



Evaluating 5G Services in India: A Multi-Dimensional Comparison of Network Providers

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Abstract: This study investigates the rapid uptake and rollout of 5G technology in India and highlights its disruptive implications for the telecommunication landscape. Using a mixed methods approach, which draws on primary data through user questionnaires alongside more prevalent secondary data datasets from TRAI reports, this research provides a comprehensive account of user satisfaction, coverage extension and the overall performance of major providers including Reliance Jio, Bharti Airtel, and Vodafone Idea. The results demonstrate significant subscriber growth on the 5G networks, increased infrastructure development and service offerings for customers have improved considerably whilst users continue to struggle with indoor coverage problems and price disparities. The study also discusses the social and economic returns of the rollout including increased connectivity, rural development and economic outcomes, alongside strategic recommendations for stakeholders. This study is designed to further raise awareness of the current state of uptake and potential for future community development within the 5G technology trajectory and to inform policymakers and industry actors through an evidence base to help make India the country to provide global leadership through next-generation wireless technology.

Keywords: 5G, India, telecommunications, network coverage, user satisfaction, socio-economic impact, infrastructure, growth, future technology

I. INTRODUCTION

The rollout of 5G technology is generally seen as a milestone in telecommunications evolution that will see profound improvements in network speed, capacity, and latency over its predecessors. In India, where digital transformation is happening at a fast clip, 5G will become a key driver of innovation in several sectors including healthcare, education, agriculture, smart cities, and industrial automation. The potential of the technology to support high-data-rate applications, ultra-reliable communication, and massive machine-type connectivity can drive increased socio-economic development and digital inclusion.

India's major telecom operators—**Reliance Jio**, **Bharti Airtel**, and **Vodafone Idea (Vi)**—have aggressively rolled out 5G services across the country, targeting both metropolitan and rural populations. Despite this progress, the 5G landscape in India is marked by considerable variation in terms of service coverage, pricing strategies, service quality, and customer satisfaction. Consumers face challenges related to affordability, reliability, and varying network performance, which can influence adoption rates and the overall perception of 5G services.

Currently, most studies on 5G focus predominantly on technical performance indicators such as speed, latency, and spectrum efficiency or on pricing alone. However, such analyses often fail to capture the complete user experience and real-world consumer preferences in a geographically and socioeconomically diverse country like India. There is a definite need for a holistic evaluation encompassing not just technical and economic factors but also service quality and customer satisfaction to inform both providers and policymakers effectively.

This research adopts a comprehensive strategy to assess 5G services in India using primary data gathered through a user-yielding questionnaire and secondary data from the Telecom Regulatory Authority of India (TRAI). While the survey focuses on revealing experiences, preferences, and satisfaction of 5G users from different regions, it also provides in-depth insights into consumer preferences, responsiveness, and perceived value of 5G services overall. Notably, the TRAI reports provided a national context to the survey findings containing statistically representative data on pricing models, coverage maps, consumer complaints, and quality of service metrics.

This study is designed to fill the research gap by providing an integrated assessment of multiple major 5G providers with respect to multiple dimensions on value for money, coverage reliability, quality of service and level of user satisfaction. In essence, it aspires to provide important insights for telecom operators to improve their service, for consumers to make informed choices, and, for regulators to connect multiple access gaps through assessing 5G services equitably.

In conclusion, the study strives to contribute to the emerging knowledge of 5G services in India by focusing on the end user perspective, supplemented with authoritative data to systematically evaluate the multi-dimensional aspects of the provision of 5G networks.

II. LITERATURE REVIEW

The advent of 5G technology has revolutionized telecommunications worldwide, offering faster speeds, reduced latency, and higher connectivity capacities. In India, this transformation is critical, given the vast and diverse population spread across urban and rural areas. Several studies emphasize that while 5G promises substantial advancements, its adoption is heavily influenced by pricing strategies, network coverage, and quality of service perceived by consumers [1] [2]

Pricing models remain a major factor influencing consumer choices in India's 5G market. Research shows that affordable pricing with premium features can significantly enhance user adoption and loyalty. However, disparities in urban and rural pricing structures continue to challenge equitable access [3].

