



Brazil Mobile Observatory 2012





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Introduction



Introduction

The GSMA Mobile Observatory series first started with an analysis of the European market in 2008 and continued with reports on Asia and Africa. The latest Mobile Observatory examined the Latin American mobile market in 2011.

This is the first Brazil edition of the GSMA Mobile Observatory series, which provides a description of present and future trends in the mobile communication industry in Brazil. The report is based on recent statistics and discusses market developments, the economic and social impacts delivered by mobile communications, economic and technologic forecasts, main sector regulations and proposed new impactful government intervention on mobile legislation. This observatory highlights the industry and government's commitment to social inclusion through digital mobile technology.

The data analysed for this report was drawn from a wide range of sources, including discussions with mobile network operators, to provide a comprehensive picture of the mobile industry in Brazil. Commercial sources such as Wireless Intelligence and Deloitte's own research were combined with data from public and governmental organisations such as Anatel, the Ministry of Communications and Teleco to present more complete market trends.

The GSMA Mobile Observatory series is available at:

www.gsma.com/publicpolicy/public-policy-resources/mobile-observatory-series/



Executive Summary

Over the past decade, Brazil has been on a path of increasing prosperity, economic stability and improvements in social welfare. Swift action by the government led to Brazil being among the first developing economies to recover from the effects of the global financial crisis that took hold in 2008. Despite slower growth in 2011, Brazil overtook the United Kingdom as the world's seventh largest economy.

Today, GDP growth is trending up, the proportion of the population living below the poverty line has been in a steady decline, and public spending on education has increased faster than nearly any other country, according to OECD. The largest economy in Latin America, Brazil is a country on the move.

Mobile services and the commercial ecosystem surrounding them should play a major part in this transformation. The fast-growing mobile sector is generating jobs, creating new business opportunities and delivering new categories of services such as mHealth, mEducation and mCommerce, which are making an increasing impact.

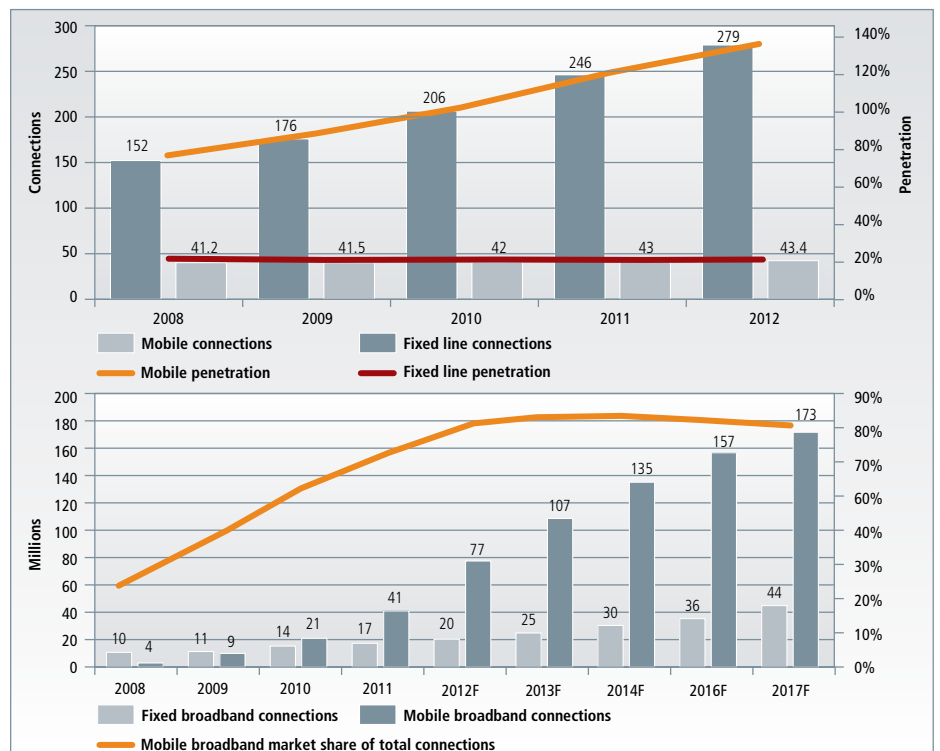
Around the world, governments that have taken a light touch in taxing and regulating the sector, i.e., those that have trusted in market dynamics to achieve universal mobile coverage and healthy competition, have seen the fastest spread of affordable mobile services for their citizens. Brazil is demonstrating its leadership in some regards, such as the commitment to deliver 4G mobile services for the forthcoming Olympic Games and World Cup. However, as this report describes, a number of constraints exist for the mobile sector, risking undermining mobile's potential to improve people's lives, and livelihoods, across the country.

A growing market

With over 260 million connections, Brazil is the fourth largest mobile market in the world, and as the largest market in Latin America, drives innovation, business ventures as well as social and cultural activities across the region.

Mobile penetration is expected to reach 140% in 2012 compared to fixed-line penetration of 22%, placing mobile as the key provider of all types of telecommunications services to the majority of consumers. This coverage allows mobile technology to connect segments of the Brazilian population that were previously unconnected as well as addressing the digital divide by increasing the availability and affordability of data services. In just four years since the introduction of 3G services, over 60 million 3G and mobile broadband connections have been provided, making mobile the main provider of broadband services.

Figure A: Mobile and fixed connections and penetration; mobile and fixed broadband connections and penetration



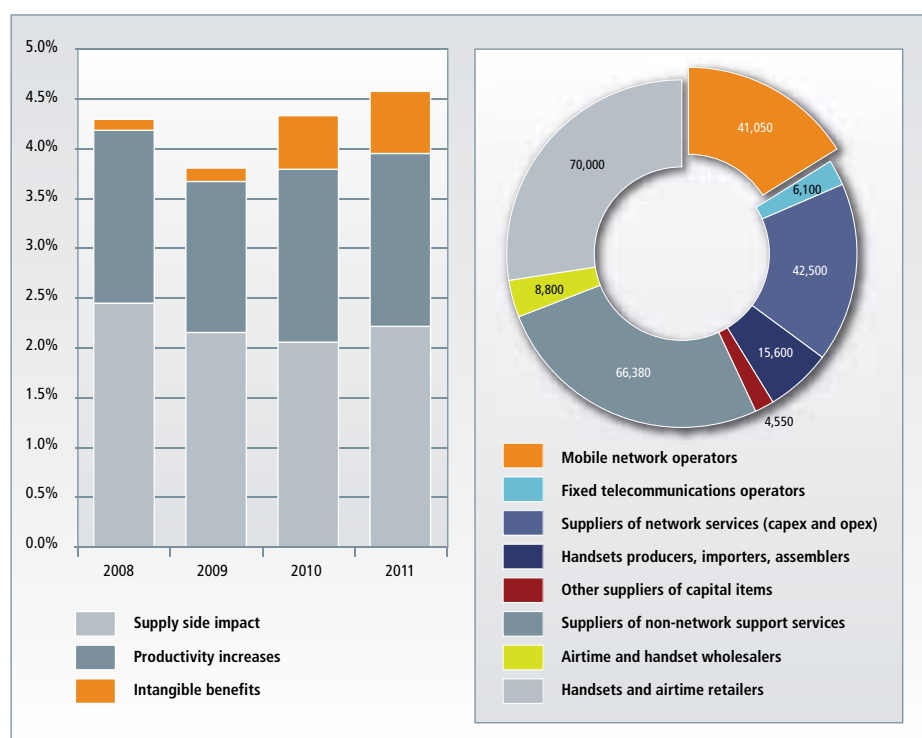
Source: Wireless Intelligence, Telebrasil and Teleco

With seven network operators, the mobile sector in Brazil is highly competitive, supporting a significant local and regional mobile ecosystem of handset manufacturers, providers of network and support services, local content providers such as “app” developers, and a network of wholesalers and retailers of handsets and airtime that spans the whole country. In 2011, this ecosystem contributed significantly to Brazil’s economy:

- The direct economic impact of the wider mobile ecosystem amounted to BRL 90 billion (US\$ 53.8 billion), including BRL 52.2 billion (US\$ 31.2 billion) in taxes.
- The wider economic impact added BRL 185 billion (US\$ 110.6 billion) to the Brazilian economy, or approximately 4.6% of GDP. This calculation takes into account the significant effects of mobile technology on workers’ productivity and the benefits provided to consumers through price reductions and increases in usage.
- Approximately 250,000 Full-Time Equivalent (FTE) jobs were created across the Brazilian economy.



Figure B: Economic contribution (% of GDP, 2008–2011) and employment (FTEs, 2011) generated by the mobile ecosystem



Source: Deloitte/GSMA analysis



Mobile services are a key enabler for social and digital inclusion

Mobile services have become an essential driver of social and digital inclusion in Brazil, with effects ranging from greater personal and family communication through to increased social cohesion and access to mobile services for people on low incomes and in the most rural areas.

- Mobile services are playing a major role in achieving the targets set by the government in its National Broadband Plan, which aims to extend internet services to all municipalities by 2014. The government's target to achieve 60 million broadband connections by 2014 has already been met, due to the growth and investment of mobile sector. There is a clear rationale for the government to consider a further role for mobile as a complement to, or substitute for, fixed broadband in social and economic development.
- Mobile services have transformed the way health, education and youth services are provided. There are currently seven mHealth programmes and numerous mEducation programmes running in Brazil, and the rising prevalence of smartphones and tablets seem certain to generate additional social benefits, especially in the rural and poorer areas of the country.
- Mobile operators have established a number of corporate social responsibility programmes in Brazil, benefitting local communities. TIM's programme in Rocinha, Vivo's programme in Belterra, and Oi's education programme are just a few examples.

Brazil's unprecedented growth in mobile services is set to continue

The Brazilian mobile market is set for unprecedented growth in the near future, as it increasingly extends its leadership in Latin America.

- The increased affordability of smartphones and tablets will allow Brazilians to take advantage of mobile broadband, and the social and commercial services associated with it. Data traffic per user is expected to grow on average by 83% per year between 2008 and 2020, with over 75 million smartphones forecast in the country in 2016. As a result of these pressures, demand for mobile broadband is expected to increase 19-fold between 2011 and 2016 and mobile networks are expected to come under significant strain if new capacity is not made available.
- The 2014 World Cup and the 2016 Olympic Games in Rio will further increase demand for mobile services, however this is likely to add significant congestion to mobile networks, as these events are widely expected to consume significant bandwidth. The World Cup is expected to bring over 1 million roaming connections, generating 300% of the normal data traffic for a period of 8 weeks. Analysts estimate that during the London 2012 games, 60GB of data crossed the network in the Olympic Park every second, and this figure is likely to grow significantly in four years' time. Providing extra capacity in such a limited time window will be a key challenge for operators.
- New business models affecting a variety of services are being successfully developed and tested on the market, including mPayments, mCommerce and mAgriculture. In particular, mPayments are expected to be available soon at retail points, in transport facilities and for special events. These services will create opportunities for small and medium-sized enterprises to add value through the development of applications and customized solutions, and the provision of local content along the value chain. New social and business services from mobile technologies will become increasingly popular.

M2M and NFC technologies and opportunities for local industry development

| | | | |
|-------------------------------------|--|----------------------|--|
| mPayments | Paying your bills (Danhero Mail) Paying in stores (Cielo, Banco do Brazil and Oi, PagSeguro) | mAgriculture | Pest control Real-time info pieces and weather forecasts. DatAgro |
| mCommerce | Buying online (Group on) Compare prices (BoaLista) | mAutomotive | Fighting vehicle theft Wi-Fi car services |
| Smart Cities/ mUtilities | Monitor energy consumption, Reda Ampla Rio De Janeiro M-Voting, Rio Grande do Sul Public transports, Fortelaza Entertainment, World Cup locations | mInfotainment | Personalised in-flight entertainment Mobile TV and services on-the-go |

Barriers to growth can be removed by supportive policies

Mobile services provide the government and Anatel with an opportunity to further address social and digital inclusion, which are widely recognised as key enablers for the whole economy. However, for growth opportunities to materialise, a series of hurdles for mobile operators and consumers need to be lowered.

Simplifying regulation and approval times for site deployment

Approvals for site and antenna deployment have been identified as the greatest obstacle to further investment by the mobile community. An array of permissions from local and federal authorities can take well over a year to secure before a site can be built and made operational. In addition to planning approval, regulations on frequency limits for electromagnetic waves are also particularly complex and unaligned among a number of national and local government bodies, as each local authority has the flexibility to determine its own policies. There are more than 250 different antenna policies in Brazil.



Overlapping and often contradictory rules are supervised by different organisations, making compliance from mobile operators increasingly complex and uncertain. An equally complex framework for infrastructure sharing is an additional barrier, as this option provides an important means for operators to rapidly increase capacity. Allowing infrastructure sharing could be key to the next wave of network investment by operators. However, infrastructure sharing should not be overly regulated, and access should not be mandated, as the threat of access obligations would risk reducing incentives for investment.

As capacity increases are urgently required, especially in the 12 World Cup cities, complex and uncoordinated federal and local regulations and approval processes on site deployment could be simplified. Positive steps have recently been made in regard to the proposed Antenna Law and to MiniCom's efforts to facilitate the approval process in four World Cup cities. The constraints remain severe and pose a threat to the success of the World Cup events, so priority should be given to the approval of this new homogenous and coordinated legislation.

Reducing inefficient taxation to increase access and usage

Taxation on mobile consumers and operators in Brazil is one of the highest in the world. The special sales tax that applies to mobile usage forces mobile consumers to pay almost 0.3 BRL for every Real spent on a phone call. Numerous taxes on operators' revenue reduce profitability, impacting retail rates and investment. High taxation is also inhibiting service development, as services that could be offered using mobile technology attract additional mobile-specific taxes. Although positive changes have been proposed recently to exempt machine-to-machine (M2M) services from special taxation, taxes remain high.

The potential benefits of reducing this taxation are substantial, as tax reductions and rationalisation could drive further consumption (the average mobile user in Brazil consumes around 40% fewer minutes than its Mexican peer) and investment in productivity-enhancing commercial services. The Communications Minister has recently defined the high tax burden of telecommunications services as a limit to the expansion of the sector, and noted that a reduction of this pressure would lead to double the sector's current rate of growth. Removing mobile-specific taxation, and consequently driving increased usage and penetration, could substantially expand the tax base for the government, potentially making the tax reduction neutral for the government in the medium term.

To ensure that taxation does not become an obstacle to further growth and to access to new mobile broadband services, targeted tax reductions could be considered.



Allocating the 700MHz Digital Dividend to mobile services in the medium term

Spectrum will become an even more vital input to the success of the industry and to the success of the government's digital and social inclusion programmes. While the recent auction of the 2.5GHz band will alleviate spectrum constraints in the short term, in the medium term the technical properties of this band will not allow nationwide mobile broadband coverage. A study carried out by the ITU estimates that in 2015, mobile telecommunications services will need over 1GHz of spectrum to meet market demands, and today in Brazil 500MHz of spectrum are allocated to mobile.

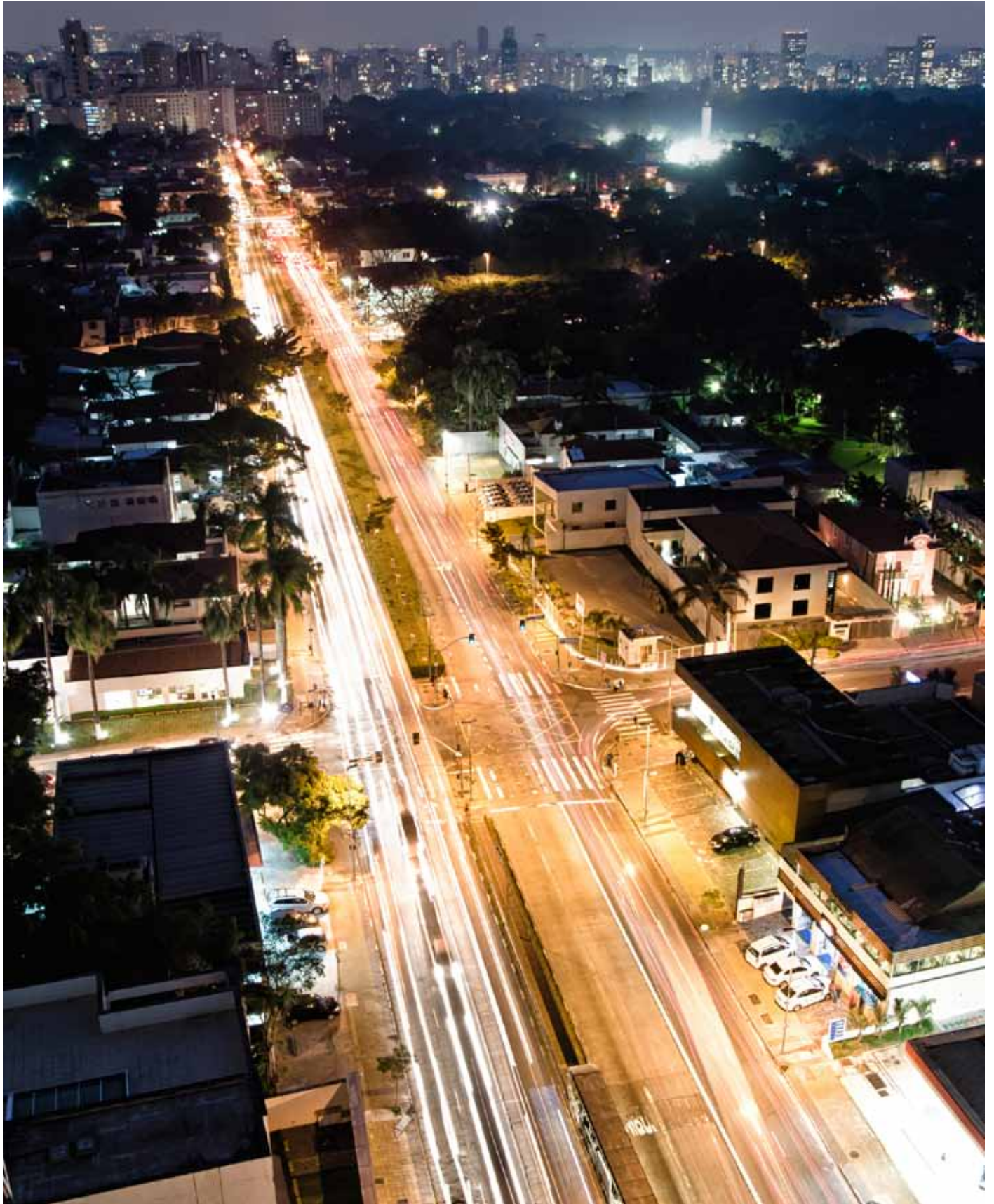
Anatel is currently considering whether to allocate the 700MHz band, currently allocated to broadcasting and known as the Digital Dividend, to mobile services. The 700MHz band has a number of beneficial technical properties whereby operators could extend mobile broadband coverage more efficiently, while installing a lower number of sites, which would reflect on lower prices for consumers and on extended services, especially in rural areas. A GSMA/TAS study recently calculated that, in Brazil, allocating the 700MHz band to mobile instead of broadcasting would provide an additional direct and indirect contribution to GDP of US\$ 5.3 billion, would generate over 4,300 job opportunities, and could generate additional tax revenue for the government of US\$1.3 billion. Scale economies would also materialise, benefitting consumers through more affordable terminals as well as operators through cheaper equipment, which would in turn drive further investment.

Implementing a more transparent, predictable and supportive regulatory regime

As a result of the global economic crisis, investment funding has been harder to obtain, and a key factor that global investors consider when deciding to invest in telecoms is whether a modern, transparent and predictable regulatory regime is in place. Competition policies should take precedence over regulations; regulatory decisions should be adopted through a transparent and consultative process; regulatory policies should be based on the 'economic benefit' principle; and coordination between local and national bodies should be improved to avoid double regulation at the local and national levels, particularly in relation to network roll-out regulations for mast and site deployment.

A collaborative approach between government and operators can maximise the benefits from growth

The mobile industry in Brazil is an enabler of economic and social development, and mobile should be at the centre of any ICT development strategy as it allows, through extensive internet access, to meet the government's social inclusion goals. Affordable mobile broadband will bring numerous advantages to Brazilians of all income and education levels, and a host of new services in all economic areas, from transport, banking, commercial transactions, to health and education. It will lead to a wave of transformation in the way Brazilians communicate and live their lives. Brazil faces a number of challenges in the next years, including the successful delivery of the World Cup and Olympic Games. By working in partnership, the mobile operators and the government can continue the remarkable success story of this industry, extending its unique benefits across Brazil and boosting Brazil's image on the world scene.



1. Characteristics of the Brazilian mobile market

This section introduces the history and discusses the features of the growth that has characterised the Brazilian mobile market since its inception. Also discussed are the recent rapid development of mobile broadband, the competitive landscape and the sector's technology evolution.

1.1 The telecom industry and mobile services in Brazil

The history of mobile telephony in Brazil began on 30 December 1990, when the Cellular Mobile System (SMC) began operating in the city of Rio de Janeiro, with a capacity for 10,000 terminals.

At that time, according to Anatel (the national telecommunications agency), there were 667 devices in the country. The number of devices rose to 6,700 in the next year, to 30,000 in 1992. Explosive growth followed, and today (Q2 2012) Brazil has over 260 million connections.¹

The privatisation of the mobile telephony sector in 1998 was the key factor that led to this market growth. Opening up the market to private capital benefitted both state-owned and new market entrants, leading to large investments in the sector. This promoted new services and led to significant price decreases, ultimately benefitting Brazilian consumers.

