Data Traffic Demand Forecast for Brazil: An Update

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CONTENTS

EXECUTIVE SUMMARY

Forecasting market demand for telecommunications services is industry common practice, crucial for suppliers in the production chain as well as for policymakers and regulators overseeing infrastructure investments. The demand for data serves as a cornerstone of modern telecommunications services and media transmitted across networks. Growth of traffic demand is prominently featured in the public consultation put in place in January 2024 by Brazil's National Telecommunications Agency (Anatel).

This debate is not new and attempts to forecast data demand growth have been carried out in recent years to provide evidence for the debate. Important recent research was conducted by Prado (2023). Using available public databases and a projection model recognized as appropriate by the International Telecommunication Union, the study concluded that "there is no perspective of traffic explosion that gives rise to a need for reviewing fundamentals in network traffic remuneration models", and that a significant increase in network investments might not be required.

This paper aims to forecast the aggregate data demand in Brazil complementing previous analyses (CISCO, 2018; PRADO, 2023). It employs explanatory variables such as the number of active broadband users with connections exceeding 34 Mbps, the prevalence of 4G and 5G services, the expected evolution of per capita GDP, demographic changes, and online services consumption. These variables are considered at the national level, drawing from reputable sources including Anatel (2023), CETIC (2023), and IBGE (2023). The findings are presented for three scenarios tailored for the Brazilian market and are benchmarked against previous reports and estimates.

The study forecasts that Brazil's total data consumption in 2033 will range from 297.01 exabytes per year in a low growth demand scenario to 400.74 exabytes per year in a higher growth demand scenario. The higher growth forecast slightly surpasses earlier projections by Prado (2023), reinforcing anticipated trends in Brazil. These figures, including upcoming innovations, are within the same range of previous robust forecast exercises and do not corroborate scenarios of congestion in the use of digital infrastructure in Brazil in the coming years.

1. INTRODUCTION

Forecasting market demand for telecommunications services is a common practice within the industry, crucial for suppliers in the production chain as well as for policymakers and regulators overseeing infrastructure investments. Accurate demand forecasting requires analyzing trends in new services and customer behavior, utilizing historical data, and considering projections for emerging telecommunications services.

Central to this forecasting framework is the demand for data, which serves as the cornerstone of modern telecommunications services and media transmitted across networks. Key recent references in this field include research by CISCO (2018) and Prado (2023), offering methodological insights for forecasting data demand and presenting empirical findings.

This study aims to forecast the aggregate data demand in Brazil, complementing previous analyses carried out by CISCO (2018) and Prado (2023). It employs explanatory variables such as the number of active broadband users with connections exceeding 34 Mbps, the prevalence of 4G and 5G services, the expected evolution of per capita GDP, demographic changes (proportion of individuals aged 20 to 60 in total population), and online services consumption. These variables are considered at the national level, drawing from reputable sources including Anatel (2023), CETIC (2023), and IBGE (2023). The findings are presented for three scenarios tailored for the Brazilian market and are benchmarked against previous reports and estimates.

While this paper's conclusions align with mainstream perspectives, as exemplified by ERICSSON (2023), it strives to enhance the precision and relevance of these estimates. By incorporating best practices in data forecasting, reevaluating the drivers of data demand, and integrating recent analytical contributions, the study offers nuanced scenarios for data demand forecasting within the Brazilian context.

2. DRIVERS OF DEMAND IN THE BRAZILIAN DIGITAL ECOSYSTEM

The telecommunications industry in Brazil is experiencing a historic moment. Challenges such as the universalization of services and fostering a positive business development environment have elevated the country to a connectivity standard comparable to OECD (Organization for Economic Cooperation and Development) nations, in particular regarding mobile broadband penetration. This sector is pivotal, providing services essential to millions of consumers and businesses. The

surge in high-tier broadband connectivity is propelled by a broader quantity of uses as part of a paradigmatic data culture embraced by Brazilian society. Digital transformation of public services, extensive use of the internet as a preferential platform for business development and the rise of Value-Added Services (VAS) have catalyzed the rapid expansion of optical fiber networks nationwide.

To cope with broadband demand, investment in Brazil's telecommunications network has been sourced primarily from three areas: telecom companies – driven by small Internet Service Providers (ISPs) investment in expanding fixed-broadband coverage –, state-sponsored infrastructure, and private investments in data processing and storage and international gateways developed mainly by tech companies. These sources have collectively accelerated the modernization of the national infrastructure, steering it towards a sophisticated digital public infrastructure. Consequently, this has created a fertile environment for cutting-edge technologies to thrive, including those based on the Internet of Things (IoT), private networks, and customized platforms catering to sectors with high demand such as entertainment and media, healthcare, manufacturing, and mobility.

