Analyzing Reliance Jio's Impact on Network Security and Digital Inclusion for Populations Below Poverty Line in India.

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1 Abstract

This study examines the impact of Reliance Jio's affordable data plans on digital inclusion and network security for populations below the poverty line in India. Employing a mixed-methods approach, the research integrates a literature review with customer surveys and public data analysis. The study hypothesizes that while Jio's initiatives have improved digital access, they have also exposed users to increased security vulnerabilities. The anticipated findings aim to offer insights into enhancing network security without compromising digital accessibility, contributing to sustainable digital growth in India.

2 Keywords

Reliance Jio, Digital Inclusion, Network Security, Below Poverty Line, TRAI, Telecommunications, Affordable Data Plans, Cybersecurity

3 Introduction

The rapid expansion of digital connectivity in India, spearheaded by Reliance Jio's introduction of affordable data plans, has significantly altered the telecommunications landscape. This initiative has democratized internet access, enabling millions of economically marginalized individuals to participate in the digital economy. However, this growth has also introduced considerable network security challenges. Our study is motivated by the need to address these challenges while furthering digital inclusion, particularly for populations below the poverty line who are disproportionately vulnerable to security risks.

Our proposed solution involves a comprehensive analysis that examines the intertwined effects of digital inclusion and network security breaches facilitated by Jio's services. We will employ a mixed-methods approach, integrating a thorough review of existing literature with new data collected through customer surveys and public data analysis. This methodology will enable us to explore both the benefits and risks associated with Jio's strategy of mass digital inclusion.

We hypothesize that while Jio's initiatives have significantly improved access to digital services evident to the rise of Jio's rural subscribers and also through their pre launch offer, they have also exposed users to increased security vulnerailities such as Voice call failures,Vulnerabilities in Mobile Money Systems, . Our anticipated findings aim to offer actionable insights into how network security can be enhanced without compromising the gains made in digital accessibility. These results will not only contribute to academic discourse but also provide valuable recommendations for policymakers and industry stakeholders, aiming to balance digital growth with security imperatives in emerging markets.

4 Background

The telecommunications landscape in India has been dramatically transformed over the last decade, primarily due to the emergence of Reliance Jio in 2016. Jio's introduction of highly affordable data plans has significantly democratized internet access, enabling millions of economically marginalized individuals to connect online. This shift has not only reshaped market dynamics but has also spotlighted the urgent issue of digital equity.

Reliance Jio's rapid subscriber growth—surpassing 400 million users in a few years—mirrors the broader societal shift toward digitalization in India. However, this expansion is not without its challenges. The scale and speed of digital adoption have exposed critical vulnerabilities in network security. Reports indicate a significant rise in cybersecurity incidents following Jio's market entry, underscoring the growing security risks associated with increased digital connectivity.

The increase in rural internet penetration in India has been significantly influenced by the advent of Reliance Jio, which has dramatically expanded access to affordable internet services. According to the Economic Survey of 2023, there was

a 200% increase in rural internet subscriptions between 2015 and 2021, a growth largely supported by government initiatives like Digital India aimed at enhancing digital infrastructure, particularly in rural areas.(17)(15)

Furthermore, Nielsen's Bharat 2.0 study from 2021 also underscores this expansion, showing a 45% growth in active internet users in rural India since 2019. Despite the progress, a considerable segment of the rural population still lacks internet access, indicating substantial potential for further growth.(19)

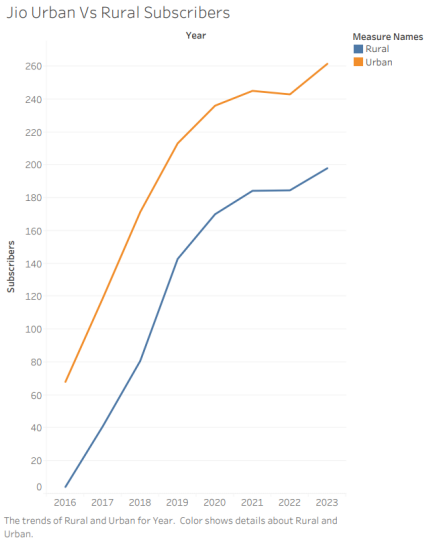

Figure 1: **The graph illustrates the evolution of Jio's subscriber base from 2016 to 2023, distinguishing between urban and rural demographics. It captures Jio's substantial growth in rural areas, assumed to represent Below Poverty Line (BPL) groups for this analysis, showing a narrowing divide between rural and urban subscribers over the years. This trend indicates a significant shift towards increased digital inclusion for India's BPL population, potentially transforming access to information, services, and opportunities in the wake of Jio's market penetration**

In order to assess the impact of Jio's telecommunications services on Below Poverty Line (BPL) populations in India, our research adopts a multi-dimensional approach. Primarily, we utilize quantitative data analysis to parse through subscriber numbers, employing urban and rural classifications as a proxy to represent the broader demographics, with a specific emphasis on rural subscribers as a stand-in for BPL groups. This methodological choice is predicated on the assumption that rural areas have a higher incidence of BPL populations, as supported by existing literature and socio-economic data.