Consumer satisfaction, pivotal in the competitive telecom sector, has increasingly become a focal point. Surveys focusing on user experience underscore that factors such as network reliability, customer support quality, and perceived service value are equally crucial as speed and data packages [4] [5]. Furthermore, empirical studies from Coimbatore and Rayalaseema regions illustrate that consumers weigh both economic and technical features while choosing providers, highlighting the importance of a multi-dimensional assessment [1].

The Telecom Regulatory Authority of India (TRAI) provides extensive datasets and analytical reports elucidating network performance across geographic locations and operators [6]. These reports reveal notable variances in coverage quality, with urban areas enjoying better service levels compared to rural and semi-urban zones—a digital divide that challenges the full realization of 5G's promise. Recent TRAI independent drive tests demonstrate responsiveness in network performance metrics such as call setup success rates and data throughput among operators like Jio, Airtel, and Vi, affirming their leadership but also marking scope for improvement [7].

Comparative analyses reveal that Jio's 5G network, leveraging low-band spectrum, achieves broader coverage particularly in rural sectors, while Airtel's 5G deployment targets urban-focused non-standalone architecture for better throughput [8]. These strategic distinctions are reflected in varied customer experiences and satisfaction scores, converging to shape competitive dynamics within India's 5G landscape. International studies have similarly advocated for integrating user feedback with regulatory data to provide a comprehensive picture of 5G effectiveness [9], a gap this research seeks to fill specifically for India by combining consumer-centric survey insights with authoritative TRAI data.

Summarizing, the literature highlights the critical need for multi-dimensional assessments of 5G services incorporating economic, quality, and user perception parameters, which this study addresses to provide actionable insights for providers, consumers, and policymakers.

III. RESEARCH METHODOLOGY

3.1 Research Design

This study uses a mixed-methods approach that systematically integrates both quantitative and qualitative data to provide a well-rounded evaluation of 5G network providers in India. By using primary data collected through a detailed, user survey with secondary data sourced from the Telecom Regulatory Authority of India (TRAI), this approach captures a comprehensive view of the 5G ecosystem, spanning consumer perceptions, service quality, and regulatory compliance. The mixed-method approach helps the research by allowing quantitative data to be contextualized with qualitative insights, thereby enhancing the depth and reliability of the findings.

3.2 Primary Data Collection: User Survey

The primary data collection was conducted with the help of a structured online questionnaire, hosted on Google Forms. This carefully crafted survey aimed to capture various aspects of user experiences and preferences related to 5G services. Participants were asked to provide information regarding their 5G service providers, pricing satisfaction, network coverage reliability, speed and data performance, and quality of customer support received. In addition to these, respondents were also requested to express their overall satisfaction with their current 5G provider and their willingness to recommend the provider to others.

Efforts were made to ensure that the survey reached a diverse audience across different demographic and geographic segments, including urban, semi-urban, and rural regions of India. The survey was open for a predefined period during which responses were collected anonymously, thereby encouraging the participants to provide candid and unbiased feedback.

3.3 Secondary Data Collection: TRAI Reports

To complement the primary data, secondary data were collated from recent and relevant TRAI reports. These reports contain authoritative information on pricing structures, network coverage, complaint logs, and quality of service metrics across Indian telecom operators. The TRAI independent drive test reports provide objective evaluations of network performance indicators such as call setup success rate and data throughput. This secondary data serves as a national-level benchmark, offering critical insights into the overall market landscape, which, when combined with the user survey data, provides a more holistic understanding of 5G services in India.