Recent progress in data forecasting has enabled the sector to enhance the quality of predictions regarding data demand. It is crucial to consider the current trends in the dynamic digital ecosystem and the increasing dependency of various services on data to achieve their intended results. Insights from application trends reported by CISCO (2018), ERICSSON (2023), and SPGLOBAL (2023) provide a glimpse into the myriad of data demand drivers anticipated in the upcoming years. These reports suggest that activities like internet video surveillance, government cloud services, and corporate applications for managing traffic, virtual reality (VR), and augmented reality (AR) are poised for a global upsurge. These activities, typically managed by private corporations and the public sector, illustrate how both are harnessing internet capabilities to improve their operations and deliver superior services to the community.

Despite the data estimates available for end-user demand, estimates of the consumption of data from corporate applications and government sources is still incipient. Indications of data traffic demand imply that these sectors are integral to shaping demand trends, as the data traffic generated by industry automation and public services will merge into the network flow to access the internet. Therefore, the demand from corporations and governments extends beyond consumer-focused applications, including progress in artificial intelligence, innovative software development, cloud and edge computing, quantum technologies, and the broad digital transformation of public services and climate-related technologies. This expansion requires a more in-depth understanding of the role of digital public infrastructure as a public good.

This trend is in line with the current direction of digital transformation in the

public sector and the ongoing digitalization of Brazilian industry. For example, an assessment of the government plans for the 27 Federative Units of Brazil during the 2022 election revealed that 46.4% of the candidates prioritized state digital transformation as a central policy (ÁVILA et al., 2022). This indicates a comprehensive review of public services processes and delivery and their migration to digital platforms.

In addition, national connectivity public policies are setting ambitious targets for both retail and industrial connectivity. The federal government anticipates an increase in connectivity for end consumers by 10.8% from the 2022 baseline by 2027 (BRASIL, 2024), and aims to digitally transform 90% of all Brazilian industrial companies within a decade, up from the current 23.5% (MDIC, 2024).

This understanding also extends to the widespread use of certain internet practices, such as automated tasks that simulate human activity and large-scale messaging. Although historically underreported, recent data (IMPERVA, 2023) indicates that these practices are representative of the total internet traffic, marking an annual increase of 5.1% from 2022 to 2023.

From the digital ecosystem's standpoint, the demand drivers propelled by the state and private sectors could result in the need for additional capital inflows into the telecommunications infrastructure. Recognizing this cause-and-effect relationship, both the public sector and the industry have committed to increasing investments and incentives to develop the country's digital public infrastructure. On the state's part, this effectively means new sources of state-sponsored infrastructure that will complement initiatives by the Ministry of Communications for Brazil and the sector's regulator. These include commitments for investment as a prerequisite for spectrum allocation (ANATEL, 2022), the obligations of the Universalization Plan (PGMU), and the Terms of Adjustment of Conduct (TAC) (ANATEL, 2023), among others. Industry estimates project a 12.9% growth in investment in information technologies and communications, with figures expected to reach $27.4 billion by 2026 (IDC, 2023). Figures for investment are explored later in this paper and in a specific chapter on network investment.

Conversely, the domestic retail sector's prospects are more modest. Broadband usage already surpasses 90% of Brazilian households (IBGE, 2023), and there is a high penetration of intensive data services (CETIC, 2023) within the Brazilian society, suggesting that no extraordinary pressure on the telecommunications network investment will come from this segment (ANATEL, 2024). This assessment is corroborated by data indicating a marginal decline in the growth rate of IP video traffic and streaming content in recent years (ERICSSON, 2023), suggesting the potential for a demand plateau.

According to industry forecasts, the annual growth rate of mobile data traffic will decelerate until 2029, with marginal growth slowing to below 20 percent after

2027 (ERICSSON, 2023). This projection includes the expected surge in the use of XR-type services, such as AR, VR, and mixed reality (MR), which are anticipated to gain significant traction by the end of the decade. The industry's projections for mobile data traffic are summarized in figures 1 and 2 below.