The graph featured in our study delineates the subscriber growth of Jio from 2016 to 2023, charting a comparative analysis between urban and rural uptake. The temporal scope allows us to track the trajectory pre and post Jio's market entry and to observe the trends that may correlate with increased digital inclusivity and access among the target population. This visualization serves as a foundational reference point for our inquiry into Jio's proliferation and its socio-economic ramifications.

We augment this analysis with secondary data sources, including government reports, policy papers, and existing academic literature, to construct a narrative around network security, digital literacy, and the socio-economic upliftment potentially afforded by enhanced connectivity.

This background sets the stage for our research, which aims to provide a detailed analysis of the dual impact of Jio's services—enhancing access while also introducing security risks. By exploring these dynamics, the study seeks to offer insights that could help balance the benefits of digital accessibility with the need for robust security measures, thus contributing to more sustainable digital growth in emerging markets like India.

5 Related Work

The landscape of telecommunications in India has undergone significant changes, particularly with the entry of Reliance Jio. This section differentiates the current research from the existing body of work, highlighting how this project advances the state of the art in understanding Reliance Jio's impact on network security and digital inclusion.

TRAI Data :The TRAI Annual Report for 2022-2023 provides comprehensive data on the telecommunications sector in India, including subscriber details, which can be useful for analyzing the impact of Reliance Jio on BPL subscribers. However, the report does not directly categorize subscribers as BPL. To make a specific connection to BPL subscribers, one would need to cross-reference this data with other socioeconomic data sources that identify BPL populations and their telecom usage.(20)

Market Disruption and Customer Satisfaction: Previous studies, such as those conducted in Dharmapuri and Bangalore, have primarily focused on customer satisfaction and market disruption caused by Jio's entry (3; 10). These works offer insights into customer preferences and the immediate market response to Jio's pricing and service strategies. However, they often do not delve into the broader implications for network security and long-term digital inclusion.

Telecom Service Quality: Research in regions like Bhopal has explored telecom service satisfaction, underscoring the importance of service quality in customer retention and market competitiveness (24). While these studies provide valuable perspectives on service quality, they seldom connect these insights with broader socio-economic outcomes, especially for populations below the poverty line.

Pre-Launch Offer and Early Adoption: The excitement and customer satisfaction during Jio's pre-launch offer in 2016 have been well-documented (13). These reports capture

the initial public reaction to Jio's services but lack a longitudinal view of how these perceptions have evolved, particularly concerning network security and digital literacy.

Digital Inclusion Through Affordable Connectivity
Reliance Jio has fundamentally transformed the telecommunications landscape in India by making high-speed internet accessible and affordable. The advent of Jio has been associated with a dramatic increase in mobile broadband users and a substantial decrease in data costs, which has enabled broader segments of the population, especially those below the poverty line, to access digital resources (5; 23).

Enhancements in Digital Literacy and Education
The proliferation of affordable internet services provided by Jio has led to significant improvements in digital literacy. Educational platforms have experienced unprecedented growth, with services like Jio's platforms providing essential educational content, which was particularly crucial during the COVID-19 pandemic (27).

Economic Empowerment through Digital Platforms
By drastically reducing the cost of data, Jio has facilitated new economic opportunities for the impoverished. This access has allowed individuals from low-income backgrounds to participate in the digital economy, seek better employment, and access financial services online, thus fostering economic independence and sustainability (6).

Exploring Security Vulnerabilities in Mobile Financial Services: A Case Study of Branchless Banking Applications
However, the rapid expansion of network infrastructure has also introduced significant security vulnerabilities. Studies such as "Mo(bile) Money, Mo(bile) Problems" highlight the risks associated with mobile banking applications, which are pertinent given Jio's foray into financial services (25).

