POSTER: Measuring the Unmeasured: Mobile Broadband Inequality in the Global South

Syed Tauhidun Nabi
Virginia Tech
Blacksburg, VA, USA
tauhidun@vt.edu

Rahul Roy
Univ. of Liberal Arts Bangladesh
Dhaka, Bangladesh
roy18rahul@gmail.com

S. M. Taiabul Haque
BRAC University
Dhaka, Bangladesh
taiabul.haque@bracu.ac.bd

Syed Ishtiaque Ahmed
University of Toronto
Toronto, Canada
ishtiaque@cs.toronto.edu

Shaddi Hasan
Virginia Tech
Blacksburg, VA, USA
shaddi@vt.edu

Abstract

Mobile broadband is the dominant mode of Internet access across the Global South, yet independent quality assessment remains fundamentally limited. Crowdsourced platforms capture only where motivated users run speed tests, while standard administrative aggregation collapses communities with vastly different connectivity realities into a single metric — together rendering marginalized communities invisible to measurement. We construct iQoE, a normalized broadband quality index derived from crowdsourced data, and show that measurement density correlates strongly with wealth while national progress narratives obscure deep spatial inequality. To reach communities iQoE cannot see, we propose a mixed-methods approach: a lightweight Android app paired with a diary study in Korail — Bangladesh's largest urban slum — triangulated against network planner interviews. We seek SIGCOMM community feedback on measurement design for underserved urban contexts in the Global South.

CCS Concepts

• **Networks** → **Network measurement**.

Keywords

Mobile broadband, measurement inequality, Global South, crowdsourced data, quality of experience

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1 Introduction

Mobile broadband (MBB) has become the primary vehicle of Internet connectivity in the Global South, enabling access to healthcare, education, and financial services where fixed infrastructure remains limited [3, 5]. In Bangladesh, among approximately 130 million Internet users, the overwhelming majority depend on mobile networks [3]. Yet, a persistent tension remains: operators and crowdsourced measurement providers report improving KPIs—coverage, throughput, latency—while users in marginalized communities continue to experience unreliable, slow connectivity in their daily lives [1, 9].

Independently measuring mobile broadband quality remains a fundamental challenge in the Global South. Crowdsourced measurement platforms such as Ookla [8] capture only where motivated users run speed tests, systematically underrepresenting low-literate and low-income communities [6, 10]. Standard administrative boundary aggregation, the same spatial unit network planners rely on, further compounds this: communities with vastly different lived realities are collapsed into a single metric. Korail, Bangladesh's largest urban slum (~200K residents), sits within Dhaka's Gulshan Thana—one of the country's wealthiest administrative units—rendered invisible by both crowdsourced undersampling and geographic aggregation.

To characterize these measurement failures, we construct *indicative Quality of Experience (iQoE)*, a normalized broadband quality index derived from Ookla data and aggregated to Thana boundaries—mirroring how network planners typically assess performance. Our analysis reveals that only 25% of Bangladesh's quadkey tiles contain any speed test observation, and measurement density correlates strongly with wealth ($R^2 = 0.90$ across 650 Thanas). Yet iQoE itself inherits the same blind spot it tries to characterize: sparse data in rural areas hinders independent assessment, while Thana-level aggregation obscures inequality within dense urban communities. This motivates our central open question: *What is the lived connectivity experience of communities rendered invisible by these measurement frameworks—and how do network planners' KPI regimes interpret or ignore the gaps that independent measurement surfaces?*

Contributions. This paper presents an ongoing mixed methods investigation of mobile broadband inequality in Bangladesh. If successful, this project will produce three contributions. First, iQoE will provide empirical evidence of how standard measurement frameworks systematically obscure intra-urban inequality, establishing a replicable diagnostic methodology for other Global South contexts. Second, a lightweight Android measurement app paired with a diary study in Korail will produce the first ground-level account of lived connectivity experience in a community structurally invisible

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to existing measurement frameworks. Third, semi-structured interviews with network planners—using iQoE maps and user study findings as elicitation probes—will surface how KPI regimes shape organizational blind spots: what gets measured, what gets invested in, and who gets left behind.