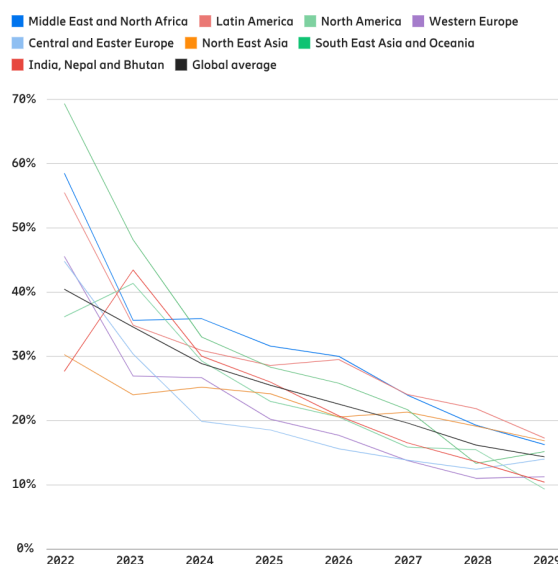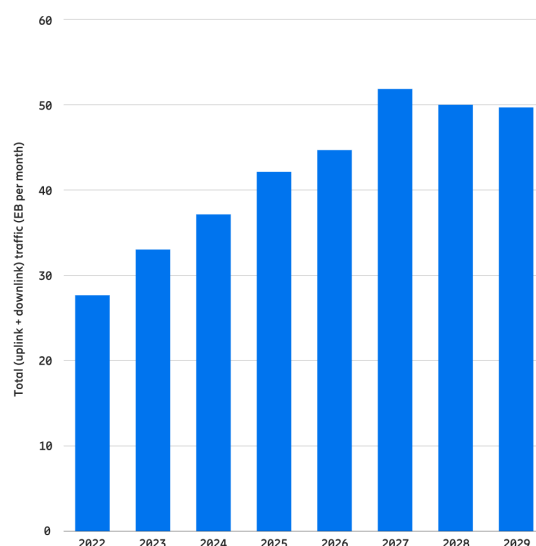Figure 1. Forecast year-on-year mobile data traffic growth rates by region 2022–2029

Figure 2. Forecast yearly net added mobile data traffic 2022–2029

Source: Ericsson, 2023

Even among VAS consumers, commonly regarded as a significant driver of data demand from end-users, historical trends show that these services undergo cycles of adoption and are periodically replaced without a significant shift in the duration of consumer engagement (FRANSER, 2014; KOUL et al., 2021). Therefore, while the intensity of data per content unit is likely to increase, it is improbable that this will impose excessive strain on the network, considering the current level of usage and the expected life cycle effects of VASs that vie for consumer acquisition and retention.

It must be acknowledged that VAS providers have introduced numerous technical features to tailor content to the network conditions of end clients. One notable feature is dynamic data compression mechanisms, which facilitate a seamless match between content quality and density and the consumer's network conditions. This technology plays a crucial role in the consumer's data consumption journey, explaining how even lower-tier broadband capacities can accommodate the use of VAS applications. Moreover, features like compression technologies are gaining traction and are being enhanced with the integration of deep learning mechanisms. These serve as an intelligent layer between applications and network operations, offering a solution to hardware limitations.

These factors collectively highlight the presence of a diverse array of drivers

influencing data traffic demand in Brazil. They also highlight the risk associated with attributing trends to a single vector, which could result in an incomplete understanding of the broader discussion and merely resonate within a subculture focused on narrative disputes surrounding private interests. The conclusions drawn from the research forecasting exercise require an assessment of the ecosystem.

3. FORECASTING SCENARIOS AND METHODOLOGY

Data demand and consumption behavior in Brazil have been monitored with a certain regularity over recent years. There are two primary sources for this measurement. The first is a mix of demand forecast and bottom-up measures, based on infrastructure measurements, with the VNI Complete Forecast Highlights (CISCO, 2022) being a commonly cited reference. The second is a top-down method derived from primary surveys, such as those conducted by CETIC (CETIC, 2023), and based on methodology standards set by the International Telecommunication Union (ITU). The Brazilian regulator also provides a top-down historical dataset of contracted broadband capacity (ANATEL, 2023a), based on the declared number of active accesses per range of contracted capacity by the service providers.

By its turn, data demand forecasting typically relies on two alternative methods: qualitative techniques and time series analysis and projection. The qualitative method is built on expert opinion, market research, or panel consensus. The Delphi model, which falls under the qualitative branch of forecasting models, is consistently applied to data forecasts and offers a long-term perspective on various future trends. Delphi studies adhere to the ITU best practices for demand forecasting (ITU, 2023) and are periodically conducted by the Brazilian regulator (ANATEL, 2020). Prado (2023) has used this method to forecast the growth of fixed and mobile broadband end-users, and historical trends for predicting the evolution of data consumption per end-user.

The time series method focuses on identifying patterns in data demand trends and their changes over time, relying on historical data. This method, which is employed in this paper, aims to complement efforts in forecasting data demand for Brazil. It is based on observations and projected data from 2017 to 2033 and considers the variables: data demand (DATA_DEMAND), number of active mobile accesses in 4G and 5G technologies (4G5G), declared broadband contracted speed above 34 Mbps (ABOVE34MBPS), population aged between 20 and 60 years old (POP20TO60), declared fixed broadband prices between 101 and 150 Reais per month (ABOVE150REAIS), and an aggregated variable of declared regular online service consumption through the internet (ONLINE_SERVICES). A dummy variable

(DUMMY) was defined to capture the effects of the COVID crisis on the data series.