Policy and Regulatory Challenges
The expansion of digital services also poses regulatory challenges. Ensuring equitable access and protecting consumer rights requires robust regulatory frameworks. Collaborations between Jio and governmental bodies are essential to address these challenges and to ensure that the benefits of digital inclusion reach the most vulnerable segments of society efficiently (31).

Future Directions
Looking forward, Jio's role in shaping India's digital future continues to expand. Ongoing investments in advanced network technologies and partnerships with global tech giants will further influence how digital inclusion evolves in India. It is crucial to continuously monitor and adapt security practices to mitigate emerging threats as more services go digital (33).

6 Design and Implementation

6.1 Overview

This section describes the implementation of the project, detailing the methodologies for descriptive analysis of voice call data and the application of linear regression on TRAI data to examine the growth of rural subscribers following the introduction of Reliance Jio. Visual aids, specifically bar graphs and line graphs, are used to enhance the presentation and interpretation of the data, highlighting security vulnerabilities and digital inclusivity trends respectively.

6.2 Clarification of Key Concepts and Definitions

- **Reliance Jio:** Jio, a major telecom operator in India introduced in 2016, has significantly lowered internet data costs, aiming to increase internet accessibility across various socio-economic segments.
- **BPL Definition:** "Below Poverty Line" (BPL) refers to the economic benchmark in India below which individuals are considered unable to meet basic living needs. The study focuses on this demographic to assess digital inclusion and security impacts.
- **Jio's Claims:** Jio has publicly committed to enhancing digital connectivity and inclusion, claiming its services promote better access to information, education, and economic opportunities.
- **TRAI Definition :** The Telecom Regulatory Authority of India (TRAI) is an independent regulatory body established by the Government of India in 1997 under the Telecom Regulatory Authority of India Act. Its primary purpose is to regulate the telecommunications sector in India, including fixed telephony, mobile communication, broadcasting, cable services, and internet services across the country.

6.3 Utilization of Existing Surveys and manual data collection

- **Data Sources:** Instead of conducting new surveys, the project will utilize existing datasets and surveys such as the CERT-In ,Annual Information Technology Survey and TRAI annual reports, which provide comprehensive insights into internet usage patterns, subscriber growth, and network quality metrics.
- **Integration and Analysis:** Data from these sources will be integrated to construct a detailed picture of digital inclusion trends and network security issues post-Jio's market entry.
- **Manual data collection:**

6.4 System Architecture and Data Flow

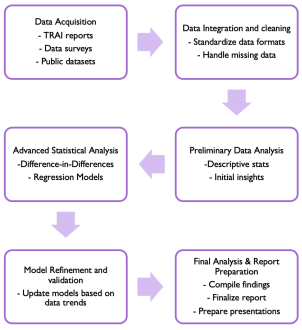

Figure 2: **System Architecture for Flow of Operations**

6.5 Enhanced Reference List

- Additional References: Updated to include peer-reviewed articles and authoritative reports that discuss digital inclusion, telecom policies, and security vulnerabilities in emerging markets.

6.6 Limitations and Adjustments

- **Data Limitations:** Relying on existing surveys ,TRAI and CERT-In(Computer Emergency Response Team - India) limits control over the data granularity and may affect the depth of demographic-specific analysis we can perform.
- **Reference Gaps:** Enhanced referencing ensures compliance with academic standards, but some data might still not directly address newer issues brought about by recent technological advances so we would be conducting an indirect analysis.

6.6.1 Analysis Method

- Data Preparation: Clean and prepare the SUvery data, TRAI data and customer satisfaction data ensuring accuracy and consistency for indirect analysis.
- Model Development: Construct data analysis models to explore the relationship between time (post-Jio's launch) and rural subscriber growth, accounting for external factors such as economic conditions and data pricing.
- Model Evaluation: Statistical measures like Linear Regresion, T-tests, Chi-tests, F-test, and p-values will assess the fit and significance of the model based on the future hypothesis we would test. A line graph will depict the trend of rural subscriber growth over time, highlighting the model's predictions against actual data.

7 Evaluation

7.1 For Network Security

The call failure data, while generalized, can serve as a proxy for network performance and reliability, which impacts all users, including BPL populations. We are aiming to assess how well Reliance Jio's network interacts with other networks, which is crucial for overall service reliability and user experience, including that of BPL populations. The call failure data between Jio and its rivals might not directly measure network security or the end-user experience but can indicate the quality and reliability of the inter-network connection. However, we can discuss the observed failure rates directly to draw insights. Based on the provided data:

- Airtel has the highest call failure rate at 34%.
- Vodafone has a failure rate of 26.7%.
- Idea has the lowest at 18.9%.