Since 1998, the year of privatisation of telecommunications services, Brazilian GDP per capita has grown by 30.5% and the density of landlines increased by 83.8%. In contrast, over the same period, mobile phone connections grew by 2,813%.

The last 20 years have seen a number of transformations in the mobile industry and in the mobile ecosystem. The timeline on the next page captures the main market events.



¹ Mobile network access points – e.g., one SIM card

Figure 1: Timeline of mobile communications in Brazil



1.2 A growing market

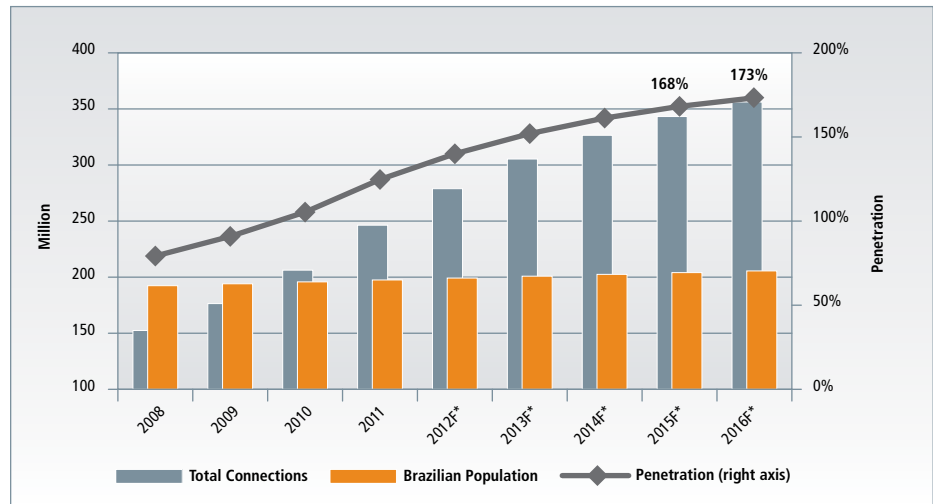
1.2.1 Mobile connections keep growing

The Brazilian mobile market is the fourth largest in the world for number of connections, after China, India and the USA, respectively, and represents almost 40% of the entire Latin American market.

Brazil has over 260 million active mobile telephony connections and mobile penetration of over 130%, as shown in Figure 2. Unlike many large, mature markets, penetration has continued to grow solidly in recent years: since 2008, connections have increased by over 100 million units from a penetration level of 79%.

Brazil has over 260 million active mobile telephony connections and a mobile penetration of over 130%

Figure 2: Connections, penetration and population

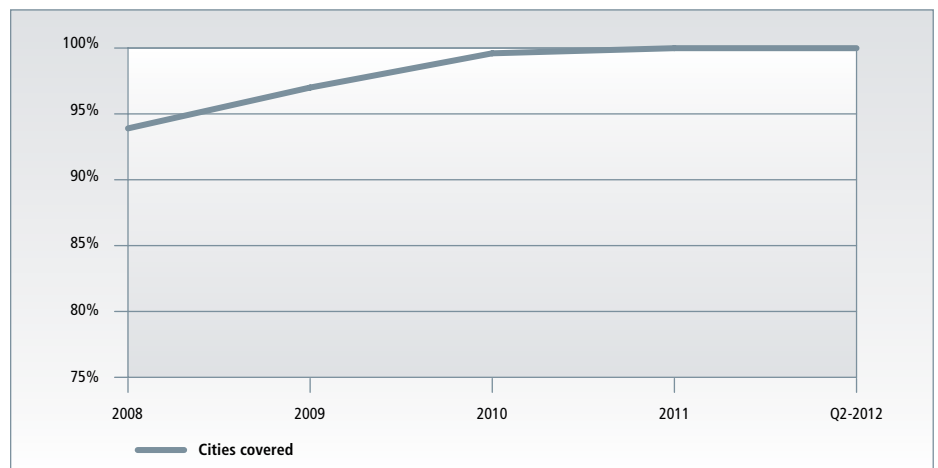


Source: Wireless Intelligence

Coverage has increased rapidly, and mobile services have connected the unconnected population

The growth in access and service availability to the Brazilian population has been made possible by mobile operators' investment in extending service coverage to an increasing number of areas in the country. Today, according to Teleco and Anatel², mobile operators cover over 99% of the population and 99.9%³ of the Brazilian municipalities, increasing from 76% since 2008.

Figure 3: National mobile coverage over time



Source: Teleco

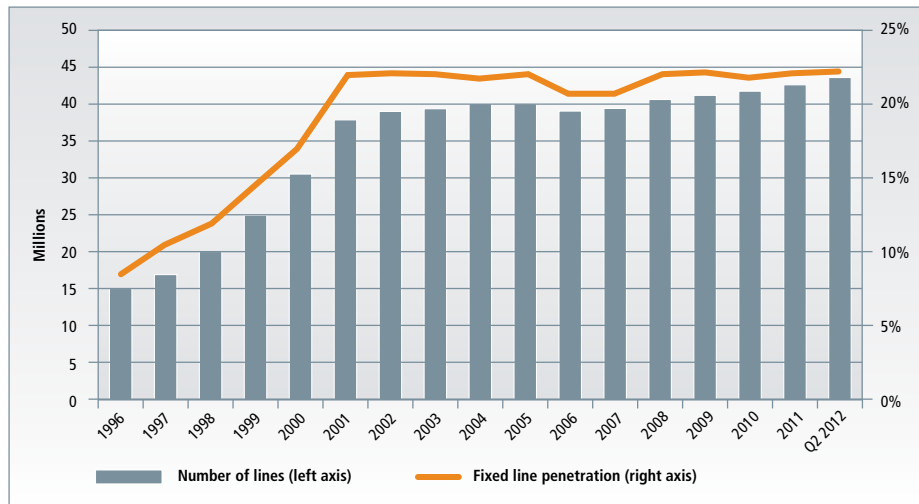
2 http://www.teleco.com.br/en/en_cobertura.asp

3 According to Teleco, coverage was reviewed according to new rules established by Anatel. The number of cities covered by TIM and Oi may be overestimated. According to Anatel's information published in the beginning of August, only the city of Gurinhem (13.8 thousand inhabitants) in the State of Paraíba was not covered by cellular operators.

In comparison, there are over 40 million fixed lines, representing a fixed penetration of only 22% in 2012. As such, mobile telephony has largely outpaced fixed telephony as the key provider of telecommunications in Brazil.

As fixed penetration is only 22%, mobile telephony has largely outpaced fixed telephony as the key provider of telecommunications in Brazil

Figure 4: National fixed coverage over time



Source: Telebrasil and Teleco

Increased coverage and service extensions have contributed to one of the biggest transformations of the Brazilian economy and society in recent years: mobile telephony has promoted social communications, digital inclusion and social cohesion in ways never experienced in Brazil before. This is witnessed by the growth in the number of municipalities⁴ served by mobile telephony and for which mobile broadband is available, as shown in Table 1 and Table 2.

Table 1: Percentage of municipalities served by mobile

| % | 2008 | 2009 | 2010 | 2011 | Q1 2012* | Q2 2012 | Jul/12 | Aug/12 |
|-----------------------|-------|-------|-------|--------|----------|---------|--------|--------|
| Served | 75.5% | 86.3% | 97.2% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| Not served | 24.5% | 13.7% | 2.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Served by 1 operator | 19.5% | 29.4% | 38.3% | 39.7% | 39.7% | 39.7% | 39.5% | 39.4% |
| Served by 2 operators | 10.2% | 11.3% | 11.9% | 12.6% | 12.6% | 12.6% | 12.8% | 12.8% |
| Served by 3 operators | 15.2% | 13.4% | 11.6% | 7.2% | 7.4% | 7.4% | 7.5% | 7.5% |
| Served by 4 operators | 29.7% | 31.2% | 34.3% | 38.7% | 38.7% | 38.7% | 38.7% | 38.7% |
| Served by 5 operators | 0.9% | 1.1% | 1.2% | 1.5% | 1.5% | 1.5% | 1.5% | 1.5% |

Source: Telebrasil, 2012. *Quarter

Table 2: Municipalities served by mobile broadband per mobile operator

| Operator | 2008 | 2009 | 2010 | 2011 |
|----------|------|------|-------|-------|
| Vivo | 314 | 579 | 1,206 | 2,516 |
| Claro | 282 | 389 | 402 | 657 |
| TIM | 23 | 55 | 195 | 391 |
| Oi | 99 | 168 | 211 | 20 |

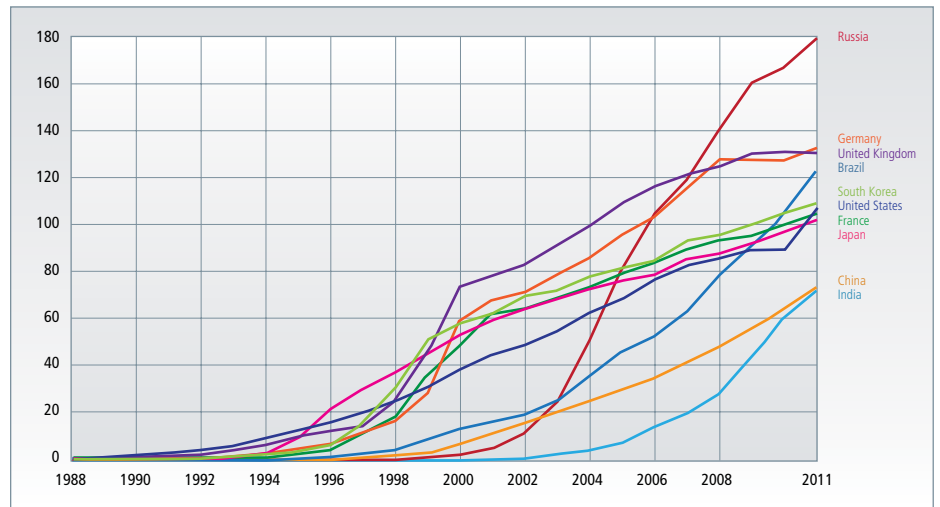
Source: Telebrasil, 2012

⁴ A municipality is defined as an administrative autonomous part of a state, governed by a mayor. It is considered to be served by mobile if 80% of the municipality's geographic area is covered by the service.



Figure 5 shows that Brazil has caught up with other developed mobile telephony markets in terms of penetration and is likely to surpass the UK and Germany in the next few years. Of the BRIC⁵ countries, only Russia has a higher penetration. While developed markets are reaching maturity penetration levels, the BRICs are still in a fast-growing state.

Figure 5: Comparison of mobile penetration in developed markets and BRICs



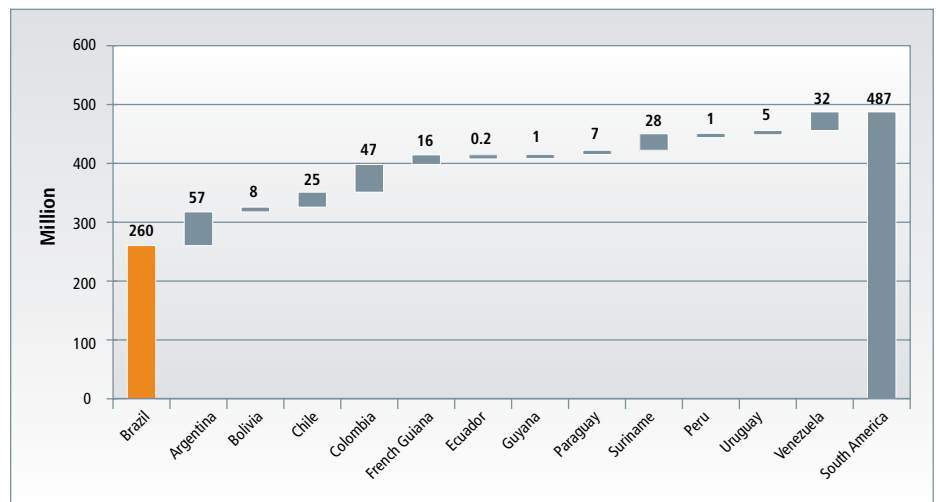
Source: ITU – International Telecommunication Union

The number of connections in Brazil makes the Brazilian mobile market the most relevant among the South American countries, as shown in Figure 6.

Figure 6: Mobile access in South America, in Q2 2012

In four years, the number of mobile broadband connections has risen by more than 1900%

Connections in Brazil will overtake the UK and Germany in 2012



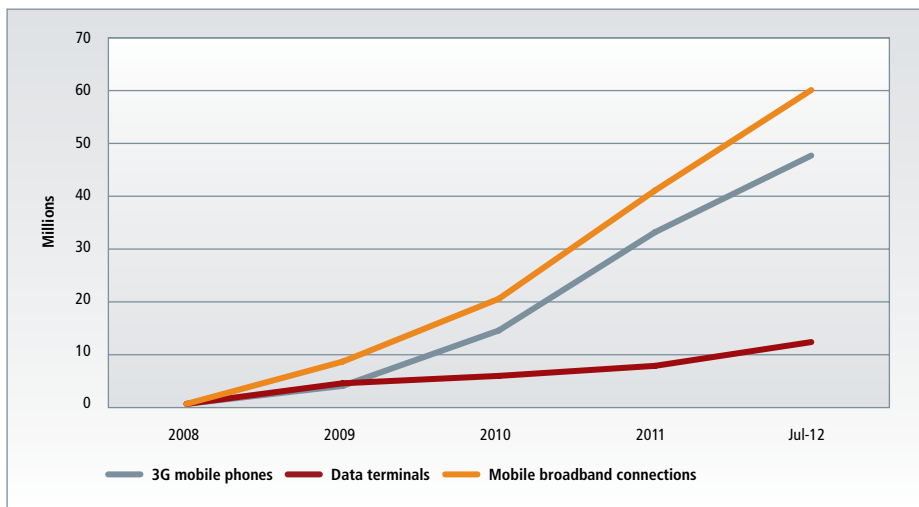
Source: Wireless Intelligence

1.2.2 Mobile broadband usage has shown massive growth

In addition to increases in penetration of mobile services, mobile data in Brazil is developing fast. Mobile broadband, largely used for mobile data and broadband terminals, totalled more than 75 million connections by July 2012.⁶ Figure 7 shows the results of research undertaken by Anatel on the growth of the number of mobile broadband connections in Brazil in the last four years.

Brazil has over 60 million 3G connections, the largest market in Latin America

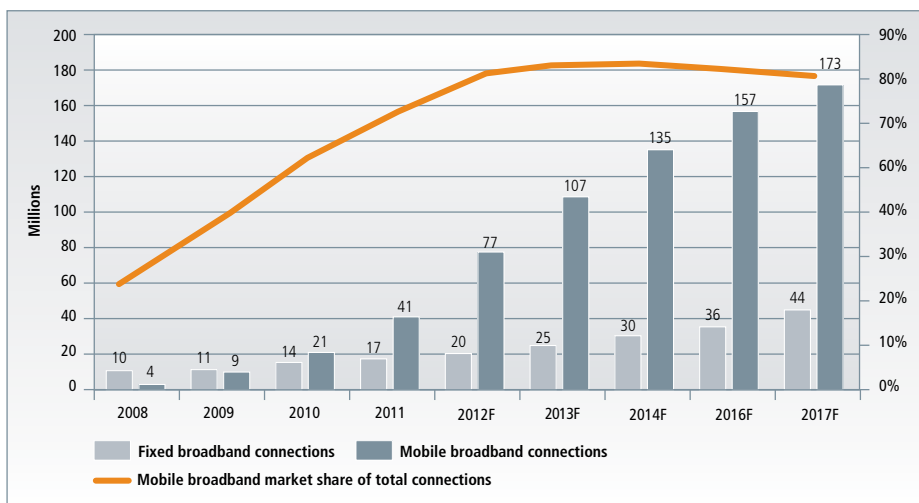
Figure 7: Mobile broadband connections



Source: Anatel, 2012

Mobile broadband connections have now surpassed fixed broadband connections, which amounted to only 17 million in 2011. The share of mobile broadband connections over all broadband connection has constantly increased to over 70% in 2011, and therefore in Brazil mobile plays a substantial part as internet provider.

Figure 8: Mobile and fixed broadband connections



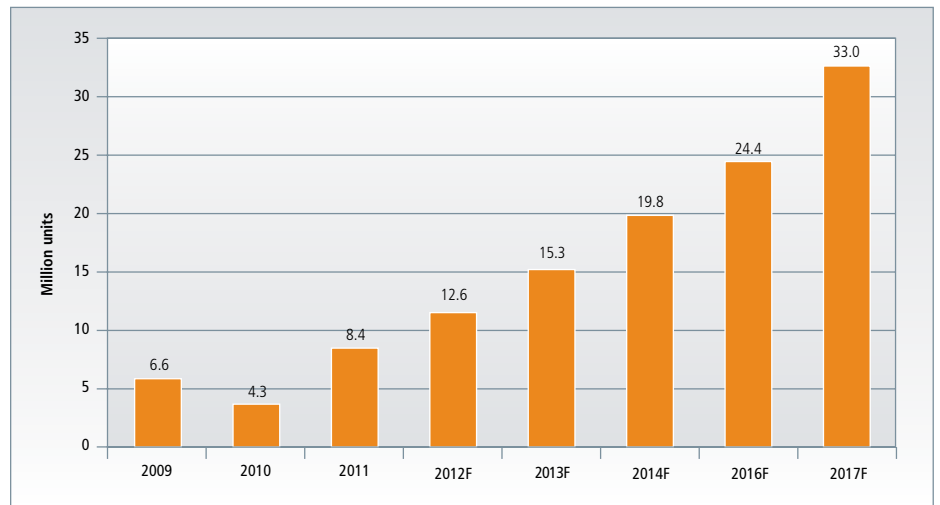
Source: Telebrasil, Teleco, Wireless Intelligence and Deloitte Analysis

Mobile broadband connections have surpassed fixed broadband connections, which amounted to only 17 million in 2011. Mobile is therefore the key provider of broadband in Brazil

⁶ Broadband access reached 78.8 million in July, Telebrasil, July 2012

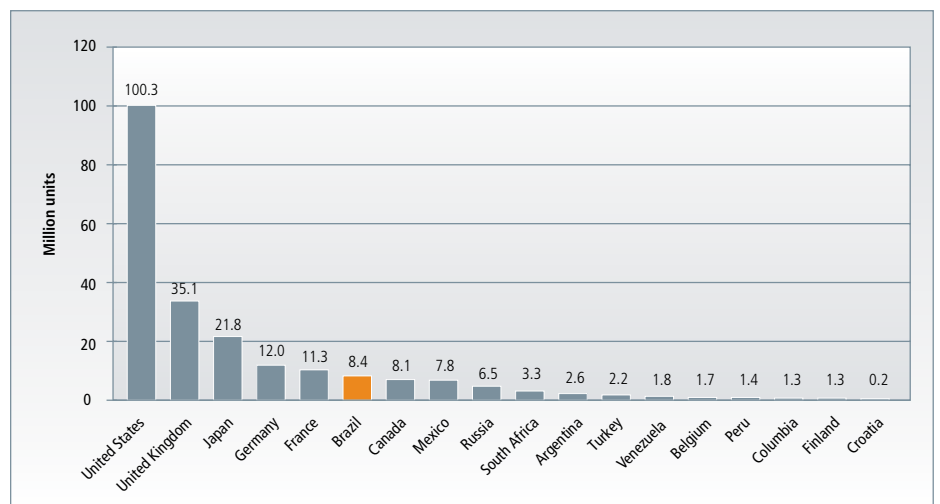
Smartphones, tablets and data-enabled handsets have increased in parallel with the increase in 3G connections in Brazil. Smartphone sales have increased since 2010, and are expected to reach over 12 million units in 2012. Medium-term forecasts by Gartner show 33 million units sold in 2016, which represents average yearly growth of 43% in the period 2010–2016. As shown in Figure 10 below, in 2011 Brazil’s sales were significantly higher than other countries in the region such as Mexico, Argentina, Peru and Colombia.

Figure 9: Smartphone sales (2009–2016)



Source: Gartner. Data for Premium Communication Devices

Figure 10: Smartphone sales across countries (2011)

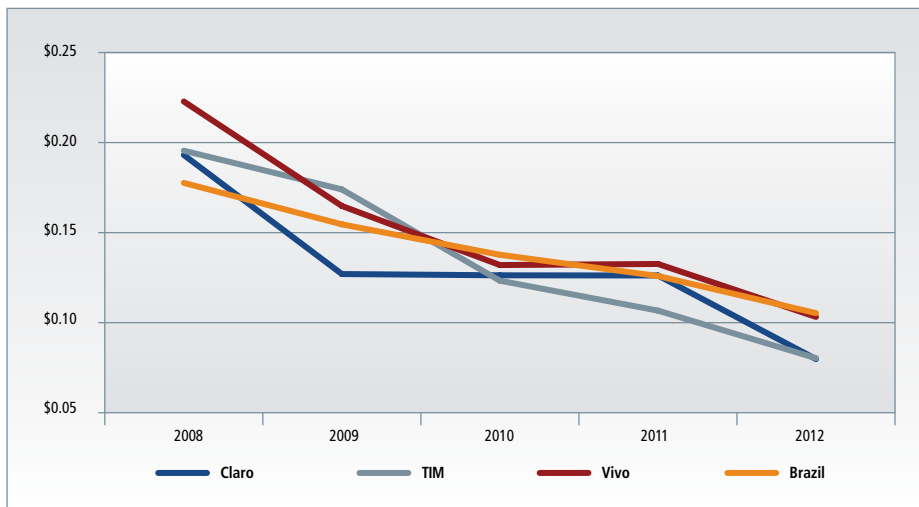


Source: Gartner. Data for Premium Communication Devices

1.2.3 Price reductions have increased affordability

Market growth, coupled with increasing market competition, has led to constant price reductions, whereby the effective price per minute has more than halved in the last four years.