Data demand is provided by CISCO (2022), while broadband consumption and cost are provided by CETIC (2023). The variable for mobile accesses is provided by ANATEL (2023), and the population data by IBGE (2023). As the available data series for data demand starts in 2017, this year was set as the starting year for the estimation that extends to 2023.

The online service variable is a composite measure that includes five sub-variables representing prevalent online activities among the Brazilian population. It covers online gaming, video streaming, music listening, content sharing, cloud services, work activities, and completing educational assignments or research, as reported by CETIC in 2023. The integration of these sub-variables into a single digital service variable was chosen to mitigate the issue of limited degrees of freedom within the model. This integration was accomplished using a weighted average method, which combined the sub-variables according to their relative significance.

The data demand forecast is projected for the period 2024-2033. The fundamental assumption behind this analysis is that relationships between dependent and independent variables, as well as trends, are stable over time. Selected variables follow theoretical grounded causal relation between these variables and data demand vectors as provided in the reviewed literature (KENNY et al., 2023; PRADO, 2023).

The following table summarizes the descriptive statistics for the selected variables, which were chosen following a stepwise procedure.

Table 1. Data Statistics (2017-2023)

Statistics	Unity	Mean	Standard Deviation	Minimum	Maximum
DATA_DEMAND	Exabytes	50.34	27.88	16	91
4G5G	Access in service	167.52	41.04	102.4	213.08
ABOVE34MBPS	%	23.04	15.17	4.29	41.99
PLAN>150REAIS	%	5	0.010	3.8	6.5
ONLINE_SERVICES	%	66.42	0.02	63.78	68.99
POP20TO60	Million people	138.04	3.13	133.39	142.03

Figure 3 provides a visual summary of a sample of variable trends over time, and Equation 1 below presents the estimated model. The estimates are derived using a standard Ordinary Least Squares (OLS) regression technique, which aims to present the conditional correlations among the selected variables.

Equation 1. Demand model equation

$$DATA\_DEMAND_t = \beta_0 + \beta_1 ln(POP > 20 < 60 years)_t + \beta_2 ln(4G5G)_t + \beta_3 ln(> 34mbps)_t + \beta_4 ONLINE\_SERVICES_t + \beta_5 ln(> 150REAIS)_t + \beta_6 DUMMY + \varepsilon_t$$

where the data demand (DATA) is the dependent variable measured by the yearly data demand in Brazil, β0 is the intercept, β1 is the coefficient associated with the share of the Brazilian population between 20 and 60 years old. β2 is the coefficient to the number of mobile broadband services accesses in service. β3 is the coefficient to the number of fixed broadband access in service. β4 is the coefficient to the declared share of the Brazilian population that consumes online services on a regular basis. β5 measures the number of consumers that declared paying above 150 Reais monthly for a fixed broadband access. Finally, β6 allows to capture the non-linear effects of the covid 19 pandemic on the model estimates. ε is the error term. Results of the regression are shown in Table 2 below.

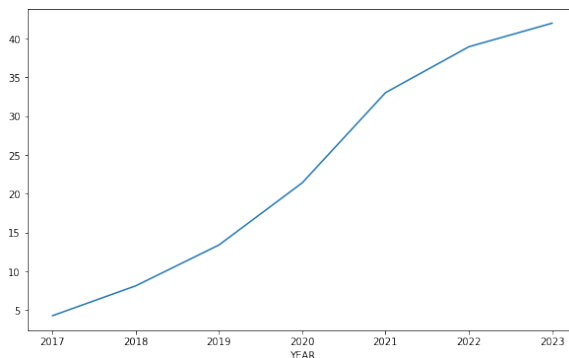## Figure 3. Overview of selected variables (2017-2023)
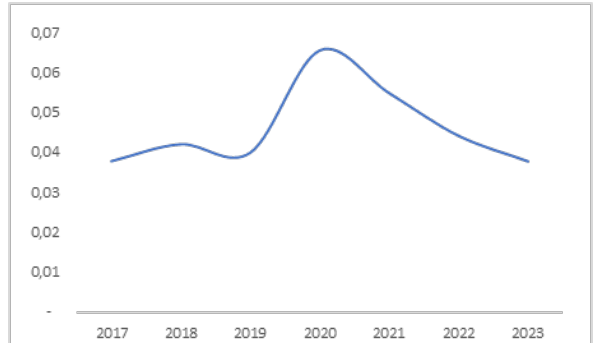
(a) Data consumption (Exabytes)
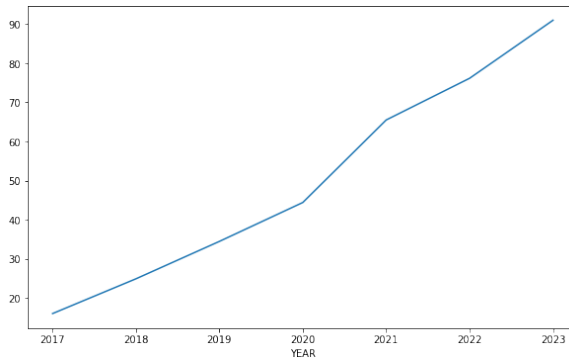
(b) 4G and 5G (Access in Service)
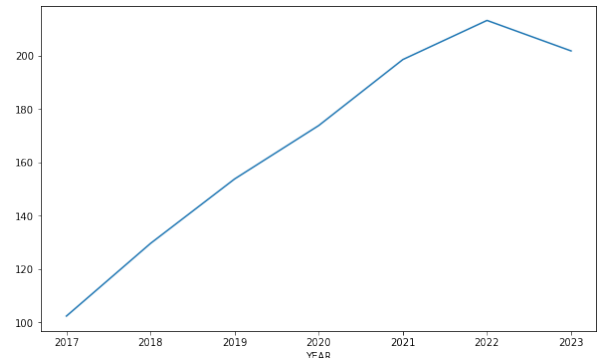
(c) Access above 34 Mbps (Access in Service)