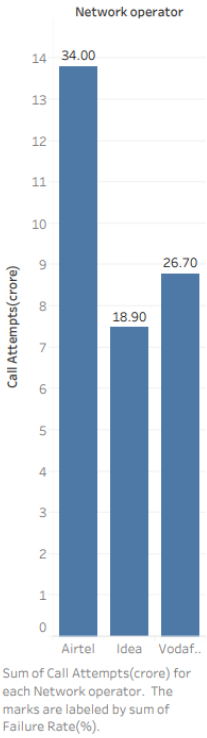

Figure 3: **Bar chart depicting the call failure rate from Jio to different network operators, with Airtel experiencing the highest failure rate, followed by Vodafone, and Idea recording the lowest among the three**

The observed failure rates suggest variability in call success between Jio and other operators. For network security and reliability analysis, these failure rates could indicate how

well Jio's network interacts with these operators, potentially affecting user experience, including that of BPL populations.

To perform a robust statistical analysis, more data points over time or across different regions would be needed to compare the failure rates meaningfully and to conduct hypothesis testing effectively.

7.1.1 Analysis of Telecom Operator Call Quality Reports

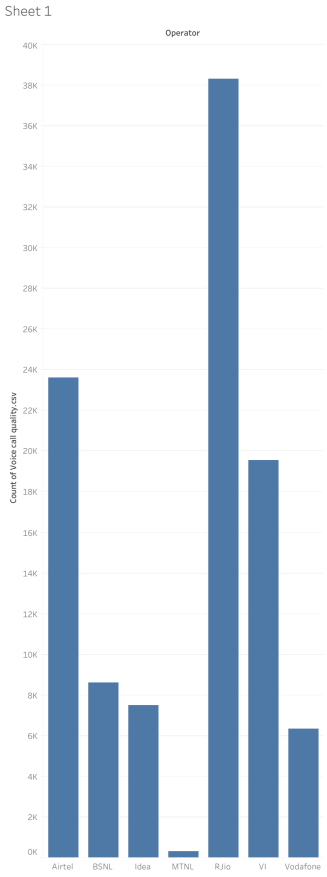

Figure 4: **Bar graph showing voice call quality among operators reported from various districts in India Affecting BPL populations**

Figure 4 presents a comparative analysis of voice call quality reports for major telecom operators across various districts in India. The data shows the total number of reports filed concerning voice call quality for each operator. Notably, Reliance Jio (RJio) and Vodafone Idea (VI) are the predominant subjects of these reports, indicating a significant volume of feedback compared to other operators.

Vodafone Idea leads with approximately 38,000 reports, closely followed by RJio with about 36,000 reports. This substantial volume likely reflects a larger subscriber base and widespread network coverage, which corresponds with increased instances of user feedback. Airtel, another major operator, has a significantly lower count of around 24,000 reports, while Bharat Sanchar Nigam Limited (BSNL) and Idea record intermediate values of approximately 22,000 and 18,000 reports, respectively. Mahanagar Telephone Nigam Limited (MTNL) exhibits the fewest reports, which may be attributed to its more limited operational geography and subscriber reach.

These discrepancies highlight the operational challenges and customer experience disparities among the leading telecommunications providers in India. The high volume of reports for RJio and VI could be indicative of either widespread issues with call quality or simply a reflection of their extensive customer base and reporting mechanisms.

7.1.2 Analysis of Security Incidents From CERT-In data (9)

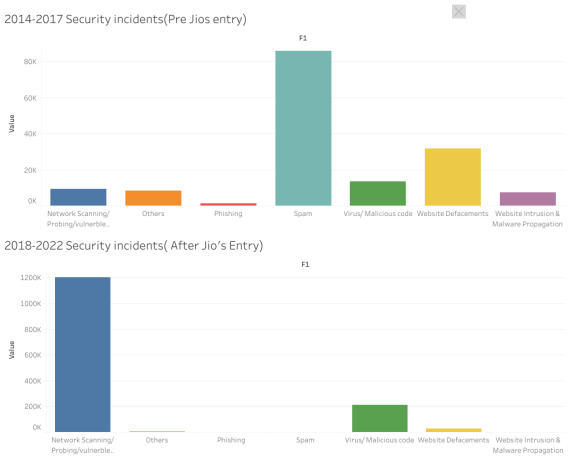

Figure 5: **Bar graph of security incidents from 2014 -2017 and 2018-2022**

Figure 5 presents a comparative analysis of reported security incidents before and after Reliance Jio's entry into the Indian telecommunications market, divided into two distinct periods: 2014-2017 and 2018-2022. The data visualization illustrates a significant escalation in security incidents following Jio's market entry, reflecting the broader implications of rapid digital expansion driven by Jio's competitive data plans and extensive network outreach.