Figure 11: Effective price per minute (US\$)

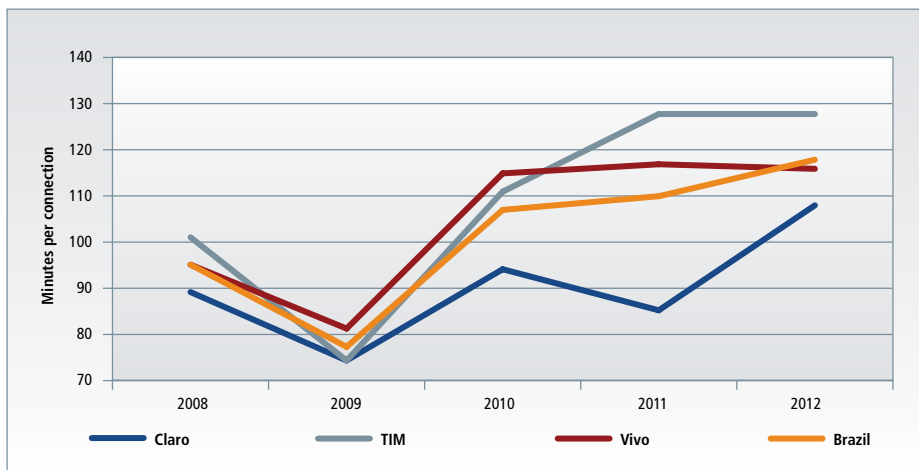


Source: Wireless Intelligence



New bundles of calls, SMS and data were created, including data caps and free on-net calls, in order to serve different segments of the market that were starting to utilise mobile phones. Average prices effectively paid by consumers for contract bundles can be notably lower than advertised prices.

Figure 12: Total minutes per connection

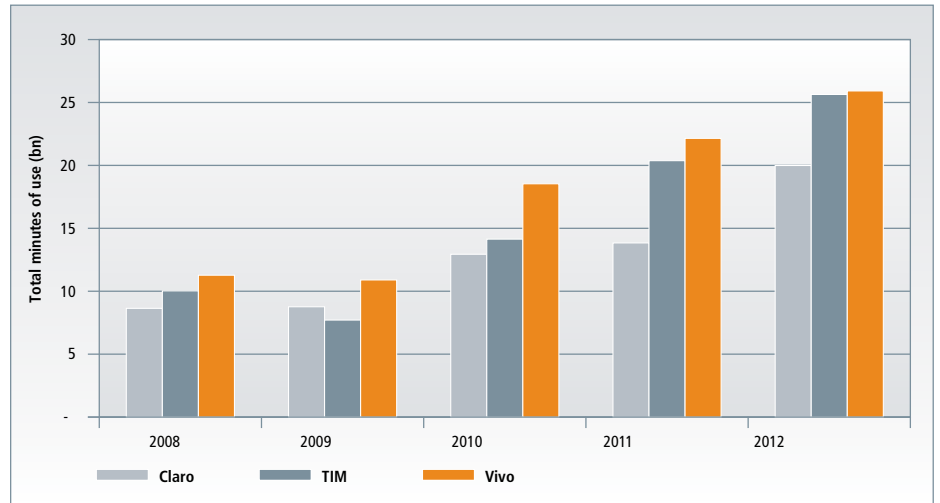


Source: Wireless Intelligence

Prices have decreased by over 30% in the last four years and usage has more than doubled

While ARPUs have been decreasing, industry revenues have grown to over BRL 60 billion in 2011

Figure 13: Total minutes of use



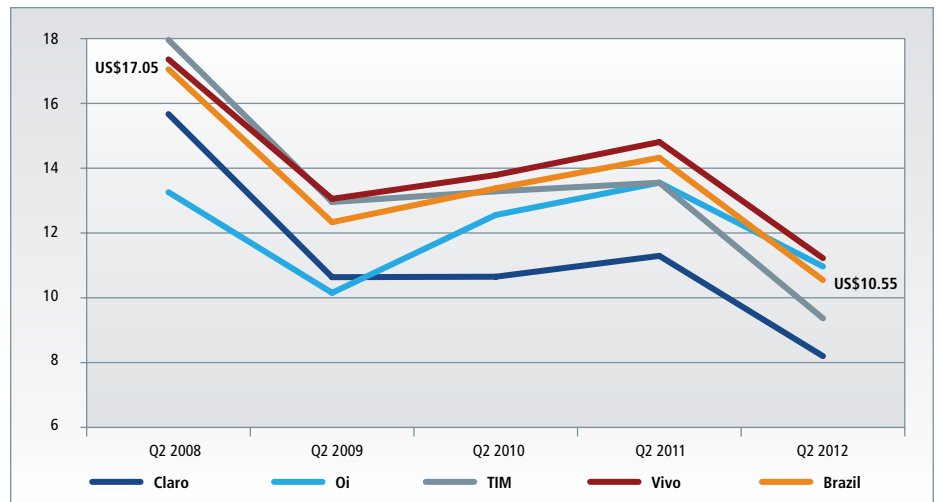
Source: Wireless Intelligence

As a result of these decreases, usage of mobile telephony has increased significantly and the market has recovered from the decrease in usage in 2009 experienced as a result of the economic crisis.

1.2.4 Healthy revenue growth can sustain further investment

Increasing competition and price reductions have impacted on several industry indicators, such as the average revenue per user (ARPU), which has constantly decreased.

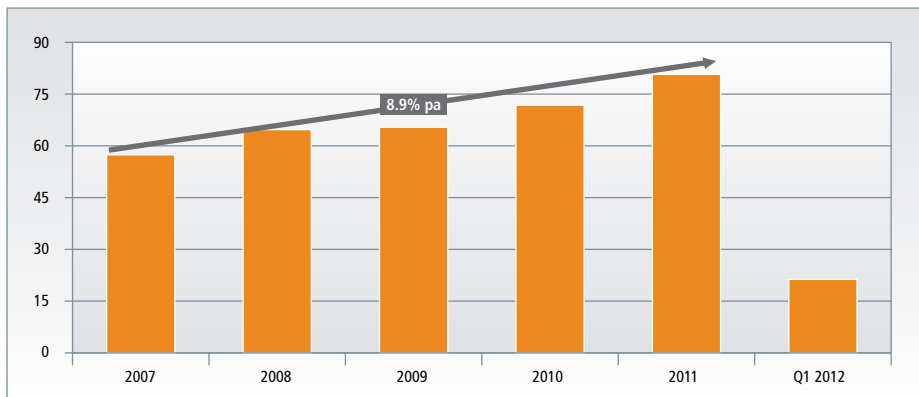
Figure 14: ARPU, US\$



Source: Wireless Intelligence

As a result of the increased market size and despite the tough economic environment, total mobile revenues have increased to over BRL 80 billion (USD\$ 47.8 billion), representing a compound annual growth rate (CAGR) of about 8.9 % in the past five years. In the same period, Specialized Mobile Service or trunking operators' revenues grew at 44.6%. In Q2 2012, the market operated with an average EBITDA margin for the four main operators of 31.4%, decreasing 1% compared to Q2 2011 (Figure 24 below).⁷

Figure 15: Mobile services gross revenues, in BRL billion



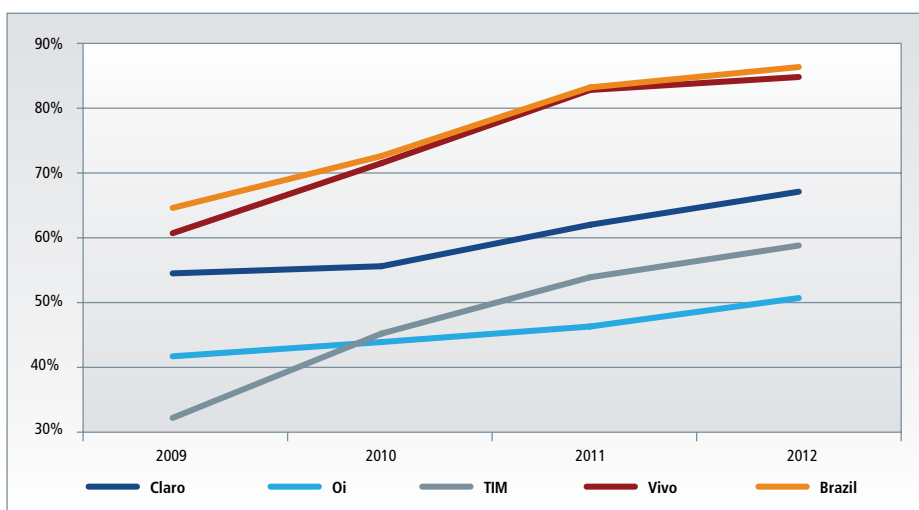
Source: Teleco

Almost 90% of Brazil's population is now covered by 3G services

1.2.5 The development of 3G services drives technology innovation

The most significant innovation in mobile services in Brazil was the launch of 3G services in November 2007. These developed fast, and by May 2012 there were 55.4 million WCDMA connections in Brazil and 10.2 million 3G data terminals (representing 22.6% of total devices).⁸ 3G coverage also increased rapidly to almost 90% of the population in 2012 and the agreements recently signed as part of the auction specify a 3G coverage obligation of 100% of population by 2019.

Figure 16: 3G population coverage per operator

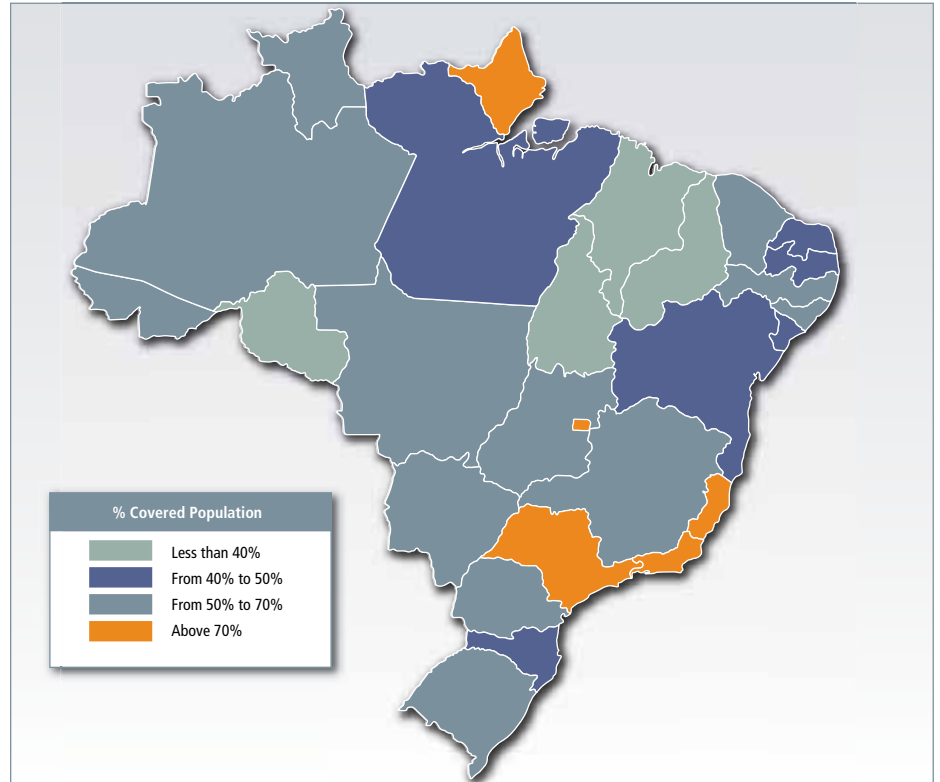


Source: Teleco

⁷ Wireless Intelligence

⁸ Wireless Intelligence

Figure 17: 3G coverage in Q2 2012

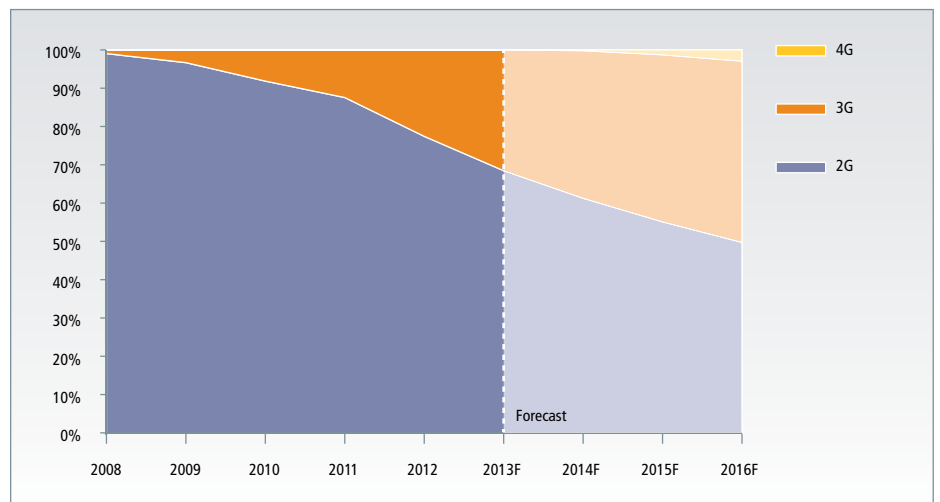


Source: Teleco

The development of 3G has had a positive impact on technology innovation in Brazil. Since 2011, 3G technology has expanded rapidly, largely driven by device availability. By 2016, it is expected that over half of the traffic will be carried on 3G networks.

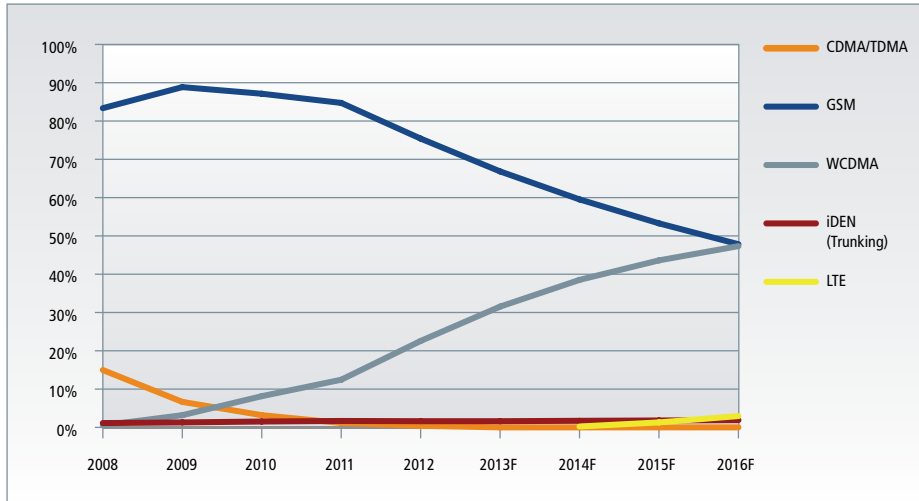
3G technology will increase its importance over the next years, while LTE will be commercially launched in 2013

Figure 18: Proportion of connections for 2G, 3G and 4G



Source: Wireless Intelligence, based on Q2 of each year

Figure 19: Proportion of connections by technology



Source: Wireless Intelligence, based on Q2 of each year

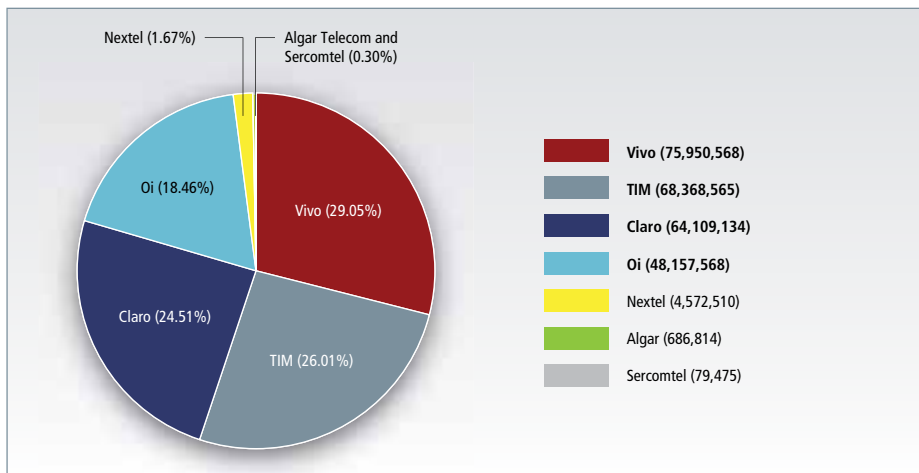


4G technology is expected to follow a similar, albeit accelerated, path. After the auction that took place in June 2012, the first LTE-compatible devices are already available in the local market and LTE services are expected to be commercially launched in 2013. Currently, LTE tests are being undertaken in several cities⁹ tourist locations and international conference venues, such as the location of the Rio+20 event to introduce the service to customers and to monitor demand patterns. By 2016, LTE devices are expected to be more widely available, and deployment of LTE networks will have taken place.

1.3 A highly competitive market for mobile

The mobile communications sector in Brazil is characterised by the presence of seven mobile operators. The largest operator, Vivo, has a market share of 29%, followed by TIM (26%), Claro (24.5%) and Oi (18.5%). The three smallest operators (Nextel, Algar Telecom and Sercomtel) have a joint market share of approximately 2%.¹⁰

Figure 20: Brazilian mobile market share and connections by operator, Q1 2012



Source: Wireless Intelligence

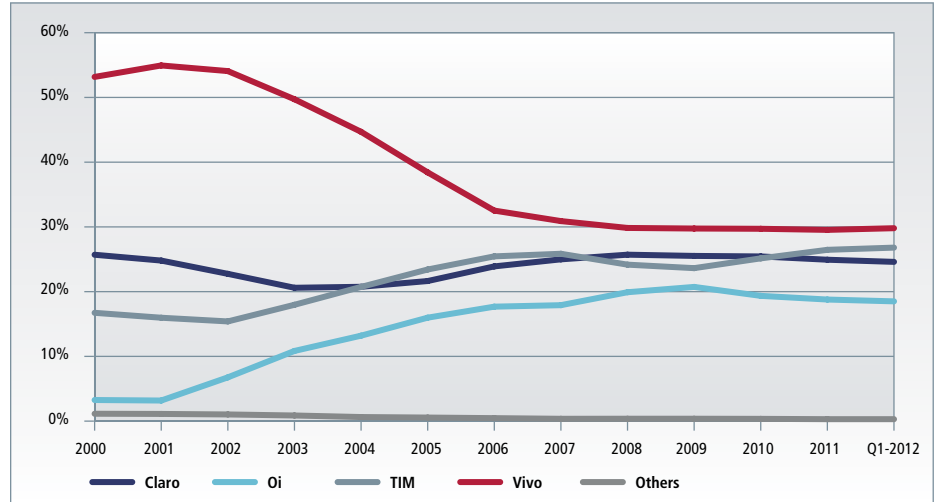
In addition to Vivo, TIM, Claro and Oi, Nextel has rapidly expanded its footprint and no other market in the region exhibits seven mobile operators

9 <http://exame.abril.com.br/tecnologia/noticias/claro-testa-4g-em-campos-do-jordao-sp>

10 Wireless Intelligence, Q4 2011.



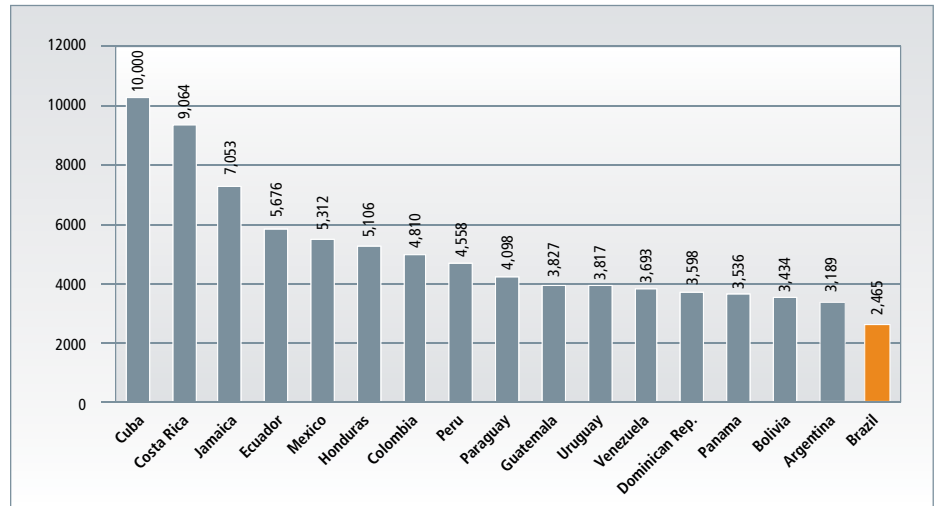
Figure 21: Market share of mobile services over time



Source: Teleco

Brazil is a highly competitive mobile market, with four companies holding close to one-fourth of the market each, and competition is expected to increase further, due to the regulator’s approval of Mobile Virtual Network Operators (MVNOs) in 2011.