(d) Fixed Broadband Plans above R$ 150 (monthly)

Source: Data Consumption (CISCO, 2023), 4G and 5G (ANATEL, 2024), Declared access above 34 Mbps (CETIC, 2023), declared prices for fixed broadband plans (CETIC, 2023).

Table 2. Coefficients

Variables	Coefficients
*In*POP20TO60	1.411**
*In*4G5G	-0.3223 *
*In*ABOVE34MBPS	3.086 *
ONLINE_SERVICES	1.224 ***
DUMMY (COVID YEARS)	-0.798 ***

Note: * $p < 0.01$; ** $p < 0.05$; *** $p < 0.15$. Adjusted R2: 0.999. Coefficients are in natural log. Observations:7 years. The variable plan price above 150 REAIS(PLAN>150REAIS) was dropped during the stepwise regression procedure.

The coefficients demonstrate a varied impact on data demand. Broadband services with speeds exceeding 34 Mbps are shown to have the most substantial effect on projections, with the demographic variable of the population aged 20 to 60 years following. A hypothetical increase of 10% in broadband plans with speeds above 34 Mbps correlates with a 13.22% increase in data demand, while the same percentage increase in the population size results in a 10.41% rise in data demand.

The consumption of aggregated online services positively influences data demand in Brazil, albeit to a lesser extent. Estimates indicate that a hypothetical 10% increase in the adoption of online services leads to a 1.12% uptick in data demand. Conversely, the availability of 4G and 5G technologies has a negative impact on data demand, suggesting that advancements in mobile technology do not necessarily translate to higher data usage in Brazil. This could be due to data cap policies that incur additional charges when consumers exceed their plan limits, thereby potentially discouraging extensive data use.

Additionally, the cost of fixed broadband implies that subscribers to these plans are more inclined to consume data intensively. This may be associated with access to a broader spectrum of digital services and data-heavy applications typically offered in higher-tier plans.

The results are presented for three demand scenarios: baseline, high demand, and low demand. These scenarios are designed to encompass all sector trends to estimate data traffic loads on Brazil's telecommunications infrastructure. The baseline scenario is predicated on a consistent growth trend in the digital environment and its influencing factors.

The high-demand scenario projects an above-average growth in data capacity, with an average yearly growth of 20% above the baseline for the demand vectors from 2023 to 2033. This could arise from the launch of highly appealing data-intensive services and quicker adoption of higher tier broadband plans with speeds above 34 Mbps. On the other hand, the low-demand scenario accounts

for potential disruptions in the provision of data services. This could be due to the introduction of extra costs for service provision, which may deter consumers from accessing higher-tier broadband plans, or due to an increase in the price of value-added services (VAS), limiting their utilization. A 'data softening demand factor' is introduced in the model to reflect a slowdown in data traffic growth. As an assumption, it assumed an hypothetical 20% average yearly decrease of the demand variables between 2023 and 2033.

4. RESULTS

The overall context of data demand in Brazil is like most emerging countries. Population demand for data has increased systematically over the last decade pushed by improvements in conditions of life, the ongoing process of universalization of broadband access through both fixed and mobile technologies and the extensive offer of digital services. Demand shocks along with the Covid-19 pandemic pushed broadband consumption to record levels and dictated a paradigmatic shift in consumption demand. Figures 4 and 5 below summarize an extended view of the extended data demand drivers considered in this study.