3.4 Sampling and Data Analysis

The study employed a convenience sampling technique for the survey, targeting a sufficiently large and varied sample to ensure statistical representativeness and reliability. The data collected from the survey were subjected to thorough quantitative analysis using software tools such as Microsoft Excel, SPSS, and Python libraries including Pandas, Plotly, and Dash for data processing and visualization. Descriptive statistics, frequency distributions, and graphical presentations were used extensively to summarize and visualize key parameters. By cross-referencing these findings with TRAI's secondary data, the study was able to derive insights into the comparative strengths and weaknesses of the major 5G network providers across multiple dimensions, ensuring that the conclusions drawn are robust and comprehensive.

IV. RESULT

The survey captured responses from a diverse cross-section of 5G users across India, providing insights into demographics, provider preferences, network performance, pricing perception, and overall satisfaction.

4.1 User Demographics and Provider Preferences

The majority of respondents (45.37%) are subscribers of Reliance Jio, positioning it as the leading 5G network provider among the sample. Bharti Airtel follows with 33.17% of users, while Vodafone Idea (VI) accounts for 12.68%. A small segment reported using multiple providers concurrently or have subscriptions with lesser-known operators, reflecting a level of market experimentation.

Analysing age demographics, a strong representation of young adults stands out, with 51.71% of respondents aged 18-25 years. The 26-35 and 46+ age groups are equally represented, each comprising about

16.10% of the respondents, while middle-aged users (36-45) make up 10.73%. Participants below 18 years were a minor group at 5.37%. Gender distribution was fairly balanced with males representing 53.17% and females 46.83%.

Occupationally, students dominate the sample (47.32%), followed by working professionals at 29.27%. The rest are comprised of various other occupational categories including entrepreneurship.

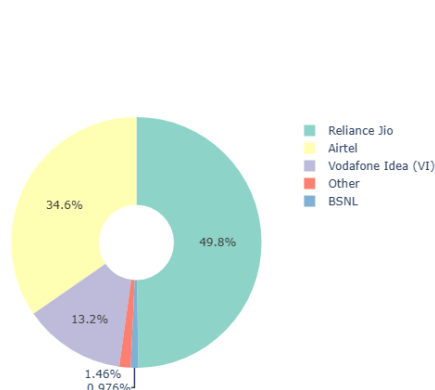


Fig 1: 5G Network Provider Market Share

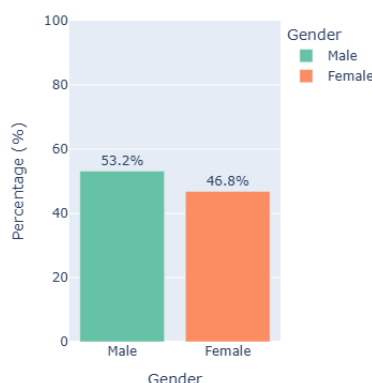


Fig 2: Gender Distribution

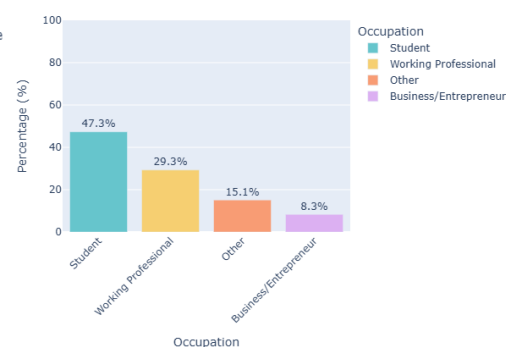


Fig 3: Occupation Categories

4.2 Network Performance and Connectivity Quality

When examining coverage satisfaction, respondents reported moderate to high satisfaction levels, with average scores between 3 and 4 on a 5-point scale. Importantly, respondents consistently noted a disparity in signal strength between outdoor and indoor environments, with indoor coverage rated significantly weaker. Users described experiencing network issues such as intermittent call drops and slowed internet access during peak usage times 'sometimes', indicating areas for infrastructural enhancement.

