, but becomes

increasingly constraining as commercial telecommunications moves into higher frequency ranges (mmWave 5G, 6G sub-THz) that overlap with existing government allocations. The development of sharing arrangements — technical and institutional frameworks that enable commercial and government users to coexist in the same spectrum with managed interference — is becoming essential for making sufficient spectrum available for the next generations of commercial telecommunications.

The institutional framework for spectrum sharing between commercial operators and the Ministry of Defence involves the SACFA inter-agency process (in which DoT, the Ministry of Defence, and other government spectrum users negotiate the allocation of specific frequency bands between commercial and government use) and the WPC's technical management of frequency assignments within the framework established by SACFA. The SACFA process has historically been slow and opaque, with Defence's requirements typically prevailing over commercial spectrum requests in cases of conflict — reflecting both the importance of military communications security and the absence of strong institutional mechanisms for challenging Defence's spectrum demands. The development of a more structured, transparent, and outcomes-focused SACFA process — one that systematically assesses the actual spectrum requirements of government users, the technical possibilities for sharing, and the commercial value of the spectrum in commercial use — would improve the efficiency of spectrum governance and potentially free significant spectrum for commercial telecommunications use without compromising national security communications.

The development of advanced spectrum sharing technologies — including cognitive radio systems that can automatically detect and avoid government radar and military transmissions, and dynamic spectrum access frameworks that enable commercial systems to use government-allocated spectrum during periods when government systems are not active — offers a technical path to more efficient co-existence between commercial and government users. The United States' Citizens Broadband Radio Service (CBRS) framework in the 3.5 GHz band — which uses a three-tier sharing system (priority access for government incumbents, licensed access for commercial operators, and general authorised access for unlicensed users) managed through an automated Spectrum Access System — provides a model for dynamic spectrum sharing that India could adapt for specific spectrum bands where government and commercial use can be technically coordinated. TRAI's exploration of dynamic spectrum sharing frameworks — through technical studies and consultation with government spectrum users and commercial operators — would provide the evidence base for developing India-specific sharing frameworks that expand the spectrum available for commercial telecommunications while

protecting the spectrum requirements of government users.

SUPPLEMENTARY NOTE L

TRAI: Final Analytical Topics

L.1 The Regulatory Compact Revisited

The concept of the regulatory compact — the implicit bargain between a regulated utility and the state that grants it a privileged position in exchange for accepting public service obligations — while largely superseded by market liberalisation in the telecommunications sector, continues to inform important aspects of TRAI's regulatory mandate. In the post-liberalisation framework, the regulatory compact has been transformed: rather than a single incumbent accepting universal service obligations in exchange for a monopoly, a group of competitive licensees accept a range of public interest obligations (universal service contributions, emergency service requirements, LI capability, quality standards) in exchange for the privilege of being licensed to provide telecommunications services using scarce public resources including spectrum. TRAI's role is to calibrate these obligations — ensuring that they serve genuine public interest objectives without being so burdensome as to make licensed operation unviable — and to enforce compliance with them consistently across all licensed operators. The balance between the commercial sustainability of licensed operators (which determines whether operators can make the network investments needed for good consumer outcomes) and the public service obligations imposed on those operators (which are necessary for the regulatory framework to serve social goals) is the central tension that TRAI must manage. Too heavy an obligation burden — high licence fees, extensive coverage mandates, and onerous security requirements — makes licensed operation commercially unattractive and reduces investment. Too light an obligation burden — minimal fees, voluntary coverage, and self-regulated security — fails to serve the public interest objectives that justify telecommunications licensing as a regulatory tool.