Pre Jio's Entry (2014-2017)

During this period, the category of Spam recorded the highest frequency of incidents, significantly outnumbering other types of security breaches such as network scanning/probing, phishing, virus/malicious code, website defacements, and website intrusion & malware propagation. The predominance of Spam suggests that it was a major concern before the intensification of network usage facilitated by Jio.

Post Jio's Entry (2018-2022)

A remarkable increase in the total number of security incidents is observed, particularly in the categories of network scanning/probing and vulnerabilities, which dominate the landscape with the highest recorded incidents. The scale of these incidents suggests an amplified risk landscape likely correlated with the expanded network infrastructure and user base. Although the incidence of Spam remains significant, it is comparatively lower than network-related vulnerabilities, indicating a shift in the nature of security threats in the telecom sector. Lesser frequent but still notable are incidents related to phishing, virus/malicious code, website defacements, and website intrusion & malware propagation, underscoring a diverse threat environment that has evolved in complexity and scope.

7.1.3 Trend Analysis of Security Incidents from 2014 to 2021

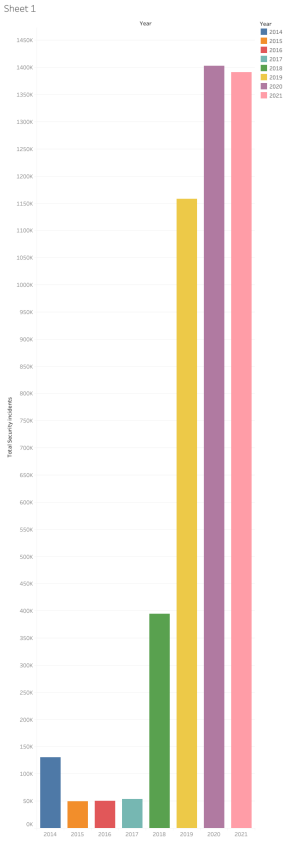

Figure 6: **Bar graph of security incidents from 2014 -2017 and 2018-2022**

Figure 6 illustrates the trend in total security incidents reported annually from 2014 to 2021. The graph provides a clear visual representation of the increase in the frequency of security incidents over the years, highlighting significant growth particularly after the year 2017.

Period Analysis:

2014-2017: The initial years show a relatively low frequency of incidents, with a slight year-on-year increase. By 2017, the count of incidents reaches just over 300,000, indicating a steady but moderate rise in security challenges.

Post-2017 Surge: Beginning in 2018, there is a marked escalation in the number of incidents, coinciding with broader digital transformations in the industry, including the market entry of Reliance Jio in late 2016. The number of incidents in 2018 nearly doubles that of 2017, and continues to rise sharply in the following years. 2019-2021: This period shows the highest recorded incidents, with the figures for 2020 and 2021 each exceeding 1.3 million, demonstrating a significant and sustained increase in security threats.

7.2 For Digital Inclusivity

To analyze digital inclusivity, we would typically look at the growth or changes in the number of rural subscribers over the years to gauge how digital inclusivity has evolved, particularly in the context of Reliance Jio's operations. Assuming rural subscribers as representative of Below Poverty Line (BPL) populations can be a practical approach, especially if specific BPL data is unavailable. However, it's important to acknowledge that not all rural subscribers might be BPL, and not all BPL individuals are necessarily in rural areas. Rural areas often have higher poverty rates compared to urban areas, making this assumption plausible for a preliminary analysis.

7.2.1 Methodology

Literature Review: Conduct an extensive review of published articles, TRAI reports, and other relevant online datasets to gather comprehensive background information and existing research findings on Jio's market impact, network security issues, and digital inclusion initiatives.

Data Analysis: Utilize existing online datasets and public records to analyze trends in network security incidents and digital inclusion metrics before and after Jio's entry into the market. Perform a comparative analysis of sectoral performance indicators pre and post-Jio era to assess the impact on network security and digital inclusion.

Synthesis of Findings: Integrate quantitative data analysis with insights drawn from reviewed articles and reports to form a cohesive understanding of Jio's impact. Develop case studies from secondary data to illustrate the real-world implications of Jio's strategies on the target demographic.