Figure 22: Herfindahl-Hirschman index* of competitiveness, Q4 2011

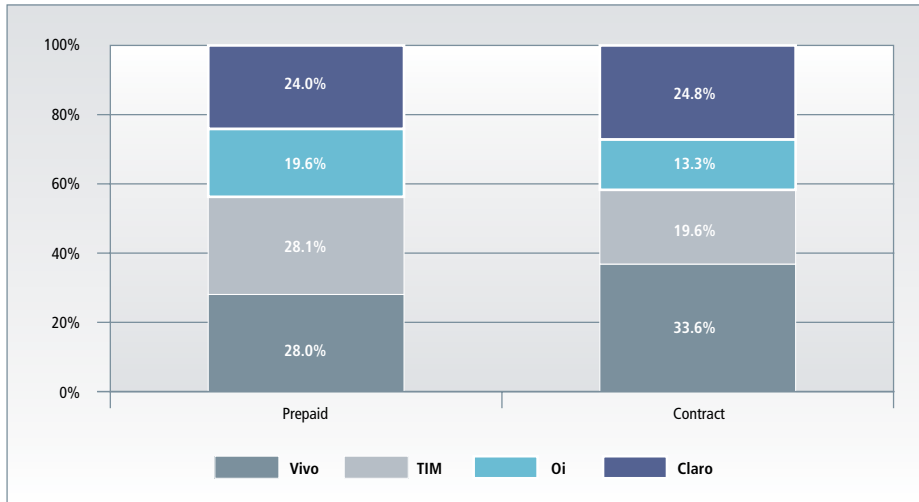


Source: Wireless Intelligence

*The Herfindahl-Hirschman Index is calculated as the sum of squared market shares of all firms in a market. Index values range from 0 (in the case of perfect competition) to 10,000 (in the case of a monopoly).

Since the acquisition of BrT by Oi in 2009, the Brazilian mobile market has been characterised by healthy competition between the four largest MNOs. As a consequence of this intense competition, around 79% of the population can choose from at least four mobile providers in their area.

Figure 23: MNO customer split in Q2 2012

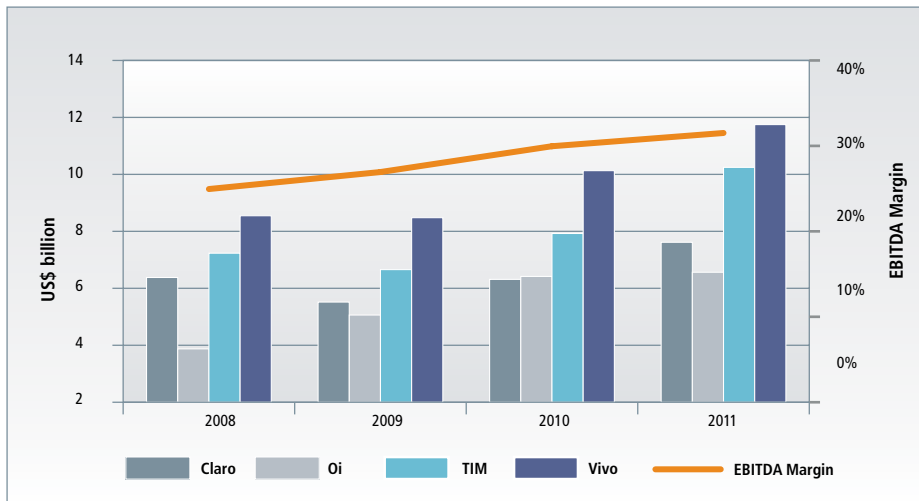


Source: Wireless Intelligence



Prepaid services are the main driver of connection growth and are common even among high-income customers. The big four MNOs in Brazil all offer prepaid services and contracts. Moreover, while Oi and TIM have a higher number of prepaid customers, Claro and Vivo attract more postpaid customers. Users, however, can change operators with relative ease. This is partly due to the dominant GSM technology and the number portability regulation, which are strong contributors to the slightly higher than average churn rates in Brazil (3.87% in Q2 2012).

Figure 24: Net revenues and average EBITDA margin



Source: Wireless Intelligence

A summary of net revenues and EBITDA margins for the four main operators are reported in Figure 24.

2 The economic contribution of the Brazilian mobile industry

This section discusses the economic contribution of the mobile telephony ecosystem in Brazil by considering the impact of revenues and expenditure generated by the mobile ecosystem on the supply side of the economy, on local employment and local industries, on government funding and on productivity. It also describes the economic impact of mobile data and the wider social impacts of mobile telephony, focussing on social and digital inclusion and on corporate social responsibility programmes undertaken by mobile operators.

The mobile ecosystem has generated investment, service expenditure and local employment

The revenues of the mobile sector represented 2% of Brazil's GDP in 2011, but the contribution of the industry extends far beyond this level

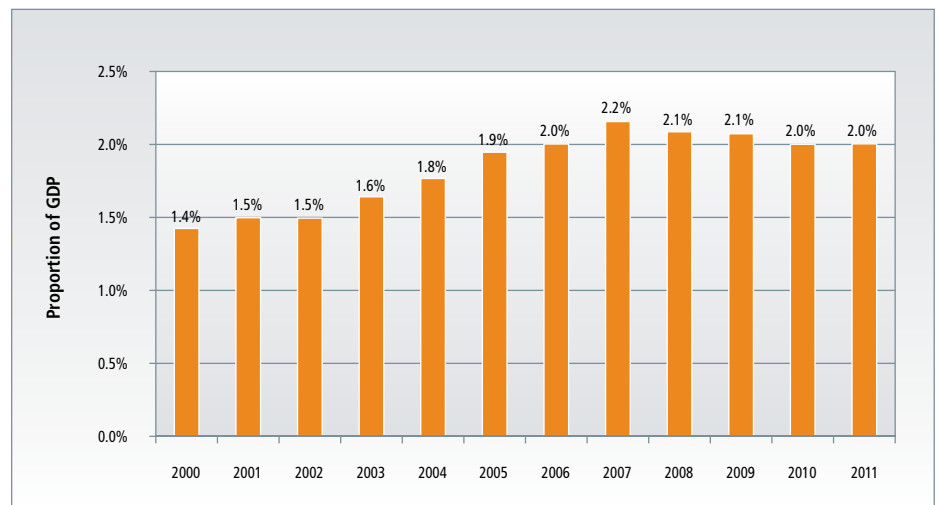
2.1 The economic contribution of mobile telephony to the economy

Mobile telephony has transformed the way consumers and businesses operate in Brazil, and the availability of mobile services generates numerous economic benefits for the Brazilian economy.

Mobile telephony has a positive effect on the supply side of the economy through the operations undertaken by mobile operators and local players in the wider mobile ecosystem, including providers of network services, providers of other support and commercial services, and the network of formal and informal points of sale throughout the country. As a result of mobile operators' operations, significant investment in networks, operations and training is generated, often resulting in foreign direct investment and knowledge transfer. Often mobile operators invest in civil works to extend their networks to rural areas. Significant local employment in a number of professions, from engineering to accounting to advertising and sales, is also generated.

The rapid take-up of mobile communication in Brazil has driven revenues for mobile operators to BRL 80 billion (US\$ 47.8 billion) in 2011, which represents a contribution to the Brazil GDP of 2%.

Figure 25: Mobile operator revenues as a proportion of GDP



Source: Teleco, World Bank

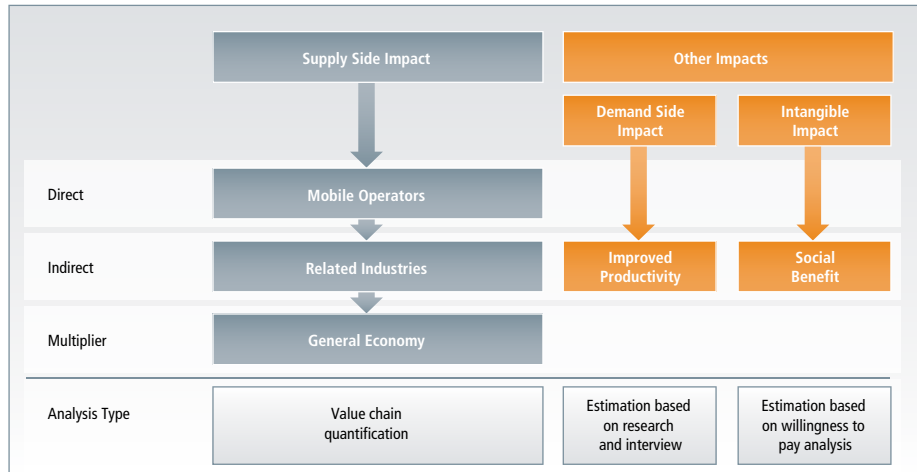
The economic impact of mobile telephony in Brazil can be estimated by looking at the value-add generated by the mobile ecosystem in Brazil. This can be estimated by examining the flow of funds across the mobile supply chain and by estimating the value add created by the MNOs and their major stakeholders. An economic multiplier can then be used in order to capture the 'knock-on' impact to the wider economy. Impacts on direct and indirect employment from firms in the value chain can also be estimated.

This analysis has been undertaken by Deloitte using Deloitte's modelling for the GSMA¹¹ based on discussions and data provided by operators such as TIM and Vivo, on data provided by the GSMA and from publicly available sources that are referenced in this report.

In addition to the analysis of the value-add, two other key components of economic value have been considered. First, the impact of mobile telephony on Brazil's productivity, through the positive impact that access to mobile telephony has on Brazil's labour force, in turn impacting business productivity. Then, the social impacts of mobile telephony are also estimated by looking at the benefits consumers have obtained from price reductions and increased usage. The framework for this economic analysis is shown in Figure 26.

¹¹ More details on the methodology adopted and the assumptions made are reported in the forthcoming Deloitte/GSMA report titled "Mobile telephony and taxation in Latin America".

Figure 26: Framework for the estimation of the economic impacts of mobile telephony in Brazil



Source: Deloitte



To estimate the value-add and employment generated by mobile telephony in the economy, the expenditure and value generated by mobile operators has been considered in relation to the other parties that operate in the Brazilian mobile communications industry. These include a variety of players.

First, international equipment providers such as Apple, Ericsson, LG, Motorola, Nokia Siemens Networks, Huawei, Samsung, Sony and ZTE have established their offices in the country. Certain manufacturers such as Ericsson have also established their own factories and assemble most network equipment directly in the country. International equipment providers rely on a number of local contractors and technical companies offering services such as installation and maintenance.

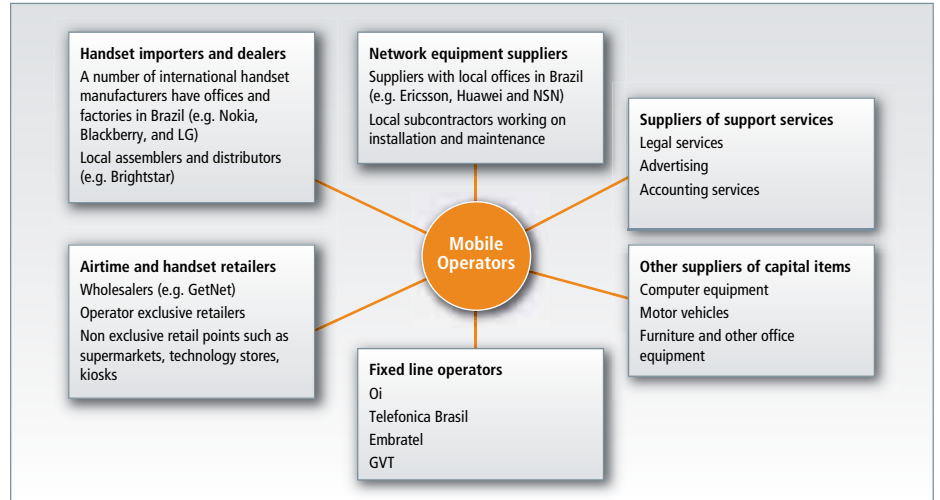
Major international handset manufacturers such as Nokia also have offices in Brazil. Following government incentives to promote local employment, e.g., in the Free Economic Zone of Manaus, international handset manufacturers now assemble most handsets directly in Brazil, thus generating local employment.

The mobile ecosystem also includes distributors and sellers of handsets and airtime and suppliers of other support services (e.g., advertising) to mobile operators.

Mobile telephony impacts both the supply and demand side of the Brazilian economy



Figure 27: Mobile communications ecosystem considered for the analysis



Source: Deloitte

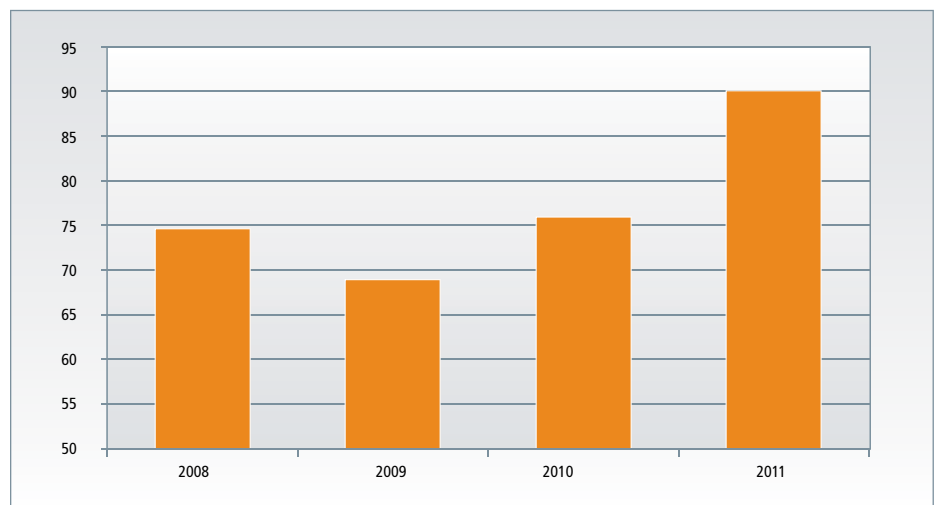
A wide local ecosystem of service providers supports the mobile operators

In addition to parties that work directly with mobile operators, a number of other local operators, such as local content providers, have also thrived as a result of mobile telephony. These are exemplified in more detail in Section 3.

2.1.1 Impact on the supply side of the economy

The impact of mobile telephony on the supply side of the economy is generated by the direct effect of mobile operators' expenditure, and these benefits are then transmitted to related industries in the mobile ecosystem and more widely across the economy. In 2011 the mobile communications industry contributed BRL 90.1 billion (US\$ 53.8 billion) from supply-side impacts to the Brazilian economy.

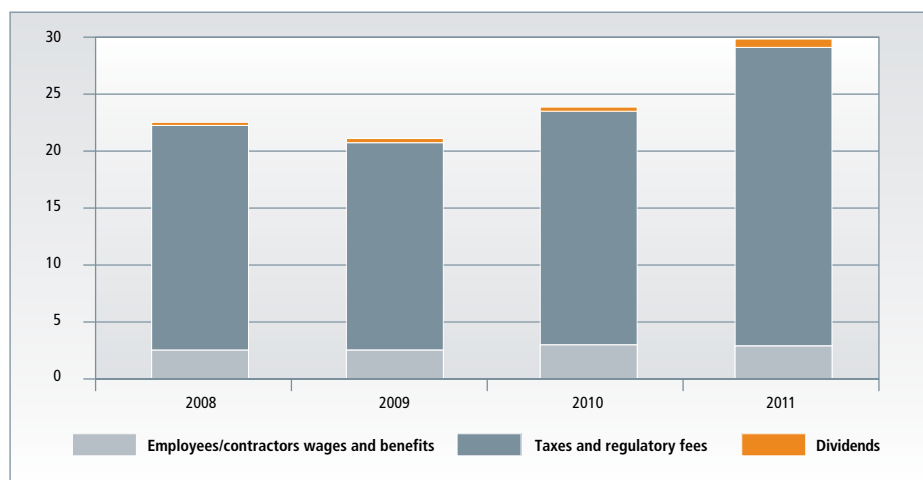
Figure 28: Supply-side value-add of mobile communications in Brazil, BRL billion



Source: Wireless Intelligence

To calculate the economic contribution generated by the industry, first the direct economic contribution created by the mobile communications industry was estimated. This consists of the value created by mobile operators' expenditure on wages, CSR programmes, dividends paid by mobile operators and taxes recovered as a result of the mobile operators' operations. In 2011, mobile operators in Brazil are estimated to have provided a direct contribution of BRL 29.9 billion (US\$ 17.9 billion), to the country's economy, a significant increase from 2009, when the economic crisis affected the economy.

Figure 29: Domestic economic contribution of mobile operators (excluding multiplier effect), BRL billion



Source: Wireless Intelligence

The economic contribution of the mobile sector to the supply side of the Brazilian economy was BRL 90 billion in 2011

Mobile operators' direct contribution contracted slightly in 2009 compared to 2008, reflecting the worldwide economic recession. This contribution, however, has rapidly recovered from 2010, reaching in 2011 a level 30% higher than in 2008.

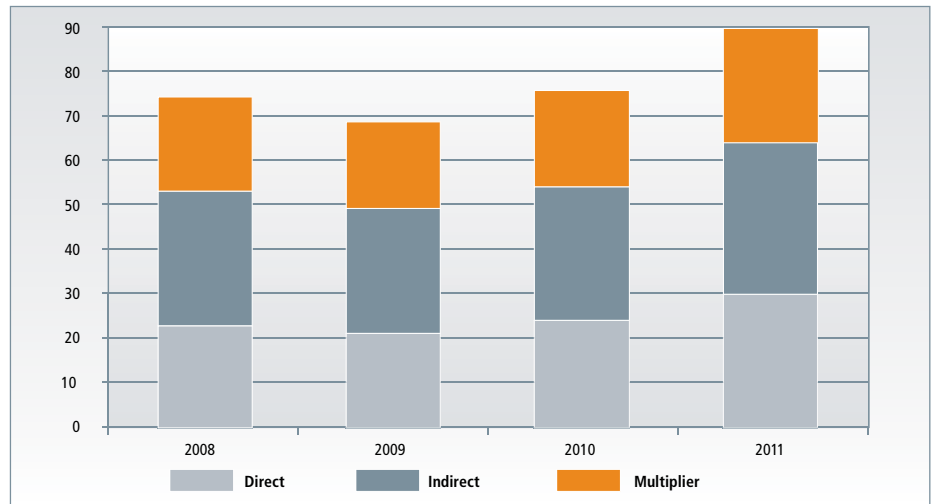
In addition to the direct economic contribution generated by the mobile operators, the indirect impacts from mobile operators' expenditure to stakeholders in the wider mobile ecosystem have been estimated, e.g., the percentage of any amount spent by the end users remains within the national boundaries to be spent in the next round. This is calculated by examining mobile operators' expenditures towards their supplier of support services in the wider mobile ecosystem. The amount of value-add, including wages, profits and taxes generated by these players is then estimated. Finally, a spend multiplier was applied to capture the effects on the wider economy.

This analysis finds that the indirect impacts from the mobile ecosystem amounted to BRL 34.4 billion (US\$ 20.5 billion), while the overall multiplier effect from the wider economy consisted of BRL 25.7 billion (US\$ 15.3 billion).



The economic contribution of the wider mobile ecosystem was over BRL 34 billion in 2011

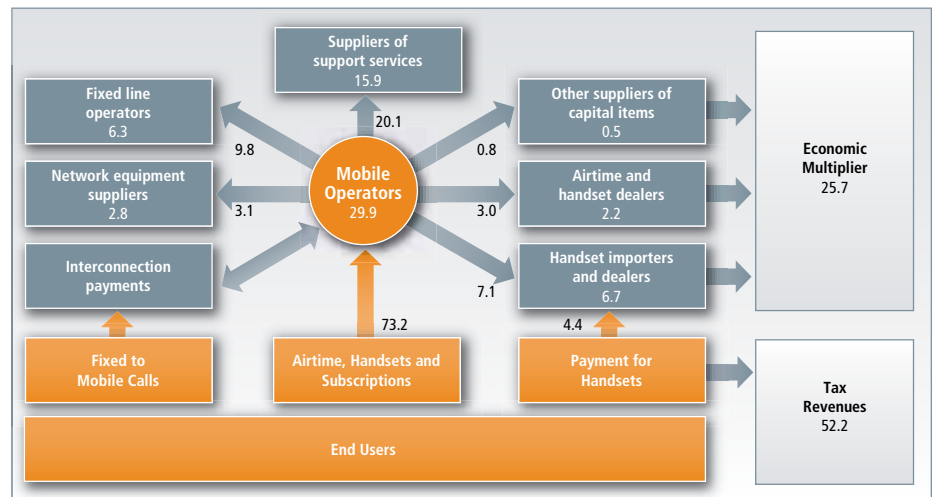
Figure 30: Supply-side economic contribution from mobile communications by component, BRL billion



Source: Deloitte analysis

The value-add relationship between the mobile operators and related industries in the ecosystem is shown below. The estimates of economic contribution include the multiplier effect on the wider economy which is assumed to be 40% of the revenues generated by the mobile operators and the related supply chain.

Figure 31: Mobile value chain and value-add in Brazil in 2011, BRL billion



Source: Deloitte analysis, values boxes represent value-add

2.1.2 Impact on employment

Mobile services in Brazil contribute to local employment in several ways, including direct employment by the mobile operators, employment in the related industries described above, additional employment created by outsourced work and taxes that the government subsequently spends on employment-generating activities. Additional induced employment is created by employees and beneficiaries spending their earnings, thereby creating more employment.