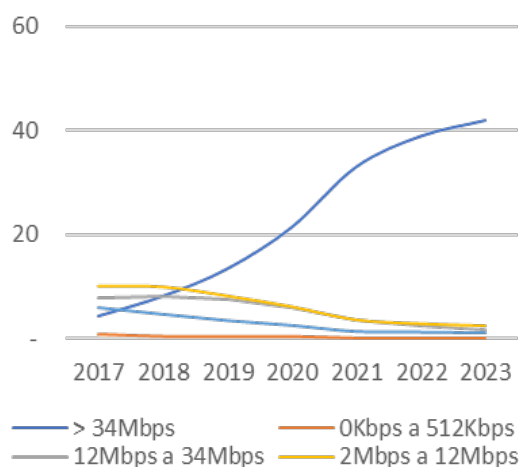Figure 4. Fixed broadband plans as contracted by consumers in Brazil (million active users)

Figure 5. Mobile accesses by technology in Brazil (million active users)
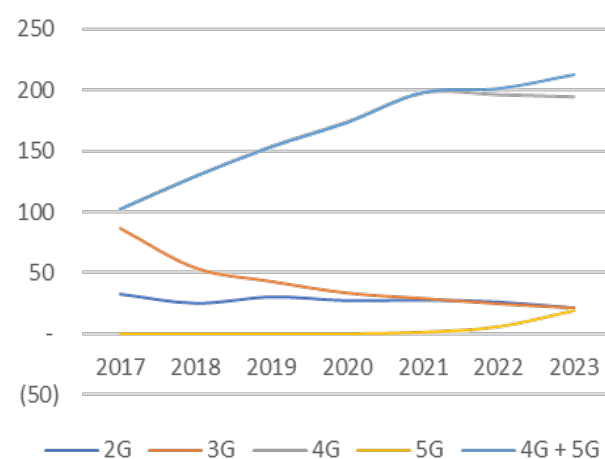
Source: Anatel, 2023

These figures suggest a significant shift towards higher tier services both in fixed and mobile technologies. It happened due to both the offer of services and the willingness of consumers to experience better quality and responsive services. The evidence collected in this study reveals the importance of broadband speed as the main vector of demand expansion in Brazil.

The underlying mechanism might be the relationship between average download speeds and the consumption of data. Higher use of fixed and mobile broadband services also suggests that demand for connectivity is closer to universalization. For this research, it implies the net addition of new consumers might only represent a marginal impact on total data demand in the country.

For the mobile industry in Brazil, even the subscriber migration from lower tier technologies on 2G and 3G subscribers to 4G and 5G would not add significant stress over the aggregate level of connectivity considering the full market supply in a couple of years. The same applies to the universalization of smartphone access that might reach a plateau in the coming years (STATISTA, 2024).

Data cap policies of most operators in the country might also reduce the willingness of mobile consumers to use mobile data. Such trends partially justify the industry expectation of slowing marginal data demand growth after the second half of the current decade (ERICSSON, 2023). It is also consistent with the ITU estimates that despite the rise of mobile broadband, fixed broadband accounts for 83 per cent of all traffic (ITU, 2024).

Trends in consumer behavior over the years are also representative of the changing pattern of data demand. Available references suggest that the pattern of online services demand demonstrates a stronger volatility between 2019 and 2023. One plausible hypothesis for this phenomenon could be attributed to the pandemic's impact on video consumption and the subsequent 'reboot effect' in the post-pandemic years. A more detailed analysis of content demand trends could foster a nuanced discussion regarding overall demand trends.

Age also influences data demand. While empirical evidence detailing this variable's impact on demand is still lacking in Brazil, studies from other countries indicate a significant causal relationship between age and data demand. For example, research conducted in the United Kingdom found that age variables for individuals aged 25–64 and those aged 65 and above are correlated with 44 per cent of the variation in data traffic across different areas, as opposed to a mere 2 per cent for average download speed (KENNY et al., 2023). This study also suggests that older populations are more likely to opt for lower-tier broadband services.

An additional insight from the study by Kenny et al. (2023) suggests that data usage is determined by consumers' 'inherent' demand, which reflects their desired activities, as well as the limitations imposed by connectivity bandwidth. From the authors' perspective, the concept of the consumer aligns with the mainstream understanding that end-users actively drive data demand.