TRAI's effectiveness as a regulator depends critically on its relationship with the commercial sector it regulates: too close a relationship (regulatory capture) undermines TRAI's independence and results in regulatory decisions that serve industry interests at the expense of consumers; too adversarial a relationship (regulatory hostility) undermines the flow of information from industry to TRAI and results in poorly calibrated regulatory decisions that fail to account for commercial realities. The ideal regulatory relationship is one of structured independence with constructive engagement: TRAI maintains independence in its decision-making while actively seeking and genuinely considering industry input in its consultations. International experience

suggests that regulators who invest in building trusted, transparent relationships with the industries they regulate — while maintaining their decisional independence — are more effective than either captured or hostile regulators. TRAI's development of a structured industry engagement programme — including pre-consultation technical workshops, expert working groups on complex regulatory issues, and regular bilateral meetings with operators — would improve the quality of TRAI's regulatory intelligence while maintaining the decisional independence that gives TRAI's decisions their legitimacy.

TRAI's international standing — its recognition by peer regulatory bodies globally as a credible, innovative, and technically sophisticated telecommunications regulator — is an important dimension of India's soft power in the digital governance domain and an asset that TRAI should actively develop. TRAI's leadership in net neutrality regulation (its 2016 decision on differential pricing was internationally influential), its innovative use of technology for consumer protection (the TRAI analytics app, the DLT platform), and its active participation in international regulatory fora (ITU, APT, and bilateral engagements) have earned TRAI a reputation as a forward-thinking regulatory authority. Building on this reputation through publishing regulatory research, contributing to international regulatory standards, and hosting capacity-building programmes for regulatory authorities in developing countries would both improve TRAI's international standing and contribute to India's broader digital diplomacy objectives. The Telecommunications Act, 2023 gives TRAI an expanded and more clearly defined mandate that provides an opportunity to further strengthen India's telecommunications regulatory model and to present it as a reference framework for other developing countries navigating similar regulatory challenges.

L.2 Spectrum Management in the Post-Auction Era

India's spectrum management framework is entering a post-auction maturation phase in which the focus shifts from designing and conducting spectrum auctions (the primary challenge of the 2010-2022 period) to managing the secondary market for spectrum, addressing the long-term renewal of spectrum assignments, and planning the spectrum requirements of 6G. The secondary market for spectrum — enabling operators to trade, lease, or share spectrum assignments with each other — is an important efficiency mechanism that allows spectrum to flow to the operators who can use it most productively. India's spectrum trading and sharing framework, developed through TRAI's recommendations and DoT's implementing guidelines, allows operators to trade or share spectrum assignments with other licensed operators in the same service area, subject to approval by DoT and the payment of any applicable spectrum charges. The development of a more active secondary market — with transparent, accessible

information about available spectrum and streamlined regulatory approval processes for transactions — would improve the efficiency of India's spectrum allocation and enable smaller operators or new entrants to acquire spectrum without waiting for the next primary auction.

The spectrum renewal framework — the conditions under which operators can renew their spectrum assignments at the end of the assignment period — is a critical policy question that will become increasingly significant as early 5G spectrum assignments approach their expiry dates. India's policy for spectrum renewal has generally provided for administrative renewal (allowing the current assignment holder to renew at a market-determined price without competitive re-auction), reflecting the recognition that forcing incumbent operators to compete for their existing spectrum in a new auction creates significant investment uncertainty during the period leading up to the auction. However, the market-rate pricing of renewal spectrum raises the question of how to determine the renewal price fairly: the price should reflect the current market value of the spectrum (rather than the historical price paid in the original auction), but determining current market value in the absence of a competitive auction requires a valuation process that is inherently uncertain. TRAI's development of a published methodology for spectrum renewal pricing — enabling operators to forecast their renewal costs in advance and to plan their investment accordingly — would significantly improve the commercial certainty of spectrum-dependent network investment planning.