Internet speed ratings tended to be moderate, with many users evaluating download and upload speeds as satisfactory or above average. However, latency satisfaction scores were slightly lower, indicating some challenges with delay-sensitive applications like gaming or video conferencing. Users gave moderately positive ratings on voice quality, though call drop frequency remains a concern for a number of respondents. Peak hour network stability showed mixed feedback, with approximately half of the users considering their connection 'somewhat stable' and the rest reporting instability, impacting the consistency of service during high demand periods.

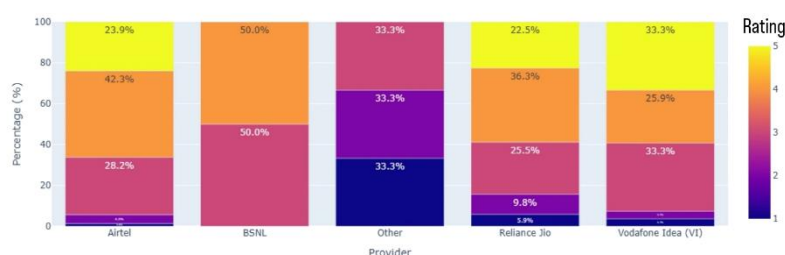


Fig 4: Coverage Satisfaction by Provider

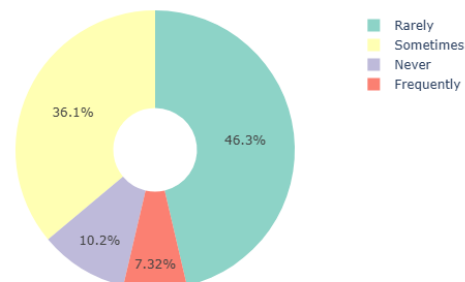


Fig 5: Call Drop Frequency

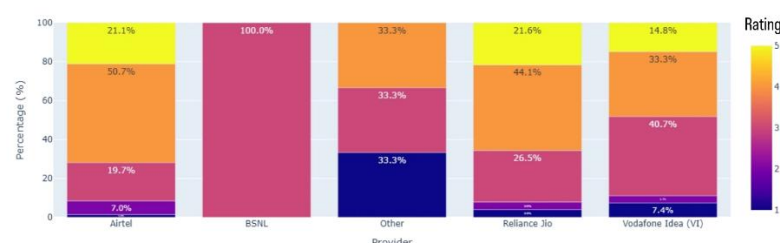


Fig 6: Internet Speed Ratings by provider

4.3 Pricing and Value Perception

On the financial front, pricing satisfaction varied across providers with a majority rating their plans as fairly priced (scores averaging 3-4 on a 5-point scale). Despite this, a subset of users expressed dissatisfaction regarding the value received, particularly concerning speed and reliability relative to cost. Data on monthly and yearly spending indicate diversity in spending habits, with several users subscribing to mid-tier plans, while a fair proportion are enrolled in long-term or unlimited data packages. Many consumers indicated a willingness to switch providers for enhanced quality or more competitive packages, signalling sensitivity to both cost and service standards.