Table 3 provides the results for the forecast scenarios. It includes the three different scenarios and uses the study by Prado (2023) as a reference.
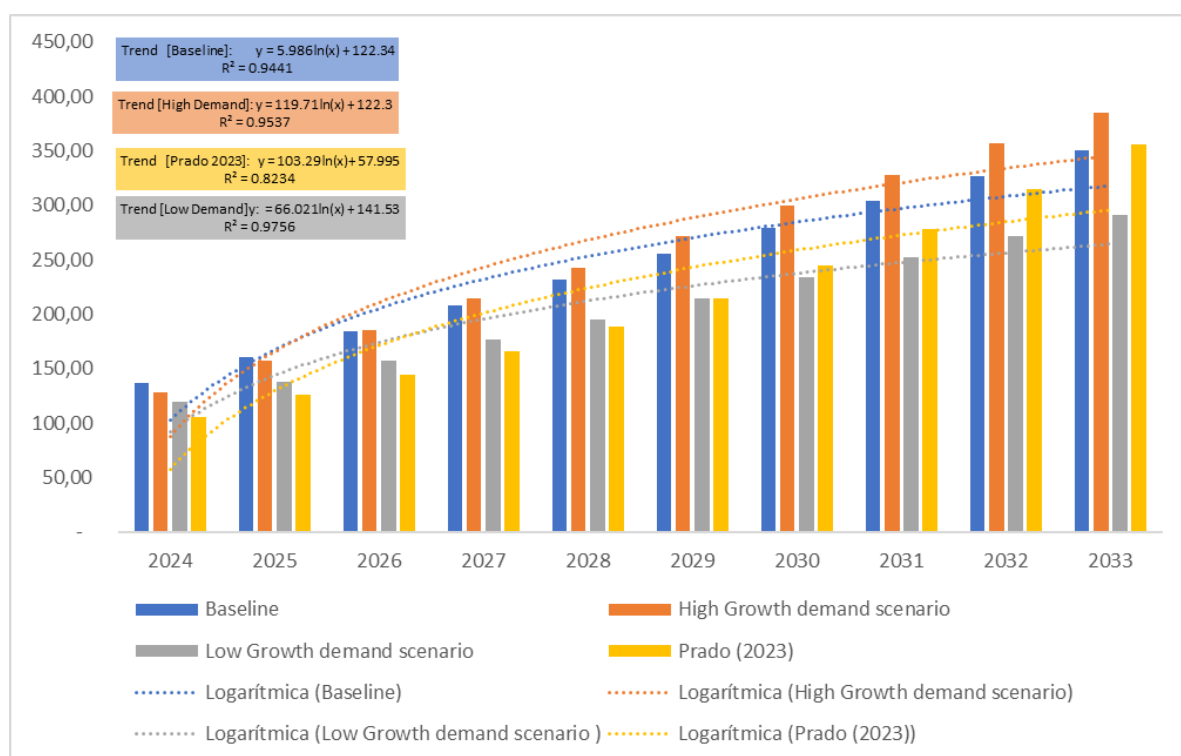
Table 3. Data demand forecast for Brazil, in Exabytes (2024 – 2033)

YEAR	Baseline	High Growth Demand Scenario	Low Growth Demand Scenario	Prado (2023)
2024	136.86	128.80	119.32	105.69
2025	160.52	157.35	138.39	126.08
2026	184.33	185.88	157.45	144.87
2027	208.23	214.41	176.51	165.63
2028	232.15	242.94	195.57	188.88
2029	256.05	271.46	214.62	215.13
2030	279.91	299.97	233.68	244.71
2031	303.69	328.48	252.73	277.89
2032	327.39	356.98	271.77	315.10
2033	350.98	400.74	297.01	356.12

Source: authors

The results suggest a growing prospect for data demand in Brazil in all scenarios, following the global trend in the sector. Estimated demand by 2033 indicates that data demand in Brazil might potentially reach 297.01 to 400.74 exabytes per year in the country which represents 3.26 to 4.40 times above the records for 2023, respectively. Results demonstrate coherence with previous study by Prado (2023) which estimated a demand of 356.12 exabytes per year in 2033.

Figure 6. Overview of data demand projections

Trend [Baseline]: $y = 5.986\ln(x) + 122.34$ $R^2 = 0.9441$

Trend [High Demand]: $y = 119.71\ln(x) + 122.3$ $R^2 = 0.9537$

Trend [Prado 2023]: $y = 103.29\ln(x) + 57.995$ $R^2 = 0.8234$

Trend [Low Demand] $y = 66.021\ln(x) + 141.53$ $R^2 = 0.9756$

Source: authors

Figure 6 offers a graphical representation of the maximum and minimum projection scenarios, incorporating the benchmark data. The narrowing gap between these scenarios over time indicates a consistency in the long-term projections. The highest anticipated average annual growth rate for data demand in Brazil is approximately 16% for the period from 2024 to 2033.

Therefore, despite projected growth in data demand, there is no indication of abrupt demand surges within the next decade. These projections are supported by industry forecasts extensively cited throughout the paper. The forecasted scenarios predict an annual data demand growth of between 13% and 16% from 2024 to 2033. Notably, the rate of data demand growth has been on a decline as digital markets reach maturity.