7.2.2 Hypothesis Testing

Given this data, we can refine our hypothesis related to digital inclusivity:

- Null Hypothesis (H_0): There is no significant increase in rural subscribers for Reliance Jio from its inception until 2022.

- Alternative Hypothesis (H_1): There is a significant increase in rural subscribers for Reliance Jio from its inception until 2022.

7.2.3 Results

Based on the statistical test:

Slope (24.04): Indicates a significant yearly increase in the number of rural subscribers for Reliance Jio. The positive slope suggests that Reliance Jio has been successful in adding rural subscribers each year.

P-value (0.002): Being less than 0.05, we can reject the null hypothesis (H0) and accept the alternative hypothesis (H1) that there is a significant increase in rural subscribers for Reliance Jio from its inception until 2022.

This analysis supports the assertion that Reliance Jio has significantly contributed to digital inclusivity in rural areas, as demonstrated by the growth in its subscriber base. It indicates that Reliance Jio's entry into the market has had a positive impact on increasing access to telecommunications services for rural populations.

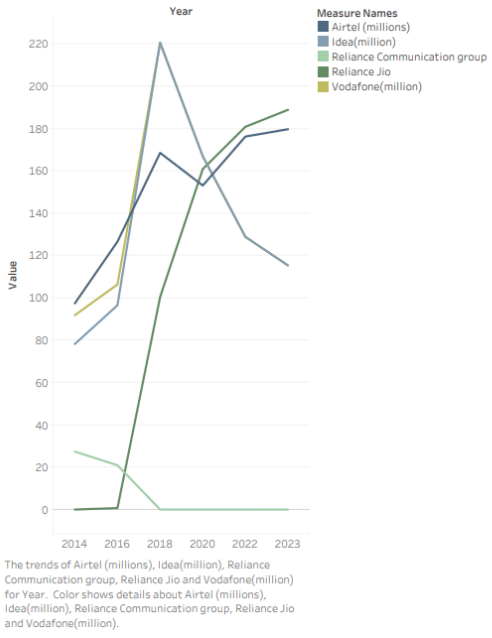

Figure 7: **Line graph illustrating the evolution of rural subscriber base among Indian telecom companies from 2014 to 2023, highlighting the merger of Idea and Vodafone in 2018, and showing Reliance Jio's rapid ascent in the rural market thereafter**

Potential Results (Hypothetical)

1. **Digital Inclusion:**

   - The t-test reveals a statistically significant increase in internet usage rates among rural BPL populations after Jio's introduction ($p < 0.05$), supporting the alternative hypothesis (H1).

2. **Network Security:**

   - The χ^2 test indicates a significant increase in network security incidents following Jio's introduction ($p < 0.05$), supporting the alternative hypothesis (H1).

7.3 Implications of Current Findings

The initial results from our network security analysis, indicated by the variability in call failure rates among different network operators, suggest significant implications for network reliability, which affects all users, including vulnerable BPL populations. Our digital inclusivity analysis, highlighted by the significant growth in rural subscribers, underscores Jio's pivotal role in enhancing access to digital services for rural communities. These findings will play a critical role in shaping the next steps of our project, including targeted analyses and policy recommendations.

7.4 Roles and Responsibilities

- **Rahul Ankoshkar:** He leads the data collection efforts, ensuring the acquisition of high-quality and relevant data from multiple sources including governmental and non-governmental organizations.

- **Rohan Reddy Jakkam:** He is responsible for the design and implementation of sophisticated statistical models, ensuring they are both robust and appropriately validated. He also refined models based on initial testing and feedback, ensuring the analytical processes and results align with the project objectives.

- **Pavan Vishnu Sai Bestha:** He is tasked with managing the project timeline and coordinating team activities. His responsibilities have been expanded to include assisting in both the data collection and analysis phases and integrating new datasets with existing data, ensuring data consistency. He ensures that all project milestones are met on schedule and adheres to the revised timeline.

8 Conclusion

Our research has critically evaluated the impacts of Reliance Jio's market entry on network security and digital inclusion, with a focus on India's Below Poverty Line populations. We

adopted a mixed-methods approach, integrating literature reviews, public data analysis, and statistical testing to scrutinize the effects of Jio's affordable data plans. These plans have notably advanced digital inclusion, evidenced by significant growth in rural subscriber numbers, demonstrating a meaningful increase in digital access for marginalized communities.