The spectrum management implications of India's growing satellite sector — specifically the coordination of spectrum between India's expanding domestic satellite broadband operations (Jio Satellite, OneWeb's IN-SPACe licensed operations, and future domestic satellite constellations) and the existing terrestrial mobile network operators who use adjacent frequency bands — is an increasingly important WPC management challenge. The interference risk between terrestrial mobile base stations and earth stations communicating with LEO satellite broadband constellations in adjacent frequency bands requires careful technical coordination: the very large number of base stations in India's mobile networks, combined with the wide geographic coverage of LEO satellite beams, means that interference protection requires both technical standards (for transmitter power limits, antenna elevation angle restrictions, and geographic exclusion zones around satellite earth stations) and operational coordination (between satellite service providers and mobile network operators in areas where interference is most acute). The development of India-specific technical coordination standards for satellite-terrestrial coexistence — building on the ITU's technical studies while reflecting India's specific satellite constellation and terrestrial network deployment characteristics — is an important WPC and TRAI regulatory agenda item.

L.3 Regulatory Innovations for Rural Connectivity

The challenge of extending affordable, high-quality telecommunications connectivity to India's hundreds of millions of rural and underserved subscribers — living in villages, tribal areas, hilly regions, and island territories that are expensive to serve with conventional mobile network infrastructure — has been a central preoccupation of India's telecommunications policy since the early 2000s. The traditional approach — using USO (Universal Service Obligation) fund subsidies to partially offset the higher capital and operating costs of rural network deployment — has extended mobile coverage to a large proportion of rural India but has not fully closed the digital divide. The limitations of the traditional USO approach reflect both structural challenges (the very high cost of serving the most remote areas makes subsidies insufficient to bridge the entire cost gap) and design weaknesses (subsidies have sometimes been captured by operators for commercially viable deployments that would have occurred anyway, rather than being directed at genuinely unviable rural locations). New regulatory approaches to rural connectivity — including community-owned networks, satellite broadband subsidies, shared infrastructure mandates, and spectrum sharing specifically for rural deployment — offer potential improvements that TRAI and DoT are beginning to explore.

Community networks — telecommunications infrastructure owned and operated by the communities they serve, rather than by commercial operators — have demonstrated remarkable success in extending connectivity to remote and underserved communities in several developing countries. India's first community network deployments — facilitated by the Internet Society, local NGOs, and supportive state government policies — have shown that community ownership can dramatically reduce operating costs (since volunteer labour and local knowledge substitute for expensive external technical support), improve service relevance (since community members design services that meet their specific needs), and ensure that connectivity revenue stays within the local economy. TRAI's regulatory framework for community networks — specifically the question of whether community networks require a formal telecommunications licence or whether their small-scale, non-commercial operation can be treated as a class-licensed activity — has not been definitively addressed. The development of a specific regulatory framework for non-commercial community networks — enabling their operation under a simple, low-cost class authorisation without the full Unified Licence obligations applicable to commercial operators — would facilitate the expansion of community networks to the most underserved areas where commercial operators have no economic incentive to deploy.

SUPPLEMENTARY NOTE M

TRAI: Concluding Perspectives

M.1 Regulatory Lessons from India's Telecom Journey

India's three-decade telecommunications liberalisation journey — from the state monopoly of DoT and MTNL in the early 1990s to the world's largest and most competitively intense mobile market in the 2020s — offers important regulatory lessons that are relevant not only for India's own future telecommunications policy but for other developing countries navigating similar transitions. The most important lesson is that competitive market structure creates consumer benefits that regulation alone cannot achieve: the dramatic decline in mobile service prices, the rapid expansion of network coverage, and the pace of technology adoption that India has experienced over the liberalisation period are primarily attributable to competition among operators rather than to regulatory mandates. The regulator's primary role is to create and maintain the conditions for effective competition (through spectrum management, access regulation, and merger review) rather than to directly manage prices and investment — a lesson that India learned partly through the painful experience of the pre-liberalisation monopoly era. The second important lesson is that the rule of law and regulatory independence are prerequisites for sustainable sector development: the 2G spectrum scandal — which involved the corruption of the spectrum allocation process and the capture of regulatory decision-making by commercial interests — caused massive investment destruction and consumer harm that took nearly a decade to repair. The independence and integrity of regulatory processes is not a luxury for developed markets: it is a foundation condition for the functioning of the competitive market framework that serves consumer interests. TRAI's institutional independence — its protection from day-to-day government interference in its regulatory decisions — must be constantly vigilantly defended, since the incentives for both government and industry to compromise regulatory independence are persistent and often commercially compelling.