2 iQoE: Motivating Evidence

We construct *indicative Quality of Experience (iQoE)* from Ookla's publicly available speed test data (Q1 2019–Q2 2024), aggregated across Bangladesh's 650 Thana administrative boundaries [2, 11]. iQoE normalizes median downlink, uplink, and latency against national percentile thresholds, enabling fair cross-Thana comparison:

$$\text{Normalized DL} = \frac{\text{Median DL (Thana)}}{\text{95th pct. DL (National)}}$$
$$\text{Normalized UL} = \frac{\text{Median UL (Thana)}}{\text{95th pct. UL (National)}}$$
$$\text{Normalized Latency} = \frac{\text{Median Latency (Thana)}}{\text{5th pct. Latency (National)}} - 1$$

This percentile-based normalization reduces outlier sensitivity and enables consistent comparison across Thanas, with latency inverted so that all three dimensions align directionally—higher normalized values indicate better user experience. iQoE also incorporates *likely coverage* — the ratio of quadkey tiles containing at least one speed test observation within a Thana, corrected for population density — as a core spatial component, contextualized against Meta's Relative Wealth Index (RWI) [4, 7] to surface socioeconomic disparities in broadband performance.

Three findings motivate our proposed methodology. First, only 25% of Bangladesh's quadkey tiles contain any speed test observation, leaving the majority absent from independent assessment. Second, likely coverage exceeds 90% in major urban Thanas but falls below 20% in border and rural districts — while national median downlink rose from 6 Mbps to 23 Mbps (Q1 2019–Q2 2024), a narrative of progress these spatial disparities directly contradict. Third, likely coverage — a core component of iQoE — correlates strongly with wealth (R^2=0.90): wealthier Thanas show consistently higher performance, confirming that measurement density and quality advantage compound each other. Together, these findings motivate an independent measurement approach that crowdsourced data and administrative aggregation cannot provide.

3 Proposed Methodology

iQoE reveals *where* the measurement gap exists but cannot close it — the index is itself built from the same crowdsourced data it critiques. We propose a three-component mixed-methods approach to reach inside the communities iQoE cannot see. The three components are designed to be read together: app data records what the network does, the diary and interviews record what residents experience and how they respond, and planner vignettes surface where these realities diverge from organizational KPI frameworks.

Component A: Android Measurement App. We deploy a lightweight Android app on participants' own devices in Korail, passively logging network signals — signal strength, throughput samples, latency, and cell generation (3G/4G) — during natural device activity. Designed for low-end devices common in informal settlements, the app runs without requiring user-initiated tests, eliminating the participation bias that renders Korail invisible in Ookla data. App measurements provide the objective network layer that crowdsourced platforms cannot capture in this community.

Component B: Diary Study with Pre- and Post-Interviews. Paired with the app, we conduct a 7-day diary study with n=15–20 Korail residents. Participants are recruited via snowball sampling by our field coordinator through community entry points in Korail, targeting adults (18+) who reside in the settlement and own a personal Android smartphone with an active data SIM, purposively selected to reach the community that aggregate measurement frameworks are least likely to capture. Structured prompts delivered via WhatsApp, chosen to minimize participation burden without requiring formal literacy, ask participants to document in-the-moment connectivity experiences: when the Internet fails, what they were trying to do, how they coped, and what consequences followed. A pre-interview establishes baseline usage context; a post-interview and brief "network tour" — where participants show physical spaces where connectivity works best and worst — grounds diary entries in spatial and material reality. This longitudinal design captures coping strategies (SIM switching, moving to rooftops, data rationing, app-specific prioritization) that users normalize and would not surface in a one-time interview. All participants provide informed consent; the study is subject to IRB review.

Component C: Network Planner Interviews. To examine the organizational side of the measurement gap, we conduct 6–8 semi-structured interviews with mobile network planners and engineers in Bangladesh. Rather than presenting abstract metrics, we use triangulated vignettes — composites of iQoE maps derived from crowdsourced data, passive network measurements from the Android app, and anonymized user narratives from the diary study — as structured elicitation probes. Planners are invited to interpret these patterns and explain how such cases would appear within internal KPI dashboards. This surfaces where planner rationalities and user-reported realities diverge, and which signals are rendered invisible within existing planning frameworks.

Expected Findings. We anticipate three outcomes. First, app measurements will confirm that Korail residents experience materially worse network conditions than Gulshan Thana aggregates suggest, validating iQoE's blind spot at the intra-Thana level. Second, diary entries will reveal coping strategies — data rationing, SIM switching, spatial movement — as normalized daily infrastructure rather than isolated frustration, invisible to any KPI framework. Third, planner interviews will surface the organizational constraints behind this gap: investment concentrated in high-ROI dense urban areas, KPI dashboards showing compliant performance where iQoE and user narratives reveal persistent degradation, and planners who recognize these limitations but face regulatory and institutional barriers to adopting equity-oriented alternatives.

4 Conclusion

Although this investigation is ongoing, iQoE provides early evidence that crowdsourced platforms and administrative aggregation can compound each other's blind spots, limiting independent assessment of marginalized urban communities. By sharing our methodology at this stage, we seek feedback from the SIGCOMM community to refine our measurement design and inform approaches for more inclusive independent broadband assessment in underserved communities across the Global South.

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