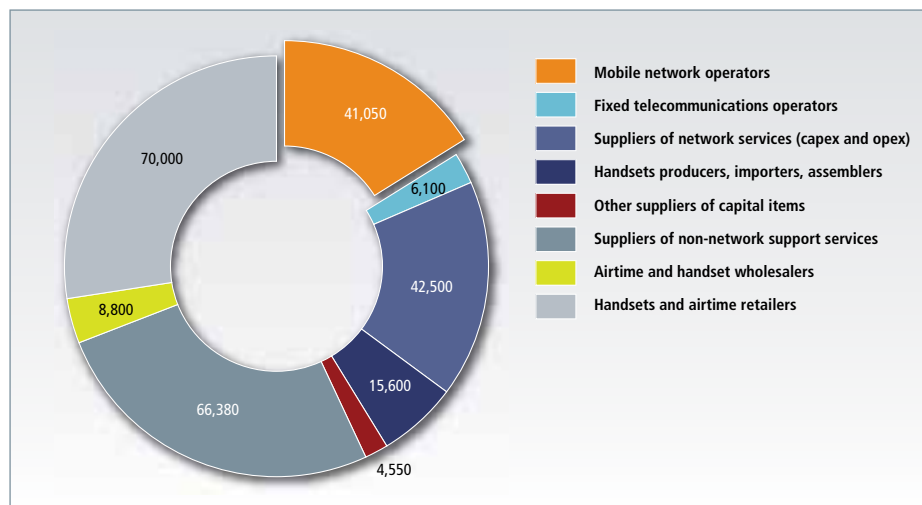
It is estimated that in 2011 the mobile communication industry employed more than 250,000 Full-Time Equivalents (FTEs) in Brazil.

While mobile operators employed approximately 41,000 FTEs in 2011, the wider mobile ecosystem employed approximately 214,000 additional FTEs. Of these, 15,600 FTEs are the handset manufacturers and assemblers, while 70,000 are handset and airtime retailers consisting of both mobile operators' third-party retailers and other independent retailers operating from supermarkets, technology stores and smaller independent points of sale. Further employment contributions are created by the suppliers of network capex and opex (42,500 FTEs) and the suppliers of support services (approximately 66,400 FTEs).



The mobile ecosystem employed over 250,000 FTEs in 2011, including over 200,000 FTEs in local support services

Figure 32: Employment generated by the mobile communications ecosystem in 2011 (FTEs)



A key positive impact is given by the opportunities that mobile telephony provides to small and medium-size enterprises (SMEs) in Brazil. Mobile broadband technology allowed new business development in small cities, such as internet cafés and small hotels. New technologies such as fast credit approval and local mobile payment applications are accelerating SMEs' deployment and growth. These new technologies and local applications will be discussed in more detail in Section 3.

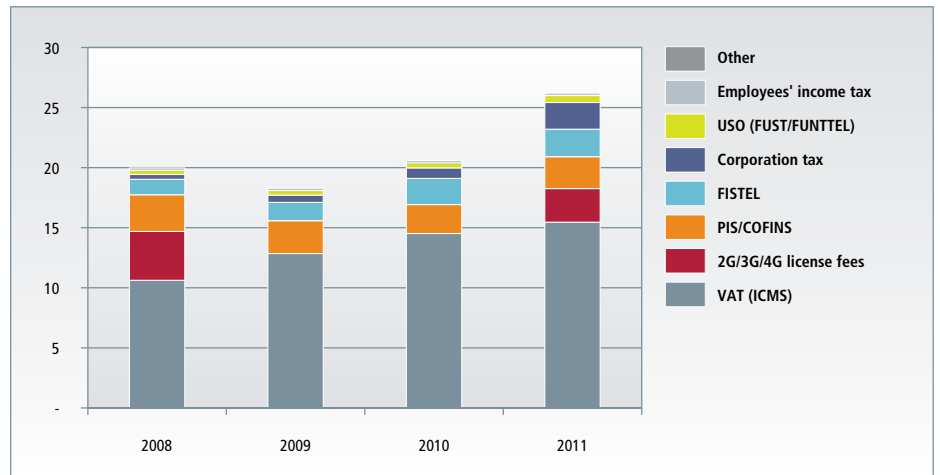
As mobile broadband develops an "app economy", opportunities for local businesses will increase



2.1.3 The contribution to public funding

In 2011, mobile operators in Brazil paid approximately BRL 26.2 billion (US\$ 15.7 billion) to the government in taxes and regulatory fees. This represented a 30% increase compared to the contributions of 2008.

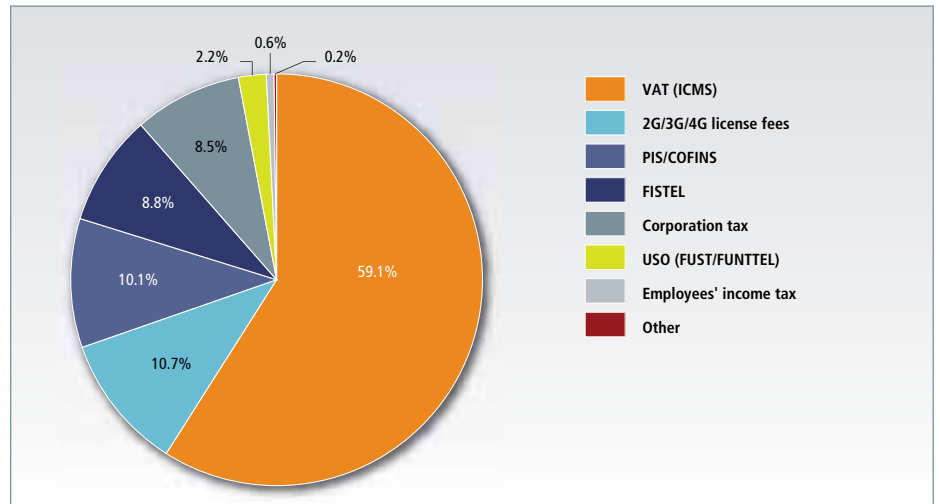
Figure 33: Tax and regulatory payments in Brazil from mobile operators, BRL billion¹²



Source: Deloitte analysis based on operator data. Taxes are defined in Section 4.1

The mobile ecosystem generated nearly BRL 52 billion in tax revenues for the government in 2011

Figure 34: Tax and regulatory payments in Brazil from mobile operators, 2011



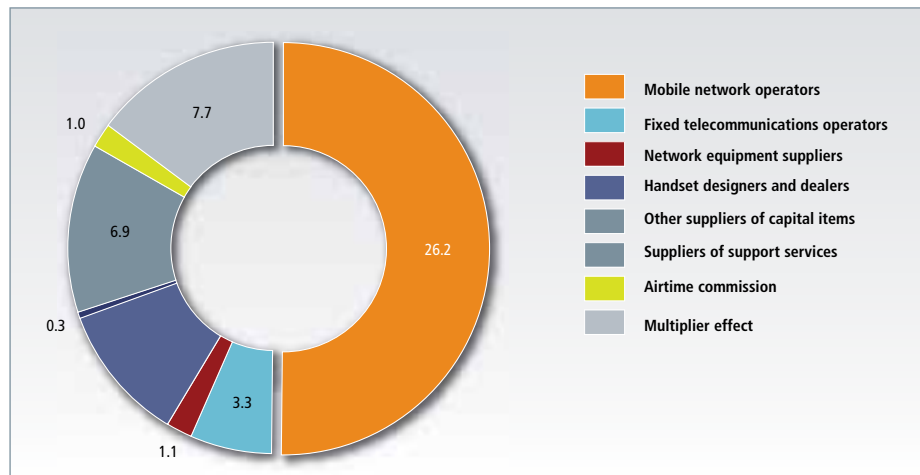
Source: Deloitte analysis. Taxes are defined in Section 4.1.

¹² These taxes are described in section 4.1.

Taxes and regulatory fees represented more than 30% of domestic company revenues for Brazilian mobile operators in 2011. The largest proportion of tax revenue was raised through the ICMS, which accounted for almost 60% of taxes paid in 2011.

In addition to the direct tax revenue received from mobile operators, other players in the mobile industry value chain generated another BRL 18.3 billion (US\$ 10.9 billion) for the government in 2011. The largest payers of tax in the mobile supply chain, aside from the mobile operators, are the handset designers and dealers and the suppliers of support services.

Figure 35: Total tax revenues directly created by revenue flows from the mobile operators in 2011, BRL billion



Source: Deloitte analysis based on company accounts, mobile operators' data and interviews. Note this represents tax revenues directly created by revenue flows from the mobile operators and not total tax revenues from the sector.



Mobile telephony has improved the way Brazilian businesses operate, increasing local productivity

2.1.4 Productivity impacts

In addition to the benefits to the supply side of the economy, mobile telephony generates productivity increases through the use of mobile technologies for business purposes. Significant economic and social research was undertaken in the last 10 years on the numerous ways mobile services can improve productivity, including in more developed markets such as Brazil:

- Improving information flows: mobile services allow workers in certain occupations to cut out the middleman, for example, traders can obtain information on prices, quality and quantities directly. This improves the incomes of producers, and helps reduce wastage.
- Reducing travel time and costs: mobile services allow workers to trade and share information without travelling.
- Improving efficiency of mobile workers: mobile services improve the efficiency of all workers in the economy. This effect will particularly be felt by workers with unpredictable schedules, for example those involved in repair and maintenance, or collection and delivery. Mobile phones will give them greater accessibility and better knowledge of demand.
- Improving job search: mobile services improve the chances of unemployed people to find employment by enabling them to call for opportunities rather than relying on word of mouth. Further to this, owning a mobile phone makes workers more employable, as they are contactable while away from their place of work.
- Encouraging entrepreneurship: mobile phones have encouraged the growth of small businesses and have increased their efficiency.
- Increased volumes of mobile data and of smartphones and tablets amplify these effects.

Smartphones, tablets and dongles allow business to process data remotely

Particular examples in Brazil include Vivo's "Fishing with 3G Nets" project¹³, which introduced 3G technology to support local fishermen's activities in the Bahia region. The project supports fishermen in their daily business by providing them with 3G-enabled mobile devices equipped with customised software applications. This enhances safety of navigation through real-time updates on location and weather conditions, it improves fishermen's marketing capabilities by providing them with constant updates on market prices and demand, and it allows them to connect directly with consumers and sell the daily catch via web-based applications.

Mobile technologies also play a central role for enhancing the productivity in Brazilian health sector. Thanks to a mobile technology developed by Sana¹⁴, Brazilian health workers can collect patient data and transfer the information remotely for a doctor to review. Doctors can notify the health worker of the diagnosis by sending results through a mobile application. This is used in Brazil¹⁵ to screen the population for eye diseases remotely and identify people with preventable causes of blindness.

The development of machine-to-machine (M2M) mobile services is expected to improve productivity and efficiency in various business areas by allowing the rapid exchange of data between remote machines via a server that manages the information flow. At the 2012 Latin American "Connected Living" summit, representatives of the Secretary of Telecommunications acknowledged the importance of reducing tax pressures as a key enabler of the growing M2M market.¹⁶

¹³ The initiative was developed by Qualcomm along with Telefónica/Vivo, the United States Agency for International Development USAID, ZTE, Santa Cruz Cabralia town hall through the Secretary's Office of Agriculture and Fisheries and the Instituto Ambiental Brasil Sustentável (IABS).

¹⁴ <http://sana.mit.edu/mission/projects>

¹⁵ The project is a collaboration between Sana, the Federal University of São Paulo and INATEL.

¹⁶ <http://www.gsma.com/connectedliving/connected-living-latam-summit>

The impact of the productivity improvements on the overall economy is estimated by assuming that the productivity improvement will be experienced by high-mobility employees within the economy. An economic value approach can be employed to provide a high-level estimation of these productivity benefits for mobile business workers. The results indicate that, if mobile workers in Brazil achieved a 5% increase in productivity as a result of using mobile technologies, the potential productivity impact of mobile services on the economy could be up to BRL 70 billion (US\$ 41.9 billion) in 2011, representing an increase of one-third on 2008.



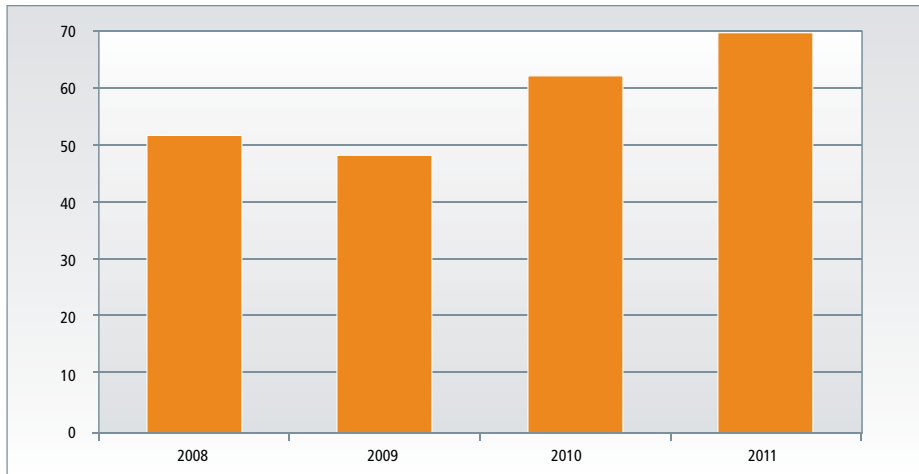
Figure 36: Economic impact in 2011 of increased productivity among high-mobility workers



Source: Deloitte analysis based on Deloitte assumptions, interviews and Brazilian Bureau of Statistics. Differences might be due to rounding.

The productivity impacts from the mobile ecosystem amounted to over BRL 70 billion in 2011

Figure 37: Economic impact of increased productivity among high-mobility workers over time, BRL billion



Source: Deloitte analysis

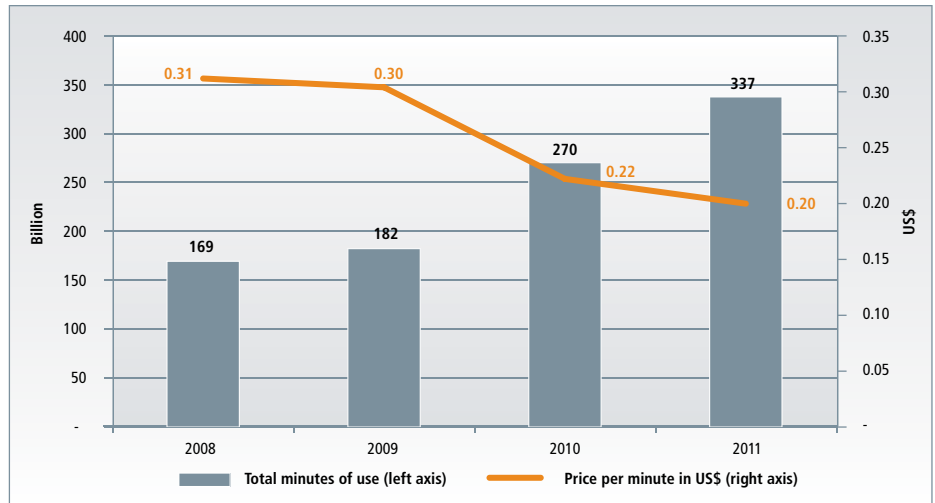


2.1.5 Estimation of consumer benefits

Mobile communications also provide a number of intangible benefits to consumers. For example these include the extension of interpersonal and family communications, the promotion of social cohesion and the extension of communication to those on low incomes and those in the most isolated areas of Brazil.

These benefits, along with the social programmes operated by mobile operators in Brazil, will be discussed extensively later in this section. In addition to these social benefits, consumers in Brazil have benefitted from the highly competitive mobile market, which resulted in a significant and consistent reduction of prices (more than 30% from 2008 to 2011). This spurred a number of high-value services provided by mobile operators and increased usage over the last four years.

Figure 38: Price per minute (US\$) and total minutes of use (billion), 2011

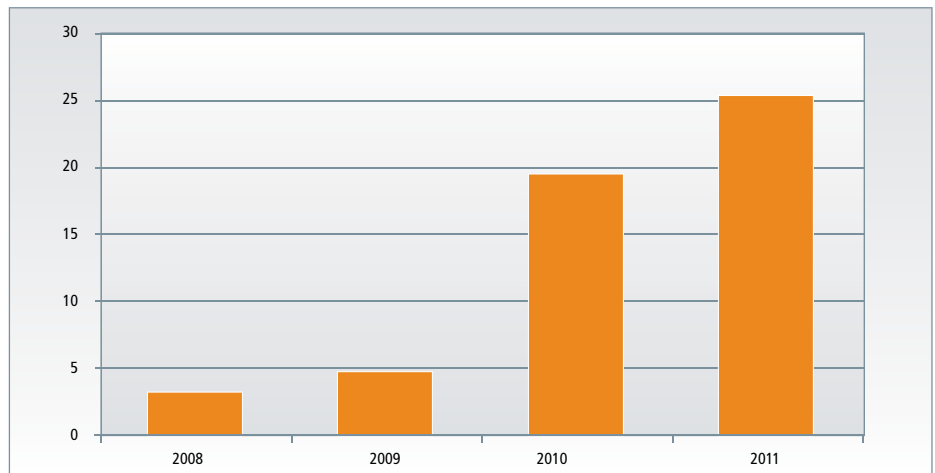


Source: Wireless Intelligence data; Deloitte analysis

Consumer benefits can be measured by considering the positive effect of price decreases and usage increases. In 2011, consumers potentially enjoyed the equivalent of up to BRL 25.4 billion in intangible benefits

A willingness to pay analysis that combines data on usage increases and price decreases over the years can be employed to estimate how these consumers' benefits from competition have increased over time in the last four years. This approach suggests that consumers potentially enjoyed the equivalent of up to BRL 25.4 billion (US\$ 15.1) in intangible benefits in 2011.

Figure 39: Intangible benefits using willingness to pay concept, BRL billion

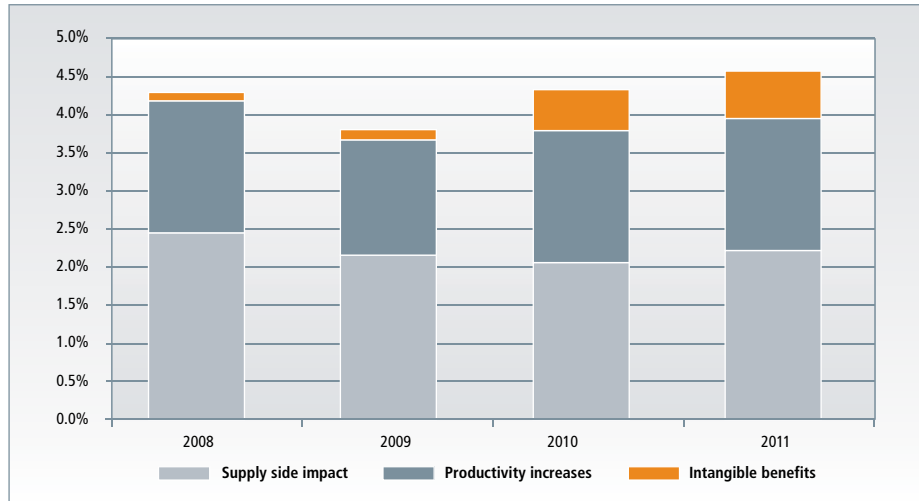


Source: Deloitte analysis

2.1.6 Total impacts

Overall, this study finds that in 2011 the mobile communications industry has contributed BRL 185 billion (US\$ 110.6 billion), which represented approximately 4.6% of GDP.

Figure 40: Domestic impact as a proportion of GDP, 2011



Source: Deloitte Analysis



The total contribution of the mobile sector to the Brazilian economy represented over 4.5% of GDP in 2011

A contribution of 2.2% of GDP is associated with the supply-side impact, while 1.7% of GDP is associated with increased productivity, highlighting the importance of mobile telephony to the productivity of high-mobility workers. An additional 0.6% of GDP relates to intangible benefits to consumers from increased usage and falling prices.

Mobile operators' total contribution to GDP contracted slightly in 2009, suggesting that the mobile sector was particularly hit by the worldwide economic recession. The sector, however, recovered rapidly during 2010, when the overall contribution to GDP of the mobile ecosystem returned to the pre-recession level.

2.2 The economic impact of mobile broadband and mobile data

In addition to the direct economic impacts, next-generation mobile telephony services, driven in particular by 3G and 4G technology and supported by devices such as smartphones and tablets, contribute to further economic growth in the long run, especially through effects on productivity and increased economic activity as a result of increased mobile communications.

Differential economic growth is supported, as these technology changes allow consumers and businesses to benefit from high-value wireless data and content services. The increase in 3G connections, supported by the increased volumes of data-enabled devices that allow mobile internet connectivity, has led to massive growth in mobile data usage.