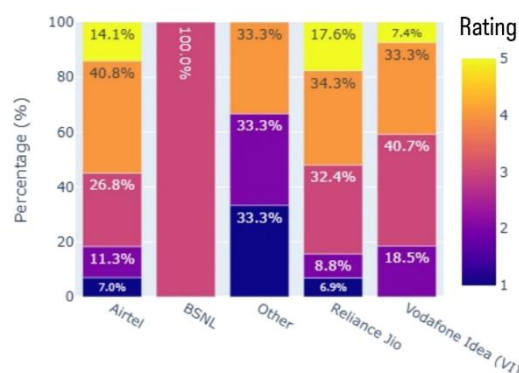


Fig 7: Pricing Satisfaction by Provider

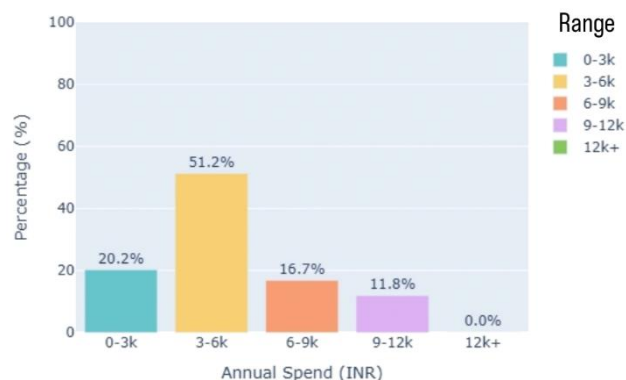


Fig 8: Annual Spending Distribution

4.4 Customer Support and Service Features

Satisfaction with customer support varies, with feedback largely aligning with the general satisfaction trends of respective providers. Add-on services and recharge plans are utilized variably, and preferences lean toward greater flexibility and long-term affordability.

4.5 Overall Satisfaction and Recommendations

Overall satisfaction levels indicate a generally positive consumer outlook, with respondents rating their providers mostly between 3 to 4 on a satisfaction scale from 1 to 5. A majority express readiness to recommend their provider, affirming service acceptance though some users remain hesitant, mainly due to network weaknesses or pricing concerns.

Users recommend improvements focused on extending and stabilizing indoor coverage, minimizing call drops, and introducing more affordable and flexible pricing plans to heighten the 5G user experience across India.

4.6 TRAI and Industry Insights on 5G Growth and Coverage

In parallel to survey inputs, TRAI's 2025 report illustrates the robust national-scale evolution of 5G services. India's 5G subscriber base exceeded 365 million by mid-2025, underscoring rapid adoption. Reliance Jio leads with approximately 191 million subscribers and provides coverage to over 80% of the population, supported by more than one million 5G cell sites contributing nearly half of India's wireless data traffic.

Bharti Airtel follows with about 120 million 5G users focused on urban expansion and mid-band spectrum optimization. Vodafone Idea (Vi) continues expanding its footprint across major cities and tier-2 and tier-3 markets through partnerships and network enhancements.

The country has witnessed an explosive increase in 5G base stations, going from roughly 140,000 in 2023 to over 436,000 by early 2024, catalysing improvements in tele-density metrics—urban tele-density surpassing 125 and rural tele-density showing steady growth.

Mid-band spectrum allocations have been pivotal for balancing speed and coverage, facilitating Fixed Wireless Access (FWA) deployments that notably enhance connectivity in underserved areas. Furthermore,

monthly data consumption per user on 5G networks ranks among the highest worldwide, driving infrastructure investments and densification. [10] [11] [12]

Projections estimate that 5G subscriptions in India may reach nearly 1 billion by 2030, constituting approximately 75% of the total mobile subscriber base and cementing India's position as a leading global 5G market.