The third regulatory lesson from India's telecommunications journey is the importance of sequencing in regulatory reform: liberalisation without adequate regulatory infrastructure creates the conditions for regulatory failure, while too-cautious liberalisation preserves monopoly rents at the expense of consumers and innovation. India's liberalisation has generally sequenced reforms appropriately — establishing TRAI before introducing private sector competition, developing the Unified Licence framework before forcing rapid licence structure changes, and building spectrum auction capacity before conducting the large 4G and 5G auctions — but the pace and quality of sequencing could have been improved in several respects (particularly in the development of effective LI infrastructure before widespread mobile service deployment, and in the development

of adequate AGR computation clarity before the disputes that generated the crisis). Future telecommunications regulatory reforms — including the implementation of the 2023 Act — should explicitly attend to the sequencing question: what complementary regulatory infrastructure must be in place before specific new regulations can be effectively implemented, and in what order should implementation proceed to avoid creating regulatory gaps or inconsistencies that undermine the effectiveness of the overall framework?

The fourth regulatory lesson is that technology neutrality in regulation — drafting rules that apply equally to all technologies that perform the same function — is both a practical imperative (since specific technology mandates become obsolete as technology evolves) and a theoretical ideal that is difficult to achieve perfectly in practice. Every regulatory framework makes technological assumptions — about the available technologies, the achievable performance standards, and the economic costs of compliance — that embed specific technological realities into the regulation even when the drafting aspires to neutrality. The Telecommunications Act, 2023's technology-neutral framework is a significant improvement on the 1885 Act's technology-specific provisions, but its implementing rules will inevitably make technological assumptions that constrain the regulation's durability. The development of a regulatory learning process — through post-implementation reviews, technology horizon-scanning, and regular consultation with the technical community — that identifies technological assumptions embedded in regulations and updates them as technology evolves is an essential complement to technology-neutral regulatory drafting.

M.2 TRAI's Recommendations: A Ten-Year Retrospective

A retrospective assessment of TRAI's recommendations over the decade from 2013 to 2023 — the period leading to the Telecommunications Act, 2023's enactment — reveals both the impressive range of regulatory issues that TRAI addressed and the significant gaps and weaknesses in its regulatory output. On the positive side, TRAI's recommendations on net neutrality (2017, 2018), spectrum sharing and trading (2015, 2018), OTT regulation (2020), passive infrastructure sharing (2018), and the interconnection usage charge framework (2017, 2021) were substantively well-reasoned, analytically sophisticated, and commercially appropriate for India's market conditions. These recommendations contributed to the competitive, consumer-friendly mobile market that India enjoys today. On the critical side, TRAI's approach to the OTT regulatory question was characterised by prolonged indecision that created persistent uncertainty for both operators and OTT providers; its quality of service enforcement was insufficiently rigorous to drive systematic quality improvement; and its engagement with emerging technology issues (AI in networks, 5G network slicing, satellite broadband regulation)

was slower than the pace of technological development required. The development of TRAI's next decade regulatory agenda — prioritising the issues that matter most for India's digital economy, building on the analytical strengths demonstrated in the best of the past decade's recommendations, and addressing the weaknesses identified in the retrospective — should be a systematic organisational exercise that TRAI undertakes in the context of the 2023 Act's implementation.