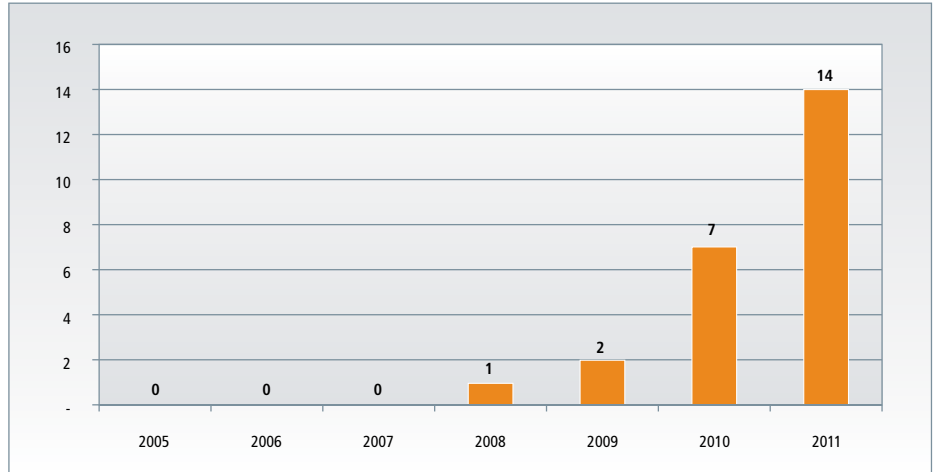
According to Cisco Systems' Visual Networking Index, total mobile data usage has increased 14 times since 2005, and it has doubled every year from 2005 to 2011, on average.

Total mobile data usage has increased 14 times since 2005, and it has doubled every year from 2005 to 2011, on average



Mobile data usage in Brazil has increased massively, doubling from 2010 to 2011

Figure 41: Mobile data usage, Pb/month (2005–2011)



Source: Cisco Systems

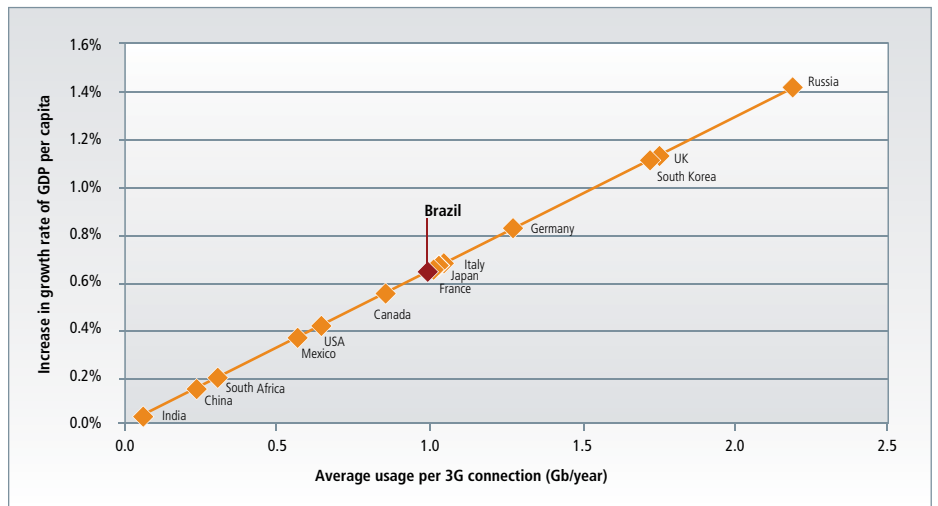
Mobile data usage for each 3G connection more than doubled, on average, every year between 2005 and 2010 in Brazil, despite the considerable increase in 3G connections.

Growth in mobile data consumption, by transforming the way consumers and businesses operate and communicate, has impacted economic growth through increased productivity effects and economic activity.

In Brazil, doubling mobile data usage has increased the GDP per capita growth by 0.6%

Using detailed information provided by Cisco Systems on mobile data usage between 2005 and 2010 in 14 countries for which historical disaggregated data is available, Deloitte has calculated the impact of mobile data usage for each 3G connection on economic growth.¹⁷ The study found that, on average, doubling mobile data use leads to an increase in GDP per capita growth of 0.5 percentage points. In Brazil, which over the period 2005–2010 was characterised by average use of mobile data per 3G user of over 1GB/year, the impact on the GDP per capita growth rate was 0.6%.

Figure 42: Marginal effect of mobile data usage per 3G connection on GDP per capita growth



Source: Deloitte/GSMA analysis based on Cisco Systems data

17 Deloitte/GSMA "What is the impact of mobile telephony on economic growth?", forthcoming

2.3 The social impact of mobile telephony

2.3.1 Mobile telephony drives social and digital inclusion in Brazil

In addition to the economic and social benefits discussed above, one of the main effects of mobile telephony in Brazil is its role in developing social inclusion, thus contributing to social as well as economic growth. While Brazil’s economy has boomed in recent years, lifting certain segments of the population out of poverty, mobile telephony, by providing access to digital services and mobile broadband, has helped to educate and improve people’s digital technology knowledge.

While a decade ago mobile telephony was perceived as a luxury good or as a business tool, in recent years a transformation in perception has occurred. Affordability and coverage have democratised mobile telephony, which is now a truly universal and essential good across all sectors of the population. This perception is growing, and mobile broadband is now increasingly perceived as essential by a growing number of people across all income and education levels. In this sense, mobile telephony in Brazil is the key driver of social and economic inclusion:

- It increases active citizenship and inclusion of an individual in society as a speaker, not just as a receiver.¹⁸
- It universalises the use of computer and communication technologies to boost autonomous and continuous learning.
- It enables citizens to operate computers, to use common applications (text editors, spreadsheets, etc.) and access the internet as a reader or navigator.
- It fosters citizenship by giving a voice to segments of the population that have no access to the media.

2.3.2 Mobile telephony and the government’s plans for digital inclusion

The recent national broadband plan, the PNBL¹⁹, is the main programme created by the government to encourage digital inclusion, which aims to extend internet usage for all municipalities in the Brazilian territory by 2014. Telecomunicações Brasileiras S.A. - TELEBRÁS is the company responsible for the achievement of the objectives and the estimated cost is BRL 12.8 billion (US\$ 6 billion) for the period of 2010–2014.²⁰

Table 3: PNBL Objectives

| PNBL Objectives |
|---|
| Promote digital inclusion |
| Expand electronic government services, facilitating the use of state services by citizens |
| Promote training of population on information technology |
| Increase technology autonomy and Brazilian competitiveness |
| Reduce social and regional disparities |
| Speed up economic and social development |
| Promote the generation of jobs and income |
| Disseminate the connection capacity among the population |

The programme aims to extend usage and supply of information technology and communication goods and services to the whole country, through a combination of offers. In PNBL, mobile, fixed and satellite companies work together with government bodies²¹ to develop specific retail and wholesale offers, as shown on Figure 43.

Mobile-driven digital inclusion initiatives have played a crucial role in social inclusion of low-income population

While mobile broadband connections represent almost 80% of all broadband access, mobile telephony was not included in the recent national broadband plan

¹⁸ The use of mobile phones in social and digital inclusion: a cluster analysis http://www.aedb.br/seget/artigos08/453_celular_e_inclusao_social_e_digital.pdf

¹⁹ Plano Nacional de Banda Larga <http://www4.planalto.gov.br/brasilconectado/forum-brasil-conectado/documentos/30-fbc/documento-base-do-programa-nacional-de-banda-larga>

²⁰ LEMOS and MARQUES (2012), “O Plano Nacional de Banda Larga Brasileiro: um estudo de seus limites e efeitos sociais e políticos.

²¹ Anatel <http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=278116&pub=original&filtro=1&documentoPath=278116.pdf>



Figure 43: Stakeholders in the PNBL



Source: Anatel

The government's target to achieve 60 million broadband connections by 2014 has already been met, thanks to the success of mobile broadband connections

Retail offers include broadband internet access to individuals, e.g., 100/128kbps download/upload speed; and up to R\$35 for residential clients and R\$29.9 in places where there are fiscal incentives. Wholesale offers cover wholesale transmission services' offers to support broadband internet access, to provide access to the authorized online network to corporate clients and prefectures. Satellite Service offers providing on demand and at no cost, a broadband access link, with 2Mbps, to public internet access points.

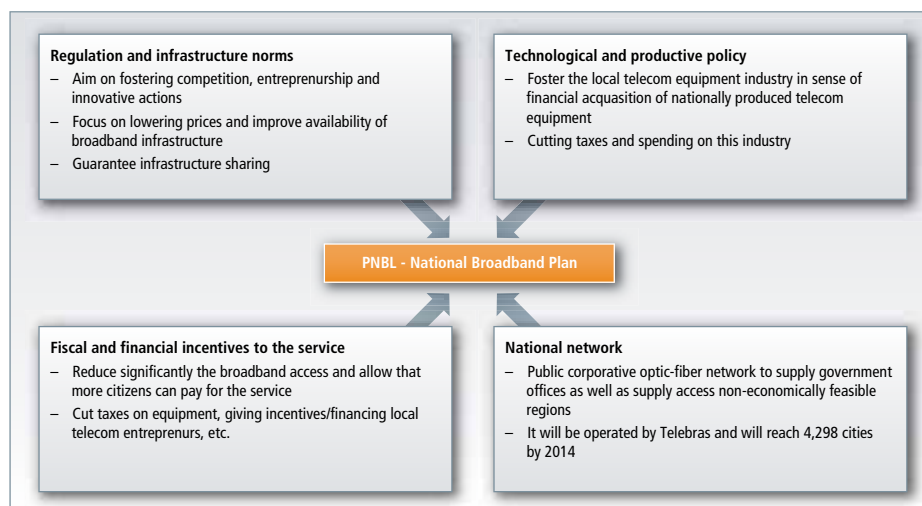
Mobile telephony was not directly addressed as part of the plan. However, as mobile broadband helps the government expand broadband coverage, mobile services contribute to achieving the goals set by the government and are therefore key to this programme. As noted in Figure 8, mobile broadband connections represent almost 80% of broadband connections, indicating the importance of mobile internet to the achievement of the PNBL's objectives. The crucial role of mobile telephony in achieving the plan's objectives is further demonstrated by the achievement of the target established by the government to increase mobile broadband access to 60 million individual users, including voice/data mobiles and data terminals (as 3G modems), by 2014. Through mobile broadband connections, the objective has already been met and by 2014 mobile broadband connections are forecast to be well over 135 million.

In consideration of the role of mobile telephony to achieve the government's objectives, mobile services could have been explicitly included in the PNBL as mobile broadband is in Brazil the most effective tool to achieving universal access to broadband. Key resources that the mobile industry requires to achieve these objectives could also have been considered explicitly in the plan, for example in relation to spectrum availability.²²

As such, mobile telephony, by providing the only broadband internet access for large segments of the population, is expected to be a key enabler of digital inclusion. This will in turn drive social inclusion, connecting the unconnected and encouraging Brazilians to use mobile phones to access the internet to exercise their citizenship and look to the internet as a primary means of communication and interaction.

²² Spectrum issues are discussed in more detail in Sections 3.4 and 4.2.1.

Figure 44: PNBL economic dimensions²³



Source: Anatel

A number of positive milestones have been achieved so far as part of this plan, which are expected to help the mobile industry develop an increasing number of offers for consumers and extend inclusion:

- The auction of spectrum in the 450MHz band, discussed in more detail later in this report
- The approval of a tax exemption for the construction of high-capacity networks, with the objective to attract private investment in communications infrastructure. It is expected that by 2016 investment will increase by BRL 20 billion (US\$ 9.8 billion).
- To increase access to broadband services and promote economic growth, the government has also taken initiatives to reduce the price of tablets, 3G terminals and fixed internet modems. The next step will be to extend this benefit to smartphones, the easiest and most immediate tool for accessing mobile broadband.

2.3.3 Mobile operators’ programmes to promote social inclusion

Mobile operators have created a number of corporate social responsibility (CSR) programmes in Brazil, which deliver significant tangible and intangible benefits to consumers and to businesses. These initiatives focus on offering mobile technology services to low income population and cities.

TIM^{24, 25, 26}, Vivo²⁷, and Oi²⁸ have initiatives focused on digital inclusion, which are summarized below and detailed in the following pages.

| TIM in Rocinha | Vivo in Belterra | Oi |
|--|--|--|
| TIM launched TIM WI-FI and TIM Fiber Projects in Rocinha, a poor community in Rio De Janeiro with the objective to offer high-speed mobile broadband to 150 thousand inhabitants of the community. | Vivo launched a mobile tower in Belterra/PA, a city of 17,000 inhabitants, which until then had no access to mobile communication. | The partnership between Oi and the federal government to provide free broadband connections to approximately 60,000 urban public schools in Brazil, benefitting more than 30 million students. |

Auctioning spectrum for mobile broadband is a key action to increase social inclusion

Mobile broadband has increased by 260% in the last two years, contributing to the success of the plan

23 Anatel (<http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=2781116&pub=original&filtro=1&documentoPath=2781116.pdf>)

24 Information provided by TIM

25 Information provided by TIM

26 Information provided by TIM

27 Vivo: Inovando em Negócios Sociais (Extract validated by Vivo) <http://brasil.nextbillion.net/blog/vivo-inovando-em-negcios-sociais>

28 Information provided by Oi

Mobile communication also enables a range of other social opportunities such as mCommerce, mEducation, mHealth, mAutomotive, Smart Cities and numerous others. These opportunities will transform the way people use their mobile, allowing low-income individuals to participate in the wider society and commerce, not only in a passive way, receiving information, but in an active way. An overview of the current and future investments in these new business models in Brazil are detailed in Section 3.

Project TIM Wi-Fi allows customers to access the operator's high-speed network, and an free access to any user who has a phone with Wi-Fi connection

2.3.3.1 TIM Initiative in Rocinha

Through the fibre optic network of TIM Fiber, TIM is implementing a pilot project unprecedented in Rocinha, the largest favela in Brazil with over 150,000 inhabitants. This is the beginning of the TIM Wi-Fi project, composed of a private network that allows customers to access the operator's high-speed network and a public net, open to any user who has a phone with a Wi-Fi connection. Through partnerships with the government, the public network will allow access to public utility services websites, such as City Hall and ministries. After deployment in Rocinha, the operator plans to expand the TIM Wi-Fi to other high-traffic areas, such as universities and airports.

In Rocinha, TIM installed numerous antennas that provide mobile broadband at high speeds of up to 54Mbps for the entire community and will work also as an access point for wireless internet (hotspot), strengthening the capacity of the data network through optical fibre, improving the quality of service. During the pilot phase, approximately 500–600 residents are expected to have access to this technology.

The Oi project provides free broadband connection to approximately 60.000 urban public schools in the country, benefiting more than 30 million students

2.3.3.2 Oi Initiative in Public Schools

One of the digital inclusion initiatives promoted by Oi is the Broadband in Schools Program ("Programa Banda Larga nas Escolas", or PBLE). In partnership with the Federal Government of Brazil, Oi provides free high-speed broadband connections to approximately 60,000 urban public schools in the country, benefitting more than 30 million students.

According to the Brazilian Ministry of Education, this is currently the largest digital inclusion program underway in the world and also the largest private contribution in Brazil. In fact, Oi is responsible for 82% of the program funding, investing almost US\$ 100 million in this initiative.

Besides PBLE, Oi participates in the PNBL, offering broadband connections of 1Mbps and contributing to the development of internet access in Brazil. So far, 1,772 municipalities have enrolled in the program, 38% of which are located in the North and Northeast areas of Brazil. By the end of 2014, all the host locations of 4,800 cities in the operation area of Oi will be covered by Oi's PNBL. The focus is the expansion of broadband access in the country, promoting digital inclusion and reducing social and regional inequality.

2.3.3.3 Vivo Initiative in Belterra

In November 2009, Vivo launched a social-inclusion project that, at the same time, could offer a financial return to the company. The chosen city was Belterra/PA, a city of 17,000. The project, called Amazon Connect (Conexão Amazônia), had investments of approximately BRL 1.5 million and began with the installation of a mobile tower at Belterra, which until then had no mobile communication service. Two partners were essential to project success: Saude e Alegria, a nongovernmental organisation that contributed to education and coordination within the region, and Ericsson, which donated 3G equipment, solar panels and chargers.

The Belterra community, in addition to having access to mobile communications, has received several social and economic benefits:

- Vivo donated 100 mobile phones to community leaders, with unlimited data usage. This improved communications with the inhabitants of other towns.
- The first new company in Belterra after completion of the tower was an internet café, showing its relevance to local entrepreneurship.
- Several companies are moving to Belterra, due to the quality of the signal in the region.
- Credit approval timeframes were reduced to 2–3 hours.
- Small hotels in neighbouring cities have increased their visitor numbers, as more people are willing to go to the region due to the enhanced mobile signal.
- After the tower installation, 20% of students were enrolled in some type of distance learning and 10% accessed virtual libraries, leading to improvements in education.



Vivo also was benefited in several ways, as highlighted below.

- The company recently opened towers in other cities, including Borá in São Paulo (Brazil's smallest city), Guaribas in Piauí (the birthplace of "Zero Hunger Program"), and Inhapim in Minas Gerais (which has the lowest HDI in Brazil).
- From this experience, by December 2011 Vivo had expanded its 3G network to 2,016 cities in the country, covering 85% of the Brazilian population.
- Improved brand image in the region. This project helped Vivo to be the leading company in the region.

The Amazon Connect project, led by Vivo, brought great benefits to the company, the community and the partners involved in the initiative

The NGO Saúde e Alegria had many benefits that could be reversed to society:

- The NGO has a hospital boat called Abaré, which was equipped with 3G equipment, smartphones and notebooks. It became a signal relay point from Belterra's tower.
- In addition, Saúde e Alegria can now receive funds from SUS (Unified Health System).
- In 15 communities, with smartphones and laptops donated by the project, young people are learning to photograph and film the daily life of their communities, producing educational and cultural videos.

2.3.4 Mobile's impact on health, education and youth services

Availability of mobile telephony has transformed the way health and education services are provided. The increased volumes of smartphones and tablets, and the possibility of exchanging and processing an increasing number of data services, will generate additional social benefits, especially in rural and poorer areas of the country. Examples of these programmes and benefits are reviewed below, along with how mobile telephony is changing prospects for Brazil's younger generations.

2.3.4.1 mHealth

Mobile devices are playing an important role in addressing healthcare accessibility and affordability in Brazil. A PwC/GSMA study has shown that 3G and 4G rollouts are opening a whole new range of possibilities in using mobile devices and the internet to address healthcare challenges. The forecast for mobile health revenues in Brazil in 2017 is US\$720m, placing it among the top10 mHealth revenues globally, as shown in the table below.²⁹

The increasing penetration is placing Brazil in a global leadership position in mHealth development

Table 4: Brazil mHealth Forecast

| Brazil mHealth Forecast | |
|-------------------------------|-------------------------------------|
| Market share in 2017: | 45% of total LATAM mHealth revenues |
| Opportunity expected in 2017: | US\$ 0.72 billion |
| M-Health projects: | 7 currently live ³⁰ |

Source: Touching lives through mobile health – GSMA/PwC, 2012

Those deployments that are already happening in Brazil provide solutions primarily aimed at monitoring, diagnosis, prevention and treatment: GlicOnLine³¹, Sana AudioPulse³², Nokia Data Gathering³³ and MyDoctor@Home.³⁴

Mobile app helps patients manage diabetes

GlicOnLine is a free system made to help diabetic patients in their day-to-day lives by automating carbohydrate-counting and calculating the right dose of insulin.

The application is controlled by physicians, and patients are able to log their sugar levels. The app is free, and patients can use it online or on the mobile phone; it only requires that patients have a data plan in their mobile service.

Sana AudioPulse

This is a mobile telemedicine solution, using mobile technology with specialized hardware to screen for hearing impairment in newborns, using a suite of hearing screening tests.

Data is securely transmitted wirelessly to a centralized medical database for validation by a trained audiologist and stored in a medical record database. The mobile technology allows for widespread deployment of hearing screenings across a broad span of rural and urban communities.

This solution was developed by a team of professionals of MIT, Harvard, UFRN and used the Sana Mobile Platform.

Fighting the spread of diseases

The Nokia Data Gathering solution offers a way to collect data using mobile phones and once it sends data from many remote locations, the collected information can be made available in near real-time for analysis. Because of this, the Amazonas State Health Department (SUSAM) and the Health Vigilance Foundation (FVS) are using this to fight the spread of diseases and increase the effectiveness of treatment. According to Agnaldo Costa, the State Health Secretary of Amazonas State, "The transmission of data immediately after the interviews improves agility, increases public safety and avoids manual filling-in of forms which is usually a difficult and time-consuming process".

Doctor at home

TIM launched a pilot in Brazil of the MyDoctor@Home solution, which allows patients suffering from cardiac, diabetic or lung ailments to measure their clinical parameters from home and transmit this to the e-Health Connecting Platform, using any available fixed-line or mobile network. The results can then be accessed by patients and medical staff to view data via their smartphone, PC or television. The system can be configured to other uses, such as providing clinical measurement timings and reminders, alerts to take medication and escalation notifications if any measurements are outside the preconfigured safe range.

³⁰ Updated from the GSMA mHealth Tracker

³¹ GlicOnline website (<http://gliconline.com.br/>)

³² Sana AudioPulse (<http://sana.mit.edu/audiopulse/>)

³³ Nokia Data Gathering (<https://projects.developer.nokia.com/ndg/wiki/projects>)

³⁴ TIM MyDoctor@Home Case Study (<http://www.gsma.com/connectedliving/tim-mydoctorhome-case-study/>)

³⁵ Touching lives through mobile health – GSMA/PwC, 2012.