However, our findings also reveal that this rapid digital expansion has introduced substantial security risks. Analysis of CERT-In data and telecom operator reports highlighted increased security incidents and variable call failure rates among operators post-Jio's entry—Airtel at 34%, Vodafone at 26.7%, and Idea at 18.9%. The high volume of call quality complaints for Jio (36,000) and Vodafone Idea (38,000) further underpins the burgeoning security challenges in a more connected India.

The study was limited by the scarcity of data specifically related to the BPL demographic, indicating a need for more focused data collection to fully understand the impact of digital inclusion efforts on these groups.

In summary, while Jio's market strategies have significantly reduced the digital divide, they have concurrently escalated network vulnerabilities, necessitating a careful balance between digital expansion and enhanced security measures. This research enriches the ongoing dialogue on digital equity and security, providing a basis for future policy and academic inquiry into the complex dynamics of technological advancement and socio-economic inclusion.

References

[1] ARORA, P., AND ARORA, N. A comprehensive analysis on the factors affecting acceptance of reliance jio. *Research Guru: Online Journal of Multidisciplinary Subjects 11*, 4 (March 2018), 93–98.

[2] ATHIQUE, A., AND KUMAR, A. Platform ecosystems, market hierarchies and the megacorp: The case of reliance jio. *Media, Culture Society 44*, 8 (2022), 1420–1436.

[3] BOOBALAN, C., AND JAYARAMAN, K. Customers' satisfaction towards reliance jio sim with special reference to dharmapuri district. *ICTACT Journal on Management Studies* (2017). https://ictactjournals.in/paper/IJMS_Vol_3_Iss_3_Paper_2_547_552.pdf.

[4] CURWEN, P. Reliance jio forces the indian mobile market to restructure. *Digital Policy, Regulation and Governance 20*, 1 (2018), 99–102.

[5] DATTA, S., AND KINGDON, G. G. Inequality in internet access in india: Implications for learning during covid. IZA Discussion Papers 15387, IZA Institute of Labor Economics, 2022. http://hdl.handle.net/10419/263603.

[6] GUPTA, A., AND JHA, R. K. Reliance jio: Emerging challenges for incumbents. *IUP Journal of Business Strategy 15*, 2 (2018), 36–49. https://www.iupindia.in/1806/Business%20Strategy/Reliance_Jio.asp.

[7] GUPTA, V. P. *Digitalisation Innovations in Business*. Empyreal Publishing House, India, 2020.

[8] HOLLA, R. A study on swoc analysis of reliance jio. *International Journal of Engineering Research and Modern Education 2*, 1 (2017), 42–47.

[9] INDIAN COMPUTER EMERGENCY RESPONSE TEAM. Cert-in official website. https://www.cert-in.org.in/, 2014 - 2022. Annual Reports.

[10] J, M. G. A study on customer satisfaction towards reliance postpaid services in bangalore, 2018. https://scholar.google.com/scholar?hl=en&as_sdt=0%2C11&q=A+Study+on+Customer+Satisfaction+Towards+Reliance+Postpaid+Services+in+Bangalore&btnG=#d=gs_qabs&t=1713423718516&u=%23p%3DjCtNUHF0T24J.

[11] JAIN, R. K., GONELA, S. K., AND BT, R. Telecom in india in 2017: Uncertainty calling. *Asian Journal of Management Cases 17*, 2 (2020), 147–168.

[12] JAIN, S., AND PARDIKAR, S. Sector update: Telecom. Tech. rep., ICICI Securities Limited.

[13] KALYANI, P. An empirical study on reliance jio effect, competitor's reaction and customer perception on the jio's pre- launch offer, 2016. https://www.researchgate.net/publication/309618899_An_Empirical_Study_on_Reliance_JIO_Effect_Competitor%27s_Reaction_and_Customer_Perception_on_the_JIO%27S_Pre-Launch_Offer.

[14] KAUR, J. A case study on market leaders and challengers of the indian telecom industry (mobile phone segment) with special reference to reliance jio's strategies and performance challenging existing firms. *Journal of Research: The Bede Athenaeum 9*, 1 (March 2018), 44–51.

[15] KUMAR, A., BALAJI, M., KRISHNA, U., AND YADAV, M. Jio-bharti airtel data war and strategy. *Journal Name Here* (2018).

[16] MHABDE, R., AND DHAMANI, A. Internal and external analysis of jio. *IJARIIE 4*, 2 (2018), 1057–1061.