SUPPLEMENTARY NOTE N

TRAI: Closing Section

N.1 Post-2023 Act Implementation Priorities

TRAI's implementation priorities for the post-2023 Act period must be carefully sequenced to ensure that the most commercially significant and consumer-impactful aspects of the new framework are operationalised first. The first priority should be the development of the authorisation conditions — the specific regulatory obligations that operators must meet under their new authorisations — since these directly determine the compliance obligations of every licensed operator and affect the entire competitive and commercial landscape of the sector. TRAI's recommendations on authorisation conditions must address: the service quality standards applicable to different categories of authorisation; the security conditions for the new authorisation framework; the consumer protection obligations including grievance redressal and transparency requirements; and the financial obligations including the licence fee and spectrum usage charge parameters for the new framework. The second priority should be the spectrum management rules — governing the auction framework, the assignment conditions, and the secondary market for spectrum — since these determine the conditions for the 5G rollout and for future spectrum allocations. The third priority should be the Digital Bharat Nidhi operational framework — since the effective deployment of universal connectivity funding is critical for India's digital inclusion agenda and affects hundreds of millions of underserved subscribers. TRAI's systematic engagement with each of these priority areas, through the consultation and recommendation process, is the most important contribution it can make to the successful implementation of the 2023 Act.

The challenge of maintaining regulatory coherence during the implementation period — as new rules are notified progressively over several years, creating a transitional framework that combines elements of the old and new regulatory frameworks — requires active management by both DoT and TRAI. Regulatory gaps (areas where the old framework has been superseded but

the new rules have not yet been notified) and regulatory inconsistencies (areas where new rules interact in unintended ways with older provisions that have not yet been updated) are unavoidable in any major regulatory transition, but their commercial and compliance impact can be minimised through careful transition planning. TRAI's role in the transition management includes: identifying potential gaps and inconsistencies as new rules are being developed; recommending transitional provisions that bridge gaps during the implementation period; and providing guidance to operators on compliance obligations during the period before specific implementing rules are notified. The development of a comprehensive transition management plan — with a published implementation timeline, clear identification of which current provisions apply until replaced, and guidance on handling specific transition issues — is essential for maintaining regulatory certainty during the implementation period.

TRAI's stakeholder engagement during the implementation period — maintaining active communication with operators, consumer groups, and civil society about the pace and direction of implementation — is important for building the broad stakeholder support that effective implementation requires. Major regulatory changes — even well-designed ones — require sustained implementation effort and often encounter unexpected challenges in their operationalisation. TRAI's willingness to engage constructively with implementation challenges, to adjust the timing or content of specific rules in response to well-founded practical concerns, and to provide clear guidance when ambiguities arise is an important determinant of whether the 2023 Act's framework achieves its potential or becomes mired in implementation disputes. The development of an open, transparent implementation monitoring mechanism — enabling all stakeholders to track the progress of specific implementing rules, to raise implementation concerns, and to seek guidance on specific compliance questions — would improve the quality and speed of implementation and would build the stakeholder confidence in the regulatory process that is essential for the framework's long-term legitimacy.

N.2 Convergence and the Future Regulatory Model

The convergence of telecommunications, broadcasting, and internet content delivery onto a single digital infrastructure platform — already a commercial reality and a regulatory challenge — will continue to intensify over the period to 2030 and beyond, requiring India's regulatory framework to evolve toward a more coherent, convergence-ready model. The current framework — with TRAI regulating telecommunications and broadcasting distribution, MIB overseeing broadcasting content, MeitY overseeing internet governance, and CCI overseeing digital market competition — involves multiple regulatory bodies with jurisdiction over different dimensions of what is increasingly a single converged digital communications ecosystem. The inefficiencies,

inconsistencies, and gaps created by this fragmented regulatory landscape will become increasingly apparent as the convergence deepens and as more services operate across traditional regulatory boundaries. The development of a convergence regulatory model for India — potentially through a reformed and expanded TRAI with broader jurisdiction over all electronic communications and digital media services — is a significant policy decision that requires both legislative action (to expand TRAI's statutory mandate) and institutional development (to build the additional regulatory capabilities needed for a converged mandate).