The increase of chronic diseases, coupled with increasing income levels, will lead to significant opportunities for monitoring and treatment of mobile services. Brazil is expected to have a market for monitoring services related to chronic diseases of about US\$420m with independent ageing solutions contributing a further US\$30m in revenues, in 2017.³⁵

In June 2012 Ipsos Mori interviewed 484 people among cardiologists, diabetes specialists, primary care physicians and community health workers, adult patients with a chronic cardiovascular condition, diabetes and adults with a high level of interest in health and wellness who do not suffer from a chronic health issue to understand their perspective of mobile health in Brazil. The research indicated that 98% of healthcare providers see a benefit to mHealth, and 84% of patients see a benefit to mHealth.³⁶

The “Information Age” requires a more dynamic learning process, which mobile technology is best placed to provide

2.3.4.2 M-Learning / M-Education

An innovation that contributed to the enhancement of education in Brazil was the implementation of eLearning. Also known as Distance Learning, it emerged between the 1970s and 1980s and comprises computer and web-based learning. However, with the proliferation of mobile devices, the opportunity for digital learning has extended beyond eLearning. Information and knowledge require accelerated, dynamic and participatory learning processes.³⁷ Mobile technology facilitates these objectives.

A study conducted by the Federal University of Rio Grande do Norte (UFRN) argues that mLearning in Brazil will become increasingly popular, and will be a key tool for promoting digital inclusion and education for all Brazilians.³⁸ According to the Mobile Education Landscape report, the highest growth rates of mEducation applications are in China, India, Indonesia and Brazil.³⁹

Below are two examples of M-Learning applications in Brazil. The first one, led by Vivo, focuses on providing language courses by phone⁴⁰ and the second is a governmental initiative to improve teachers’ connectivity.⁴¹

Table 5: Examples of mLearning and mEducation

| |
|---|
| Learning English and Spanish by phone |
| An mLearning application in Brazil that has gained great prominence is Kantoo, created by Vivo for teaching English and Spanish, taking advantage of the great interest of Brazilians in the subject, particularly given the forthcoming World Cup and Olympic Games. According to Vivo, this service has already gained nearly 3 million users. |
| Connecting the Department of Education with teachers |
| Another mLearning application in Brazil is the communication between the Department of Education and teachers from the state of Rio de Janeiro. Through SMS, the department informs dates, deadlines and other important matters. The project aims to update, in brief, students and their parents of important disclosing dates. In the long run, the department aims to send content by mobile, functioning as a kind of tuition. |

2.3.4.3 mYouth

According to the survey “TIC Crianças 2010”⁴², out of a sample of 2,516 children from five to nine years of age, 59% had already used a mobile phone. Figure 45 shows that a higher proportion of children in rural areas (21%) compared to children in urban areas (18%) have used a mobile phone. According to data from the survey, the main activity on mobiles is playing games (84%), followed by calling someone (64%). Internet access (1%) is expected to grow as cheaper smartphones are made available.

36 M-Health: HCP and Patient Perspectives, Ipsos Mori, 2012

37 Como anda o Mobile Learning no Brasil? (TI Master Magazine) http://www.timaster.com.br/revista/materias/main_materia.asp?codigo=1731&pag=1

38 Learning via Dispositivos Móveis no Brasil: Estado da Arte e Desafios à Luz do Acesso Participativo e Universal do Cidadão Brasileiro ao Conhecimento <http://www.lbd.dcc.ufmg.br/colecoes/desafios/2012/0019.pdf>

39 Mobile Education Landscape Report <http://www.gsma.com/connectedliving/wp-content/uploads/2012/05/landscape110811interactive.pdf>

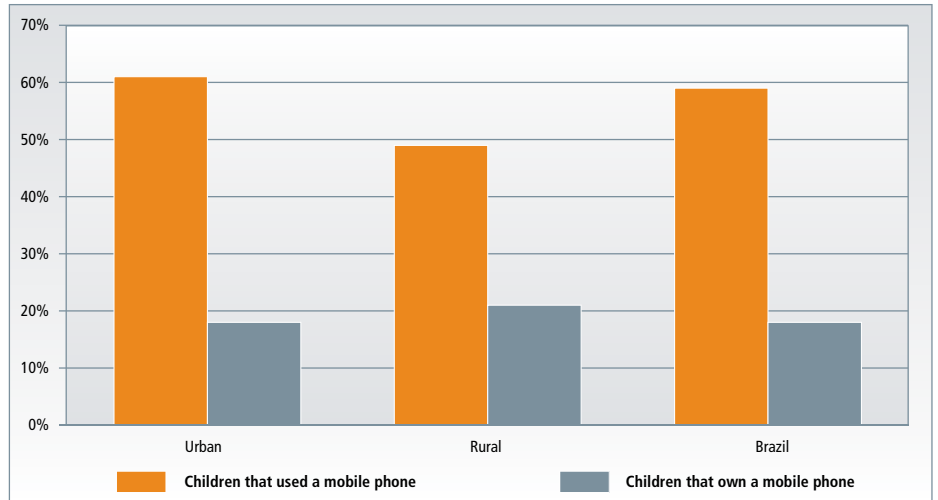
40 M-Learning deve consolidar-se em 2012 (Indigo website) <http://fi.indigo.com.br/2012/04/m-learning-deve-consolidar-se-em-2012/>

41 Como anda o Mobile Learning no Brasil? (TI Master Magazine) http://www.timaster.com.br/revista/materias/main_materia.asp?codigo=1731&pag=1

42 “TIC Crianças 2010” (Use of ICT by children), held by NIC.br (Information and Coordination Centre of Point BR) and by CETIC.br (Studies Centre on Information and Communication Technologies).

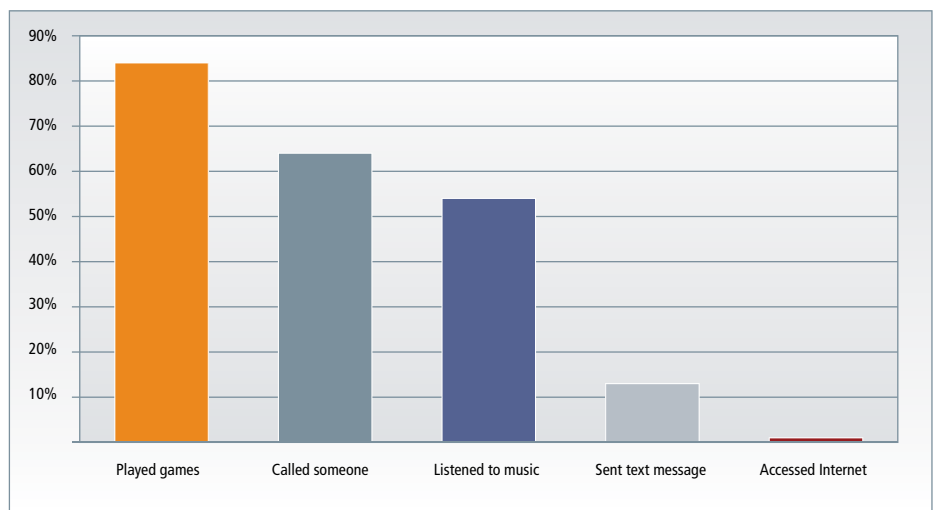
59% of Brazilian children from five to nine years of age have already used a mobile phone, providing unique social and education opportunities

Figure 45: Children’s experience with mobile devices



Source: TIC Crianças 2010, % of the total population between 5 and 9 years of age

Figure 46: Activities with mobile phone



Source: TIC Crianças 2010, *% above total internet users between 5 and 9 years of age

Cognisant of the increased use of mobiles by children and young people, the GSMA has developed the mYouth programme.⁴³ It is aimed at promoting greater understanding of how young people across the world use their mobile devices through a multi-year research project run in conjunction with NTT DOCOMO’s Mobile Society Research Institute (MSRI).⁴⁴ The GSMA also leads several industry-wide initiatives related to a safer mobile experience:

- The European Framework for Safer Mobile Use by Younger Teenagers and Children: A self-regulatory initiative of the mobile industry, which advises mobile operators on how to ensure that younger teenagers and children can safely access content on their mobile devices.
- Age Sensitive Content: The GSMA has produced a toolkit to consolidate the experience of its members in this area, so that the mobile industry is well placed to proactively manage its responsibilities as it rolls out new content services.
- The Mobile Alliance against Child Sexual Abuse Content: Aimed at creating significant barriers to the misuse of mobile networks and services for hosting, accessing, or profiting from child sexual abuse content.

43 <http://www.gsma.com/publicpolicy/myouth/>

44 <http://www.gsma.com/publicpolicy/myouth/research/>



3 Market outlook: mobile at the centre of the future Brazilian society



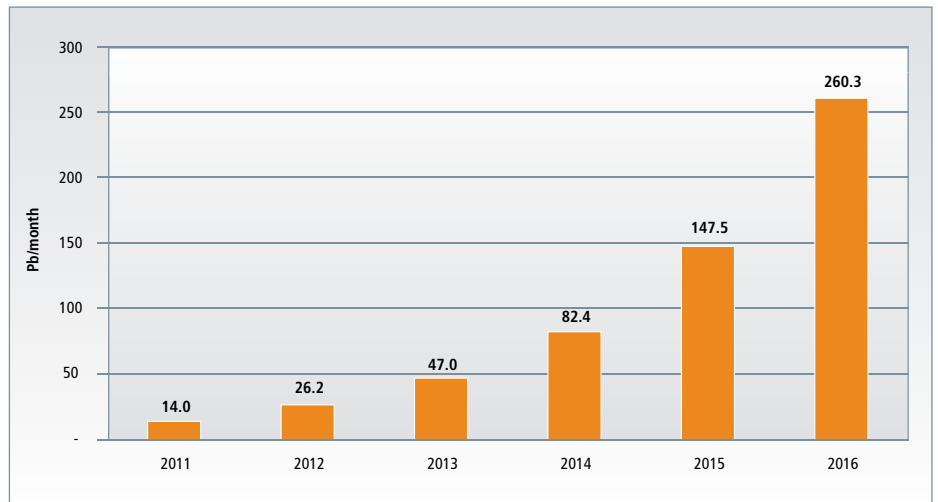
Availability of mobile broadband and mobile data will transform the way Brazilian businesses and consumers work and socialise. Demand for mobile broadband is expected to boom as result of three factors:

- Smartphone affordability will drive availability of mobile data to a larger consumer base;
- The World Cup and Olympic Games will generate unprecedented demand for mobile services; and
- Increased volumes of new data-based services, from social networks and commercial propositions such as contactless payments to utility services, will drive consumption for multiple transactions.

Cisco predicts that mobile data will increase 19-fold between 2011 and 2016, and, on the supply side, mobile operators and the government will need to work together to meet the challenges of growing data demand and to ensure economic benefits are realised and shared.

Cisco predicts that mobile data will increase 19-fold between 2011 and 2016, which risks placing an unprecedented strain on mobile networks

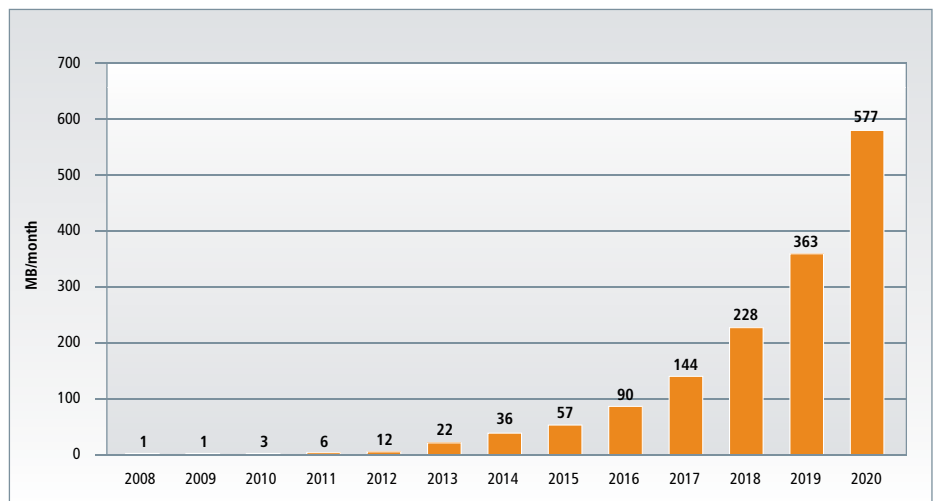
Figure 47: Total mobile data traffic and forecasts in Brazil



Source: Cisco, 2012

Data from Strategy Analytics further reinforces Cisco’s forecasts of sustained traffic growth. As shown in the figure below, data traffic per user is expected to grow on average 83% per year between 2008 and 2020, reaching 577MB per user per month in 2020.

Figure 48: Average data traffic per user (2008–2020)



Source: Strategy Analytics

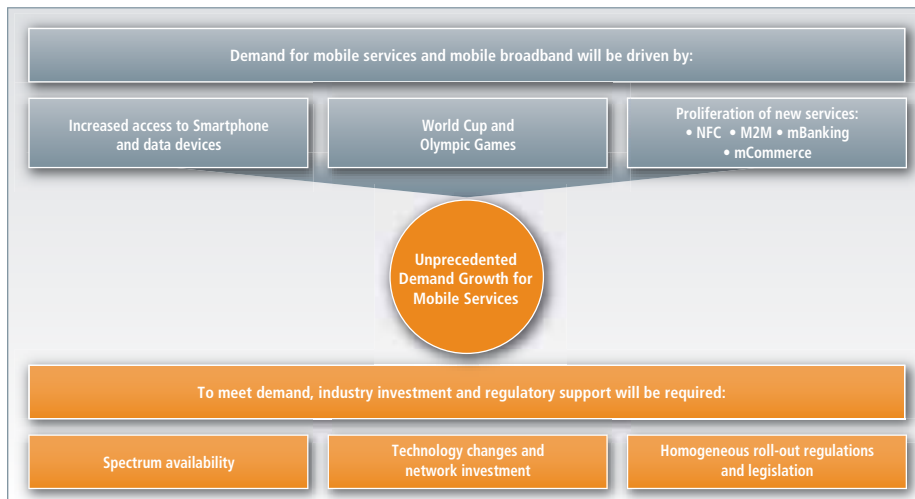
In light of this increasing demand, both industry investment and government support will be required:

- Operators have committed over BRL 25 billion (US\$ 15 billion) in further network investment in the next two years, which will also allow the deployment of more efficient technologies.
- In the short term, and in particular to meet the extra demand generated by the World Cup and Olympic Games, supportive regulations that facilitate network roll-out and site and antenna installation are required. This has become a significant issue as site deployment is delayed as a result of complex approval processes. This has generated increasing congestion in the networks, with implications for service quality. Homogenous and coordinated regulations in these areas have become the single largest obstacle to network deployment in Brazil.
- Availability of spectrum will be key to meeting a growing demand in the medium term. In June 2012 LTE spectrum in the 2.5GHz and 450MHz bands were auctioned. While this will be employed in the short term to increase capacity, the technological properties of the 2.5GHz are not favourable for rural coverage, and spectrum in the 700MHz ("the Digital Dividend") could be allocated to mobile services in the medium term.



This section discusses developments on the demand side and then describes how mobile technology in Brazil is helping to drive innovation and develop commercial and utility services. It also discusses the operators' investment plans for the next years. An analysis of the administrative barriers to site deployment and of spectrum issues is presented in more detail in Section 4.

Figure 49 Determinants of increasing demand for mobile data





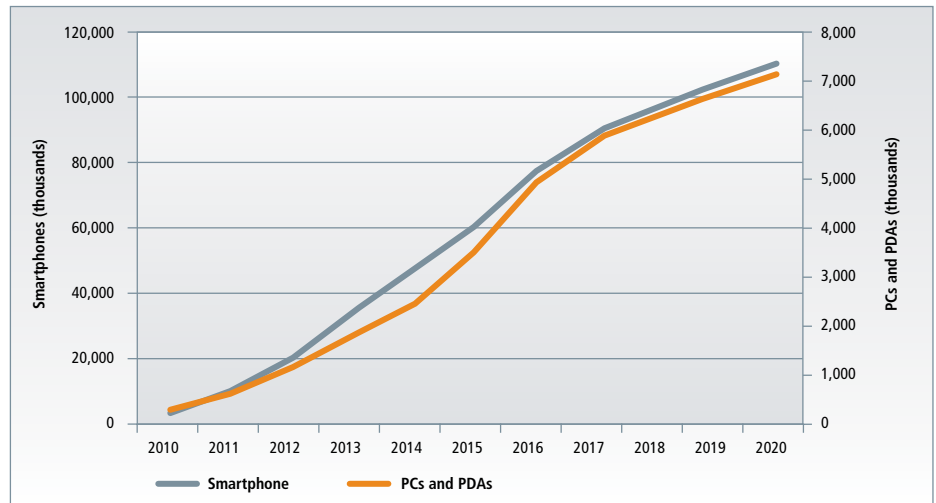
The growing usage of smartphones among Brazilians brings opportunities across multiple social and business areas

Mobile Social Networking has already transformed how people communicate, creating opportunities for advertising and local service providers

3.1 Affordable smartphones will make mobile broadband a daily user experience

As previously noted, smartphone ownership in Brazil is growing fast. The expected commercialisation of the “\$100 handset” (BRL 200) by the end of 2012 is likely to allow a growing number of Brazilian consumers to use mobile data on a daily basis, and data traffic will be driven by increased penetration of mobile-broadband enabled devices such as smartphones, personal computers and personal digital assistants (PDAs). Data from Telecom Advisory Services estimates that smartphones will reach over 75 million units in 2016 and well over 100 million units in 2020. PCs and PDAs will show a similar growth (approximately 40% per year), although from a lower base, reaching 7 million units in 2020.

Figure 50: Installed base of internet broadband-enabled devices (2008–2020)



Source: Telecom Advisory Services, LLC

This will trigger a number of transformational changes in the way people socialise and communicate, and demand for mobile broadband will increase at a fast pace.

In May 2012, Google published three reports from the “Our Mobile Planet” series,⁴⁵ a research partnership with Ipsos, showing how smartphones have become an increasing part of daily life, transforming consumer behaviour, helping users navigate the world and connecting advertisers with consumers. The research found that, in Brazil, 40% of smartphone owners access the internet every day. Moreover, a higher proportion of users (73%) do not leave their smartphones at home.

Google’s research also addresses the considerable change in consumer behaviours triggered by mobile data usage, in particular on a number of commercial propositions. Advertisers, for example, increasingly include a mobile proposition in their campaigns to develop cross-media promotions; as mCommerce becomes popular, the typical commercial relationships and e-commerce activities require a new form of doing business.

Mobile internet surfing on the go promotes small local business, and allows Brazilians to participate in an environment previously dominated by larger companies. According to the survey, 88% of smartphone users search for local information on their devices, and 92% of these take an action afterwards, such as calling a highlighted number.

As new forms of interactions emerge, mobile social networking will be the most important mobile data service by 2014, according to CPqD:

“One reason to believe in the success of Mobile Social Networking is that, unlike the uptake of SMS, Brazilian Internet users adopted social networks to a deeper degree than many other countries. Brazilian data point to the fact that users spend far more time on social networks than any other Internet application. This behaviour may have huge impact on network traffic by 2014, which will demand more frequency bandwidth, network infrastructure optimization and contingency planning to guarantee the availability and quality of service.”⁴⁶

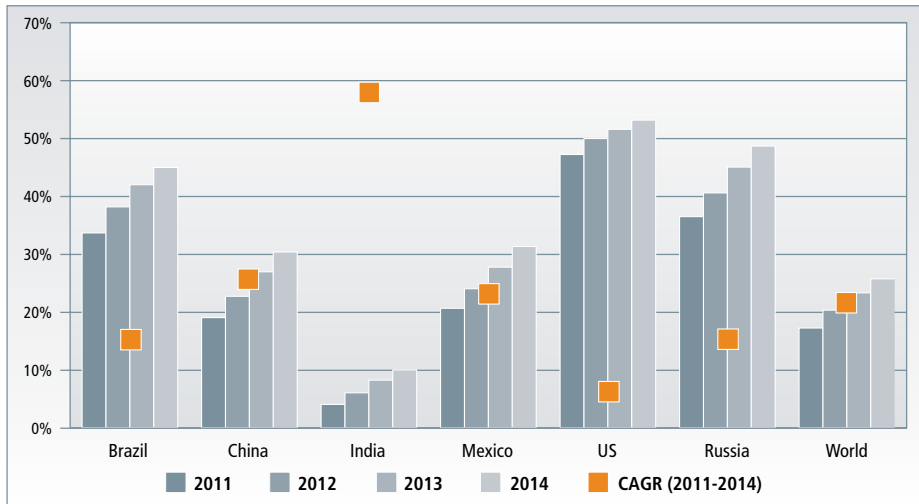
45 http://usmediaconsulting.com/img/uploads/pdf/our_mobile_planet_brazil_en.pdf

46 Mobile Telecommunications Networks for the 2014 World Cup – CPqD/GSMA, 2010

Brazilians are well positioned among other countries in terms of mobile social networking. Figure 51 shows that Brazil is above the world’s average in the index, and with similar growth of adoption to other countries.