4.7 Comparison of 5G Network Providers in India

Table 4.7: Comparison of 5G Network Providers in India

Features	Jio	Airtel	Vi	BSNL
Network Coverage	Large-scale nationwide, strong indoor/outdoor coverage, 700 MHz band used for deep indoor coverage. Over 200 million 5G subscribers.	Nationwide coverage with ongoing 5G rollout; focusing on mid-band spectrum and mmWave 26 GHz band for enhanced 5G.	5G launched in major metro and 23 additional cities; coverage expanding in 17 priority circles.	Early rollout phase; commercial 5G expected in Delhi and Mumbai by Dec 2025; wide rural and urban area focus.
Technology	5G Standalone (SA) network, network slicing with 10 live slices for various applications (IoT, gaming, FWA).	Deployment of 5G Standalone with Nokia and Ericsson partnerships, packet core integration, network automation with GenAI.	5G rollout with network enhancements; AI-powered Self-Organising Networks (SON); collaboration with Nokia, Ericsson, Samsung.	Indigenous 5G technology; aimed at affordable pricing and wider rural reach; combined with 4G expansion using homegrown tech.
Speed & Performance	Up to 1 Gbps download speeds, smart lanes for apps, high reliability.	High-speed 5G with seamless 5G/4G integration, focus on capacity and efficiency, ongoing enhancements for better experience.	Enhanced indoor coverage, increased 4G data capacity by 35%, 5G services for unlimited data plans starting ₹299.	Promises up to 1 Gbps speeds with ultra-low latency for gaming and streaming; focus on budget-friendly plans.
User Base & Scale	200 million 5G subscribers and 7.4 million fixed wireless broadband users (Jio AirFiber).	Millions of customers with scale-up of 5G SA network.	Expansion to over 23 cities with strong momentum in 5G adoption.	Still building 4G footprint; 95,000 4G towers deployed; preparing for large-scale 5G rollout.
Pricing	Competitive with various plans; focus on unlimited 5G internet options.	Varied plans with advancements in infrastructure to reduce cost per bit, focus on large-scale deployment efficiency.	Unlimited 5G data starting from ₹299 with bundled offers.	Affordable prepaid and postpaid 5G plans targeting students, small businesses, and rural users.
Key Strengths	Leading 5G provider with extensive virtual network slicing and ecosystem services.	Strong tech partnerships and network automation for faster service rollout and innovation.	AI-enhanced network with fast 4G to 5G transition, focused on urban and metro areas first.	Government supported, indigenous tech, emphasis on rural inclusion and cost-effectiveness.

Table 4.7 highlights the key features, strengths, and offerings of India's leading telecom operators—Jio, Airtel, Vi, and BSNL—for their 5G services in 2025. Jio and Airtel both provide robust nationwide 5G coverage, advanced network technology, and innovative service plans, with Jio leading in overall coverage and Airtel performing slightly better in peak speeds and metro area stability. Vi has rapidly expanded its 5G reach but is still catching up in network experience, focusing on major urban centers and entertainment partnerships. BSNL, while improving and expanding its 4G and 5G footprint, remains most competitive on affordability and rural reach but still trails in speed and overall network quality compared to the private players. This table allows for a clear side-by-side evaluation of what each operator offers in terms of coverage, technology, speeds, user benefits, and pricing, making it easier for users to choose the best fit for their needs based on up-to-date data and user experience metrics

V. CONCLUSION

The research presented in this paper underscores the rapid and transformative growth of 5G services across India. The survey findings reveal a youthful and diverse user base increasingly adopting 5G technology, with Reliance Jio, Bharti Airtel, and Vodafone Idea leading the market. User satisfaction is broadly positive, with recognition of strong coverage, enhanced speeds, and acceptable pricing, although challenges remain in indoor connectivity and network stability.

Complementing these primary insights, TRAI and industry data confirm the expansive scale of 5G deployment, with subscriber bases reaching hundreds of millions and network infrastructure rapidly evolving. The extensive 5G footprint, bolstered by strategic spectrum use and provider competition, promises to bridge India's urban-rural digital divide and drive high data usage, fueling economic and societal progress.

Looking ahead, the projected surge in 5G users and further technological enhancements signal a robust future for India's digital ecosystem. Operators must focus on refining network reliability, expanding affordable service plans, and enhancing customer support to sustain growth and deepen user engagement.

This research paper provides a comprehensive evaluation of 5G services in India through an integrated approach combining user survey insights and authoritative TRAI data. It reveals the significant progress in 5G adoption, coverage, and user satisfaction while identifying prevalent challenges such as indoor coverage gaps and call drops. By highlighting the market leadership of Reliance Jio, Bharti Airtel, and Vodafone Idea, the study informs consumers about the current network landscape and service quality.

Users are advised to consider both user experience metrics and regulatory data when selecting a 5G service provider, prioritizing those with strong coverage and customer support in their region. Further, providers should focus on enhancing network reliability, affordability, and innovative plan offerings to meet evolving customer expectations. This research contributes valuable insights for consumers, telecom operators, and policymakers to foster India's emergence as a global 5G leader.

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