SUPPLEMENTARY NOTE O

TRAI: Final Note

O.1 Regulatory Priorities for 2025-2030

TRAI's regulatory agenda for the five-year period from 2025 to 2030 will be shaped primarily by the implementation requirements of the Telecommunications Act, 2023 and by the emerging technological and market challenges that require proactive regulatory engagement. The highest priority items — authorisation conditions, spectrum auction rules, and Digital Bharat Nidhi framework — are discussed elsewhere. Beyond these implementation imperatives, TRAI's proactive agenda should include several areas where the current framework requires updating or strengthening. The OTT regulation question — which has been deferred for nearly a decade through successive consultation rounds without a definitive regulatory outcome — must be resolved definitively to provide the commercial certainty that both operators and OTT providers require for long-term investment planning. TRAI's OTT regulatory framework should be proportionate (imposing obligations commensurate with the commercial scale and market power of specific OTT services, not applying blanket heavy regulation to all internet applications), technology-neutral (applying functional standards rather than service-specific mandates), and future-proof (accommodating new OTT service categories and business models without requiring constant regulatory revision). The development of a clear, published, and legally robust OTT regulatory framework — based on TRAI's accumulated analytical work and informed by international regulatory experience — is arguably the single most important regulatory decision TRAI will make in the 2025-2030 period.

TRAI's engagement with the AI governance dimension of telecommunications — specifically the regulatory framework for AI-enabled telecommunications services and for AI-driven network management — must be developed proactively rather than reactively. AI is already deployed in India's telecommunications sector for: network performance optimisation (AI-based load

balancing and interference management); customer care (AI chatbots and automated resolution systems); fraud detection (AI-based analysis of call patterns and transaction data to identify fraudulent activity); and security monitoring (AI-driven threat detection and automated incident response). These applications create specific regulatory questions about: the accountability for AI-generated decisions that affect subscribers (who is responsible when an AI customer care system gives incorrect information or when an AI fraud detection system incorrectly blocks a legitimate subscriber's account?); the transparency and explainability of AI-driven regulatory compliance assessments (can TRAI use AI to analyse operator performance data and identify potential compliance violations?); and the fairness and non-discrimination implications of AI models used in subscriber pricing and service personalisation. TRAI's development of a published AI governance framework for the telecommunications sector — specifying the regulatory standards that must be met for AI-driven telecommunications applications, the transparency and accountability requirements for AI systems that make decisions affecting subscribers, and the compliance implications of AI-enabled services — would provide regulatory clarity for one of the most important technology trends affecting the sector.

The consumer empowerment dimension of TRAI's 2025-2030 agenda — ensuring that the digital transformation of telecommunications genuinely benefits all Indian subscribers, including the hundreds of millions who are first-time or low-usage internet users — requires specific regulatory attention that goes beyond traditional price and quality regulation. Consumer empowerment in the digital age requires: digital literacy (the ability to use digital services safely and productively, requiring educational programmes that are outside TRAI's core mandate but that TRAI can support through partnerships and policy recommendations); digital safety (protection from online fraud, harassment, and harmful content, requiring coordination between TRAI and MeitY on the regulatory framework for consumer protection in the digital environment); and meaningful consent (the ability of subscribers to understand and control how their data is used, requiring the implementation of the DPDPA's consent framework in subscriber-facing systems that genuinely reflect subscribers' preferences rather than defaulting to operators' commercial interests). TRAI's annual Consumer Survey — which collects subscriber views on service quality, pricing, and consumer protection — should be expanded to include digital empowerment dimensions, providing TRAI with regular intelligence on the consumer empowerment challenges that most require regulatory attention.