5. FURTHER NOTES ON NETWORK INVESTMENT

The recent evolution of the communications sector in Brazil is the result of transformative trends in the data consumption behavior and the structural characteristics of the market. Despite the changes, investments in the digital connectivity infrastructure have remained stable since 2015, performing below the average rate for other major economies. By 2015, the average investment in telecommunications per access in Brazil was around USD 16, far below the OECD average of USD 82 (OECD, 2020). Although this amount increased slightly to USD 19.2 by the end of 2018, it was still below the OECD average of USD 84 in the same year (OCDE, 2020).

In the last decade, most infrastructure investments in Brazil were focused on wireless infrastructure. This is explained by the strategic behavior of major operators who, pushed by incentives offered by the federal government through spectrum auctions, focused on mobile operations rather than fixed broadband. Therefore, the delay of large operators to engage in modern fiber technology have reduced their competitiveness in the market and might be related to the potential, albeit pending empirical studies, reference for infrastructure bottlenecks in certain regions.

Notwithstanding the overall debate in the private context, investments in fixed networks have relied on public subsidies and incentives. Concession legacy networks, still representative of the high-capacity transit networks, a renewed perspective on the use of the universalization fund, the shift of liabilities to infrastructure projects, and all the incentives, commitments and obligations under the spectrum allocation policies are some examples of the state sponsored infrastructure development. Most of the public sector investment rises on the understanding that enhancing the quality and availability of the digital public infrastructure is a public good to enhance the potentialities of the digitalization of

the country (ANATEL, 2013, 2021, 2023b; FREITAS et al., 2016, 2019).

While the public sector sponsored investments on telecommunications networks allow for anticipating the benefits of the digital transformation in the country, it might also generate an adverse selection problem. Although it requires further empirical studies, the supervisory mandate of the State towards the telecommunications sector might refrain private players to promote investments in the sector, slowing down the deployment of modern infrastructure or limiting it to the mandatory commitments subscribed in the mechanisms such as spectrum allocation commitment, liability conversion to investment, among others (PRADO, 2018). Similarly, aspects such as the uncertainties around the ongoing debate about the allocation of reversible assets might also play a role in the decision to postpone investment by the telecommunications' largest players (ADAMI; PEREIRA NETO, 2022).

Alongside this ongoing debate, but still in the private arena, the small ISPs, known in Brazil as PPPs, have developed a native-digital strategy, leading the fiber-to-the-home (FTTH) market in the country. According to Anatel, these companies represent 52.7% of the market share provision in the country, and above 70 per cent of the fiber technology share (ANATEL, 2024). For this segment of the telecommunications ecosystem, most investments occur on a private basis, out of the reach of the public incentives. Further details on the current and prospective status of digital network investment in Brazil are provided in a subsequent study.

There are several attempts to forecast the need for telecommunications network investment in Brazil in the coming years. For instance, Jung and Katz (2023) estimate the need of US$ 4,3 billion in both mobile and fixed broadband infrastructure to reach 98.5% of 4G penetration and 68.0% of FTTH from 2023 to 2029. The Inter-American Development Bank, in a study conducted with support of Anatel (IADB, 2022), found that US$ 9.6 billion in investments were required to achieve 98.2% of broadband population coverage, and to connect 26,800 public schools and 6,300 health facilities. Both reports focus on the investment needed to expand the access to broadband to virtually the entire population, without considering the investments needed to maintain and update the current infrastructure to keep up with the increasing data traffic demand.

Accounting for both drivers of investment (network update and expansion), the research by Prado (2023) forecasted average investments of about US$ 10,72 billion per year for the 2024-2033 period (6.7% higher than the average yearly investments of the 2018-2022 period), according to official estimates for both fixed and broadband penetration and traffic demand. Considering that the results of the new data traffic demand forecasting exercise reported in this study are aligned with the results reported by Prado (2023), its conclusions regarding the investments needed to cope with data traffic increase are upheld.

6. CONCLUSIONS

This study contributes to a broader initiative aimed at elucidating the determinants and benchmarks of data demand in Brazil. Its objective was to project future data demand and to contribute new insights to the ongoing debate on data demand trends in the country. By building upon prior research in the sector, this study not only corroborates but also strengthens the body of evidence found in existing literature.

The findings suggest that the anticipated data growth over the next decade is a manifestation of a data-centric culture that permeates all segments of Brazilian society. Data demand appears to be indicative of a structural transformation within Brazil, with projections indicating an upward trajectory consistent with global trends in the sector. By 2033, data demand is projected to range from 297.01to 400.74 exabytes, which could represent an increase of up to 4.40 times thefigures recorded for 2023. These figures are within the same range of previousrobust forecast exercises, such as the one conducted by Prado (2023) and do notcorroborate scenarios of congestion in the use of digital infrastructure in Brazil inthe coming years.

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