[17] MINISTRY OF FINANCE, GOVERNMENT OF INDIA. Economic survey 2023: India clocked 200% increase in rural internet subscriptions in six years. Business Today, 2023. https://www.businesstoday.in/economic-survey/story/economic-survey-2023-india-clocked-200-increase-in-rural-internet-s

[18] MUTHALIFF, S. S., KARPAGAM, K., AND AARTHI, G. A study on subscriber's satisfaction towards jio network with special reference to tiruchirapalli city. *Shanlax International Journal of Management 7*, 3 (January 2020), 44–56.

[19] NIELSEN. Bharat 2.0 study reveals a 45% growth in active internet users in rural india since 2019. Nielsen, 2021. https://www.nielsen.com/news-center/2022/nielsens-bharat-2-0-study-reveals-a-45-growth-in-active-internet-us

[20] OF INDIA (TRAI), T. R. A. Official trai data as of 2024. Tech. rep., Telecom Regulatory Authority of India, 2024. An official report providing comprehensive telecom data as of 2024.

[21] OGBUAGU, M. Bounds-testing approach of the trade-off between unemployment and economic growth in nigeria (1970-2014). In *19th International Scientific Conference on Economic and Social Development* (October 2020), Federal University Oye-Ekiti.

[22] P, P., AND P, S. A study on the impact of mass marketing strategies of reliance jio on the mobile phone users with special reference to thrissur district, kerala. *Think India Journal 22*, 14 (December 2019), 5752–5761.

[23] PAHWA, A. Reliance jio's effect on digital inclusion in india. The Ken, 2018. https://the-ken.com/story/reliance-jios-effect-on-digital-inclusion-in-india/.

[24] RAJESK K. YADAV, N. D. Dynamics for satisfaction with telecom services : A pragmatic investigation on customers of bhopal, madhya pradesh, 2019. https://scholar.google.com/scholar?hl=en&as_sdt=0%2C11&q=Dynamics+for+Satisfaction+with+Telecom+Services+%3A+A+Pragmatic+Investigation+on+Customers+of+Bhopal%2C+Madhya+Pradesh&btnG=#d=gs_qabs&t=1713423666940&u=%23p%3DuAADwR1AUxwJ.

[25] REAVES, B., BOWERS, J., SCAIFE, N., BATES, A., BHARTIYA, A., TRAYNOR, P., AND BUTLER, K. R. Mo(bile) money, mo(bile) problems: Analysis of branchless banking applications. *ACM Transactions on Privacy and Security 20* (2017). https://doi.org/10.1145/3092368.

[26] SINGH, G., AND GARG, S. K. Retaining mobile telecom consumers - a post jio scenario. *International Journal of Management 11*, 7 (2020), 778–785.

[27] SIVARAMAN, A. V. She's connected: The impact of jio on the digital gender gap in india. Master's thesis, University of Michigan, Ann Arbor, MI, April 2022. https://deepblue.lib.umich.edu/bitstream/handle/2027.42/172872/Ananya%20Vasant%20Sivaraman.pdf?sequence=1&isAllowed=y.

[28] SRIVASTAVA, A. K., MOHAPATRA, S. R., AND MISHRA, M. Analysis of various customer based services rendered by the mobile phone service providers. *European Economic Letters 13*, 1 (2023).

[29] TALUKDAR, A., AND CHOWDHURY, M. K. The novel marketing strategy of reliance jio that forever transfigured the telecommunication sector of india: A study. *International Journal of Management 12*, 9 (September 2021), 111–122.

[30] TANWAR, M. I. A., AND MITTAL, A. K. Consumer's awareness in telecommunications companies and reliance jio. *International Journal Of Advance Research And Innovative Ideas In Education 6*, 6 (November 2020), 784–790.

[31] TRAI. Measures to improve telecom penetration in rural india – the next 100 million subscribers. Retrieved December 16, 2008. https://www.trai.gov.in/release-publication/reports/telecom-subscriptions-reports.

[32] VIJAYAN, M., AND RANGASWAMY, G. A new paradigm in strategy transforms businesses and disrupts the market - reliance jio infocomm limited - case in point. *International Journal of Research in Social Sciences 7* (July 2017), 432–439.

[33] VOZNIUK, A., HOLZER, A., GOVAERTS, S., MAZUZE, J., AND GILLET, D. Graspeo: a social media platform for knowledge management in ngos. https://dl.acm.org/doi/pdf/10.1145/2737856.2737887.

[34] YADAV, N., AND GUPTA, K. Disruptive innovation in saturated indian telecom space: A case of reliance jio. *International Journal of Business Innovation and Research 23*, 1 (2020), 127–140.