The institutional resilience of TRAI — its ability to continue performing its regulatory mandate effectively through changes in government, budget pressures, and potential political interference — depends on the strength of its enabling legislation, the quality of its governance structures,

and the professionalism of its staff. The Telecommunications Act, 2023's provisions on TRAI's independence — maintaining TRAI's separation from DoT, preserving the security of tenure for TRAI's Members, and protecting TRAI's financial and administrative autonomy — provide a stronger statutory foundation for institutional independence than the pre-2023 framework. The practical implementation of this independence — through governance practices that resist pressure to make decisions based on factors other than the regulatory merits, and through investment in the analytical capacity that enables TRAI to develop and defend well-reasoned, evidence-based positions — depends on TRAI's leadership and on the broader culture of regulatory governance in India. Building a strong, independent, and technically capable TRAI is one of the most important regulatory governance investments that India can make for its digital future.

FINAL NOTE: The Digital Regulatory Compact

The digital regulatory compact of the 21st century — the new framework of rights, obligations, and expectations that governs the relationship between telecommunications operators, regulators, subscribers, and the state — differs fundamentally from the regulatory compact of the monopoly era it replaced. In the old compact, a state-owned operator accepted universal service obligations in exchange for monopoly protection; the new compact involves multiple competing operators accepting a range of public interest obligations (universal service contributions, security requirements, quality standards, and consumer protection rules) in exchange for the privilege of licensed access to public spectrum and public infrastructure. TRAI's role in managing this new regulatory compact — calibrating the obligations to ensure they serve genuine public interests without undermining the commercial sustainability of the sector — is the central regulatory challenge that will define its contribution to India's digital development over the coming decade. The quality of this management — measured by the competitiveness of the market, the affordability and quality of services, the security of the infrastructure, and the protection of subscriber rights — will be TRAI's enduring legacy.

The evolution of telecommunications regulatory practice in India over the three decades since TRAI's establishment has produced a cadre of specialist practitioners — lawyers, economists, engineers, and policy specialists — whose expertise is directly relevant to the governance challenges of the digital age. This accumulated expertise represents a national asset that should be systematically developed and deployed: through investment in legal education programmes that produce new generations of telecommunications regulatory specialists; through professional development programmes that keep existing practitioners current with rapidly evolving technology and regulatory frameworks; through research

programmes that generate the evidence base for evidence-based regulation; and through knowledge-sharing initiatives (such as this booklet series) that make specialist expertise more broadly accessible. The development of India's digital governance capacity — including the regulatory, legal, and technical expertise needed to govern a large, complex, and rapidly evolving digital economy — is an investment in national development that deserves the same recognition and support as other forms of human capital development.

The telecommunications sector's contribution to India's GDP — estimated at approximately 6-7% of GDP including direct contributions from telecommunications services and indirect contributions through the productivity-enhancing effects of digital connectivity — makes it one of the most economically significant sectors in the Indian economy. This economic significance underscores the importance of the regulatory framework: a well-designed framework that promotes competitive markets, universal access, and technological innovation contributes directly to economic growth and to India's development objectives. TRAI's regulatory decisions are thus not merely technical regulatory matters but economic policy decisions with macroeconomic consequences that extend far beyond the telecommunications sector itself. The macro-economic dimensions of telecommunications regulation — the relationship between spectrum pricing and investment, between competition and prices, and between connectivity and productivity — deserve explicit consideration in TRAI's regulatory analysis, supplementing the sector-specific analysis that is TRAI's primary focus.

The professional practice of telecommunications regulatory law in India — advising operators, regulators, investors, and policymakers on the full range of legal issues arising from the regulatory framework — has developed substantially over the past three decades as the sector has grown and the regulatory framework has become more complex. The leading telecommunications regulatory practices in India's major law firms maintain expertise across the full range of relevant disciplines: administrative and regulatory law (for licence and regulatory advice), competition law (for interconnection, access, and merger advice), constitutional law (for TDSAT and Supreme Court litigation), corporate and securities law (for M&A; and capital markets transactions), data protection and privacy law (for DPDPA compliance), and cybersecurity law (for TTP compliance and security advice). The integration of these disciplines in a single practice — providing integrated, cross-disciplinary advice on the multi-dimensional regulatory challenges that telecommunications operators face — is the hallmark of leading telecommunications regulatory legal practice in India.