The World Cup is expected to bring over 1 million roaming connections

Figure 51: Penetration of social networks and its evolution, by country

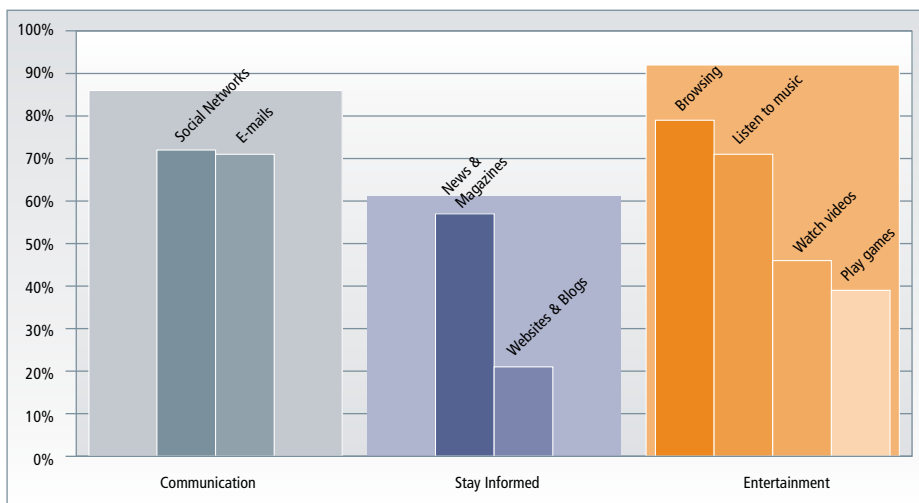


Source: eMarketer⁴⁷ and Deloitte



The figure below presents the main reasons why Brazilian smartphone owners use their mobile.

Figure 52: Internet usage profile among Brazilian smartphone owners



Source: Google, May 2012

47 Where in the World Are the Hottest Social Networking Countries, eMarketer – February 2012



During the London 2012 games, 60GB of data would travel across the network in the Olympic Park every second

3.2 Mobile will be at centre of the World Cup and Olympic Games delivery

One of the major factors that will shape demand growth will be the 2014 World Cup and the 2016 Olympic Games in Rio. These will draw crowds from all over the world and will generate a demand for data, not only related to the events themselves, but also driven by sponsors and by surrounding activities, generating an unprecedented demand for data via the mobile operators.

Operators are examining lessons learned from previous events such as the 2012 London Olympics Games and the 2010 World Cup in South Africa to understand how mobile operators in these countries prepared. Analysts estimated that during the London 2012 games, 60GB of data travelled across the network in the Olympic Park every second.⁴⁸ After that, due to the high use of mobile phones, laptops, smartphones and tablets, the BBC called the 2012 Olympic Games as “the first truly digital Olympics”. This is consistent with reports from mobile operators as Vodafone, which reported that during the two-week period its customers consumed, on average, 15% more data than usual. According to O2, its customers sent more than 4 billion texts, made more than 2.2 billion voice calls and used 3.3 billion kilobytes of data during the Games.

However, given fast technology changes and booming demand for wireless services, a degree of uncertainty surrounds the preparation. New devices and new commercial propositions (e.g., contactless payments, as discussed later in this section) are likely to make the 2014 World Cup and the 2016 Games the most connected events ever.

A detailed study⁴⁹ of mobile data usage during the World Cup indicates that capacity in and around stadiums will be challenging for operators. However, other sources of traffic spikes will arise in a number of locations, such as “Fan Fests”, open-air stadium extensions that FIFA arranges to broaden access to the games. In 2006, when these areas were first arranged, they attracted 18 million visitors, while in South Africa 6 million people watched the games in Fan Fests areas. In Brazil, Fan Fests are planned in 12 different locations, and given the size of the local population and the expected tourists, significant data demand is expected.

Additional demand is likely to be generated as a result of the development of new mobile services based on Near Field Communication (NFC) technology.⁵⁰ At the London 2012 Olympic Games, mPayments, a form of contactless payment that employs mobile technology, have seen widespread usage, especially as contactless payments were offered on all transport facilities (e.g., buses and metro stations), by restaurants and shops at the Olympic Village and by cabs and taxis. As this technology spreads over the next years, tourists and locals will demand increasing contactless facilities.

Syniverse indicates⁵¹ that Brazil is expected to receive between 600,000 and 1 million roaming connections during the 2014 World Cup, which is expected to generate 300% of the normal data traffic for a period of eight weeks.

Demand estimates by CPqD for Brazil during the World Cup suggest a traffic density of 200 bps/m² or 17 Mbps per cell area. Their study suggests that, even considering that changing system parameters might improve network performance, it is very unlikely that HSPA or LTE cells, with a 2 x 5MHz bandwidth, will be able to meet this demand.

As such, more base stations will be required in the short term to increase network capacity. While in the long term the Digital Dividend spectrum will provide an ideal solution, in the short term and in preparation for these special events, facilitation of network roll out is central to further network deployment. Recently, the World Cup governmental committee has reported that network deployment required by FIFA in the 12 host cities of the World Cup has been delayed due to complications with antenna locations.⁵² Policymakers could therefore consider the urgent need to reform legislation and practices on network installation, as discussed in Section 4.2.1.

48 BBC news

49 Mobile Telecommunications Networks for the 2014 World Cup – CPqD/IGSMA, 2010

50 These are discussed in more detail below

51 Brasil pode receber até 1 milhão de usuários móveis internacionais na Copa (Teletime website)
<http://www.teletime.com.br/13/04/2012/brasil-pode-receber-ate-1-milhao-de-usuarios-moveis-internacionais-na-copa/t/273078/news.aspx>

52 Article published in Terça, 11 September 2012

Facilitating network investment will become particularly important, as mobile operators will face additional costs as a result of these events. For example, FIFA will demand a redundant optical network to guarantee link stability. For the 2010 South Africa World Cup this redundancy cost approximately US\$ 150 million⁵³; in a country with continental dimensions like Brazil, the challenge of meeting FIFA’s redundancy requirement will be even greater. Mobile companies will also incur costs for risk management, critical infrastructure protection and information security. With the aim to comply with FIFA’s technology requirements for stadiums and their surroundings, telecommunication companies in Brazil are expected to invest close to BRL 3 billion.⁵⁴

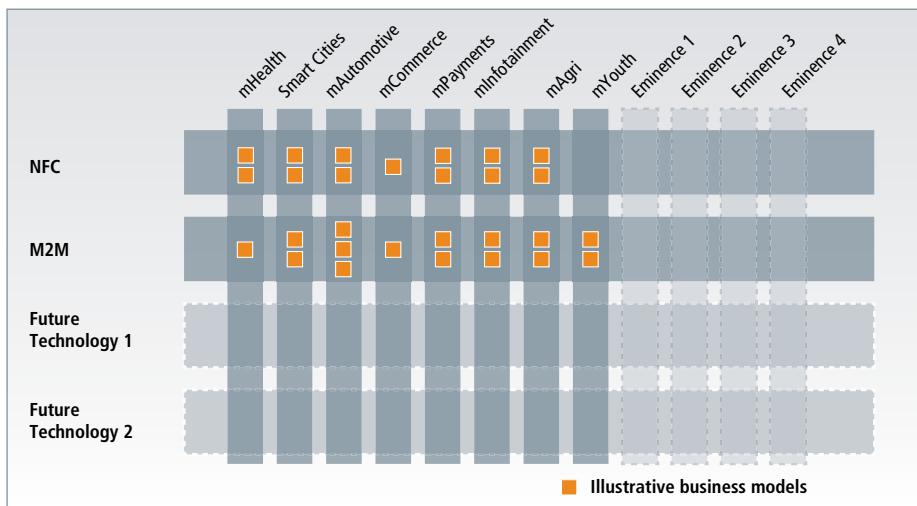
3.3 New business opportunities will be driven by mobile technology

As smartphones and tablets make mobile broadband the most common communication tool for consumers, a host of new mobile services will grow exponentially in Brazil over the next five years.

Revenues from M2M services will grow by over 9% annually

The mobile industry is at the core of the economy’s innovation ecosystem, and new business models affecting a variety of services are being successfully developed. As the “Y” generation reaches the consumer market and new technologies emerge, the relationship between companies, customers and suppliers will undergo a significant transformation. The following picture summarises the importance of the mobile ecosystem to a number of commercial and social services: “vertical” themes with most eminence in the industry include mCommerce, mBanking and mPayments and on “horizontal” technologies (NFC, M2M) that will act as enablers of these new business models.

Figure 53: Prospective mobile business ecosystem



Mobile technology innovations are affecting a number of industries through M2M and NFC facilities

Source: GSMA

These technologies and propositions are discussed in more detail below.

53 CPqD, "Mobile Telecommunications Networks for the 2014 World Cup"

54 S.L. Ribeiro, J.H.A. Franco, M.B. Trindade, E.L. Dias e R. M.F. Souza, "Aplicação da Metodologia de Identificação da Infra-estrutura Crítica no Pan 2007", Caderno CPqD de Tecnologia, Campinas, Brazil, 2007.



M2M services will boost productivity in numerous sectors, especially for agriculture in Brazilian rural areas

NFC offers convenience to consumers, new growth avenues to mobile carriers, differentiation to financial institutions, operational efficiency to the transport sector and loyal customers to merchants

3.3.1 Machine to Machine (M2M) technology

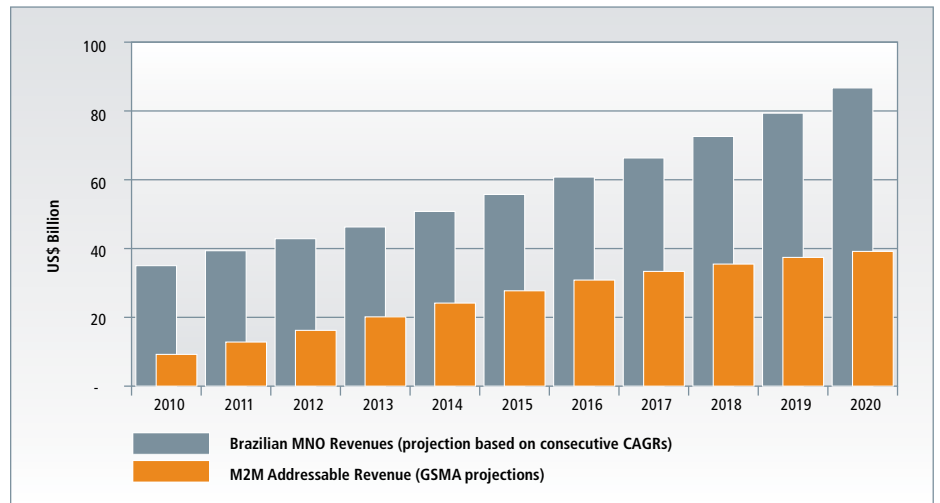
Machine to machine (M2M) refers to technologies that allow wireless systems to communicate with other devices of the same ability. M2M uses a device (such as a sensor or meter) to capture an event (such as temperature, inventory level, etc.), which is relayed through a wireless network to an application that translates the captured event into meaningful information (for example, items that need to be restocked).

The extent of the applications available for this use is such that a growing series of commercial possibilities are constantly being developed. A study by the GSMA suggests that “The consensus view on growth misses a larger market potential, in two notable respects — the size of the potential market and the range of segments that is capable of being addressed.”⁵⁵

M2M will have a number of interactions with the economy. As M2M is an enabler of services across a list of providers, M2M will positively impact the whole mobile ecosystem by opening up new markets, generating further employment and increasing innovation. In Brazil, SIM cards for M2M communication are following the worldwide trend and are emerging as a new source of revenue for the operators. They have already reached 6.2 million, or 2.4% of 3G market share. Mobile broadband access dongles have achieved a figure of 6.2 million, growing 2.4% compared to the previous year.⁵⁶

Figure 54 combines GSMA projections of the amount invested on M2M by Brazilian MNOs and a CAGR projection of industry revenue growth (9.2% yearly on average). In the past three years, M2M has been gaining importance, and the trend will continue in the near future.

Figure 54: Comparison of relevance of M2M in operator revenues



Source: GSMA, Teleco and Deloitte analysis

55 Embedded Mobile – M2M solutions and beyond, November 2008

56 3G: M2M já encosta na venda de chips para banda larga móvel (UOL website). <http://convergenciadigital.uol.com.br/cgi/cgilua.exe/sys/start.htm?mfoid=31519&sid=17>

3.3.2 Near Field Communications (NFC)

A set of NFC standards that enable smartphones and tablets to establish radio communication with other devices or applications by touching them together or bringing them into close proximity has been developed and is being rolled out globally by operators. Present and anticipated applications include contactless transactions, data exchange, and simplified setup of more complex communications such as Wi-Fi.

Mobile transactions that use NFC offer convenience to consumers, new growth avenues to mobile carriers, differentiation to financial institutions, operational efficiency to the transport sector and loyal customers to merchants.

Deloitte predicts that shipments of devices with this technology will double⁵⁷ to 100 million new devices by 2013. In Brazil, this figure is expected to double in line with global trends, and in 2013 NFC will start to become a reality in Brazil.

Initiatives on banking, transportation and retail are discussed below.

According to “SIM-Based NFC Case Study”, led by GSMA, it is possible to conclude that the “high market potential for NFC adoption in Brazil is principally driven by its large population and underdeveloped banking services. For a large portion of the population, the ability to have cards stored on their phones is a far more attractive option than having to travel long distances regularly to use bank branches and ATMs. Also Brazilian middle class consumers are increasingly likely to adopt NFC due to its ability to integrate the core value proposition with other digital consumer products such as loyalty, social media, and location-based services (e.g. coupons)”.

3.3.3 mPayments

In Brazil, the use of mobile phones for shopping and payments is in its early days, with a great potential for growth. According to research presented by Teleco, 71% of Brazilians said they would use their mobile phones instead of credit or debit cards, while 66% would check their balance and undertake transactions.

For merchants, the mPayment system is advantageous as merchant fees are expected to be lower.⁵⁸ The federal government is discussing ways to make mPayments safer and more popular.

mBanking is expected to be one of the key services that will extend banking services to poorer sectors of the population in the next few years. Currently, 65% of beneficiaries of the Bolsa Familia program, for example, have mobile phones, but only a small percentage of them have a bank account. Financial institutions and mobile operators are expected to provide mBanking services in the next few years, while the government is studying the possibility of using mobile as a channel for social benefit payments.

mTicketing is a form of mPayment that can contribute to developing mPayments.

mTicketing provides flexibility, security and lower cost to the customer and company.

mTicketing also helps to protect the environment, as it reduces the use of paper for printing of tickets, for example, and companies will be able to reduce sales and logistics costs.⁵⁹



NFC devices are expected to double in 2013

⁵⁷ Deloitte, “Telecom, Media Technology Predictions 2012”

⁵⁸ Marketing Digital – Fique por dentro do Mobile Commerce e do Mobile Payment (<http://www.e-commercebrasil.com.br/artigos/marketing-digital-%e2%80%93-fique-por-dentro-do-mobile-commerce-e-do-mobile-payment/>)

⁵⁹ Mobile payment ou mobile ticketing: qual a diferença? (<http://www.mobiletime.com.br/16/07/2012/mobile-payment-ou-mobile-ticketing-qual-a-diferenca-/289024/news.aspx>)

Examples of local payment applications (PagSeguro⁶⁰, DinheiroMail Mobile⁶¹ and a partnership between Cielo, Banco do Brasil and Oi⁶²) are shown below.

Paying bills by phone

Online payment platform DinheiroMail recently announced its DinheiroMail Mobile service. A secure financial service, this payment instrument provides mobility to the shopkeepers, professionals and small and medium enterprises. With a simple and intuitive interface, and compatible to Android, iOS and Symbian operating systems, the solution DinheiroMail Mobile allows customers to make payments, request billing or check the balance.

A partnership between Cielo, Banco do Brasil and Oi

The payment operator Cielo and Banco do Brasil bank reported in September 2010 a partnership with the mobile operator Oi. The agreement between the three companies creates a common platform for payments by mobile phone, the Oi Paggo. With this, the number of establishments that accept mobile payment in Brazil jumped from 75,000 to 1.8 million. The shopkeeper inputs in his POS (electronic terminal sale), the Paggo customer number and as a result, the consumer receives a short text message with the details of the purchase, enters a password and releases the purchase. The system started operation in 2011.

PagSeguro with NFC technology

PagSeguro, a company of online payments, introduced a new system that uses NFC technology (Near Field Communication). Developed in partnership with Nokia, this system allows people to make and receive contactless payments, much like the existing technology in buses and subway cards of some big cities. Developed initially for MeeGo, Symbian (present in N9) and Symbian (Nokia 701 and Nokia C7), the new application PagSeguro NFC allows users and shops to adopt the mobile phone as an alternative to paper money or cards.

3.3.4 mCommerce

mCommerce could become one of the single most transformational and successful ways to make transactions in the near future in Brazil. mCommerce is growing at a rate of 40% per year and there are nearly 30 million enabled smartphones.⁶³ Recent figures from Google suggest that 31% of smartphone users in Brazil have already made a purchase of services or products via their devices.⁶⁴ Internet sales grew 21% in the last year, and 5.6m customers have undertaken online shopping.

Examples of existing mCommerce applications in Brazil are shown below.

Buying by phone

MercadoLivre, a company dedicated to e-commerce and auctions, launched in April 2012 an application that allows users to buy in the marketplace through the Windows Phone operating system, which has been already supported by MeeGo, Symbian, BlackBerry, Android and iOS systems. MercadoLivre registered more than 2.5 million downloads of mobile applications in just nine months, which shows this market potential. Moreover, about 3.5% of the traffic in the marketplace is generated by portable handsets.

Research before buying

In April 2011, the collective purchasing website Groupon announced the official launch of its application for iPhone and iPod Touch in Brazil. The purpose of the tool is to help users find the best deals in a region through geolocation. Moreover, the app, which can be downloaded for free at Apple Store, allows users view and organize purchases already made and create new accounts. Furthermore to claim the discount, the coupon only needs to be shown in the screen, no longer needing to be printed.

60 PagSeguro lança serviço de NFC no Brasil, para pagamentos via celular (<http://www.techtudo.com.br/artigos/noticia/2012/04/pagseguro-lanca-servico-de-nfc-no-brasil-para-pagamentos-celular.html>)

61 DinheiroMail lança serviço que transforma celular em carteira eletrônica (<http://www.ecommercebrasil.com.br/noticias/dinheiromail-lanca-servico-que-transforma-celular-em-carteira-eletronica/>)

62 Oi, BB e Cielo fecham acordo para incentivar pagamento móvel (<http://computerworld.uol.com.br/negocios/2010/09/29/oi-bb-e-cielo-fecham-acordo-para-incentivar-pagamento-movel/>)

63 O potencial do mobile commerce no Brasil (<http://www.mobilettime.com.br/22/08/2012/o-potencial-do-mobile-commerce-no-brasil/295325/news.aspx>)

64 O potencial do mobile commerce no Brasil (<http://www.mobilettime.com.br/22/08/2012/o-potencial-do-mobile-commerce-no-brasil/295325/news.aspx>)

Comparing prices

BoaLista, applicative developed by Dot Legend Computer Services, is a complete shopping tool focused on Brazilian consumers. The app allows price comparison with online stores or physical ones near to the user. Through the device's camera, consumers can scan product barcodes and perform their search in finding the best deals. The user can also set up a shopping list and find out which store has it at the lowest price. Additionally, the app allows the calculation of the total purchase before payment, which then shares among other users.



3.3.5 Smart Cities and mUtilities

Brazil can play an important role in the development of Smart Cities, as it has one of the highest urbanization rates of Latin America (from 87% in 2010 to a projected 93% in 2050).⁶⁵ The early development of opportunities related to Smart Cities is linked mainly to the host cities of the 2014 World Cup and 2016 Olympics.

In November 2011, Rio de Janeiro hosted the Smarter Cities Forum, an event organized by IBM that brought together leaders of business, academia and governments from various cities across the globe to discuss models that would make cities smarter. IBM chose Rio de Janeiro because the city is one of the key investors in smarter technologies and is currently improving infrastructure to host the large sports events. The forum covered themes such as security, transportation, energy and construction.⁶⁶

In Belo Horizonte, a 2014 World Cup host city, the institution SEBRAE — Mina Gerais has created a project called “Projeto Smart City BH” to support the development of businesses that focus on providing smart solutions to local urban spaces. This project includes companies from sectors such as ICT, tourism, automotive, energy, lighting, design, engineering, urban planning and education.⁶⁷

Energy management supported by mobile technology will be a key area of growth. The National Agency of Electrical Energy (Aneel) has recently published a new regulation indicating that energy distributors will have 18 months to offer electronic energy meters to consumers. According to a report by KEMA for GSMA, Brazil, along with China, India, Japan and South Korea has one of the most ambitious smart meter deployment plans until 2020.⁶⁸ Other initiatives relating to Smart Cities and mobile technology were launched in Rio de Janeiro⁶⁹ and Rio Grande do Sul.⁷⁰

Rede Ampla in Rio

Ampla is an electric energy distributor, owned by Endesa Brazil, which provides electricity to 73% of the state of Rio de Janeiro. The rate of urbanisation, the nature of the accommodation (slums) and the high crime rate led to an unsustainable level of energy theft and bad credit risk. Meters at residential and commercial sites were prone to tampering and bribes to employees encouraged fraud. Ampla was averaging 23.6% energy losses on its network, reaching up to 52% in some areas, resulting in a negative impact on the utility's profitability and a higher cost of energy passed through to its customers. In 2003, Ampla began to roll out a pilot for a new mode of smart meter — located at the pole top — called Rede DAT. With it, the consumption per household is recorded at the transformer and energy consumption data is communicated by the utility over a mobile network. Customers receive consumption data through their mobile phone. The pilot proved a great success with losses from theft reduced by more than 50%, the number of supply interruptions reduced by more than 40%, and lower operating costs. A wider roll out followed, providing hundreds of thousands of Ampla's residential and business customers with access to the Rede Ampla service.

Mobile voting

For the first time, population from Rio Grande do Sul could vote using their mobile phones. The system allows citizens to provide a view as to how government funds should be spent in the following year. The experience, unprecedented in the country, mobilised 120,000 voters, according to the State Secretary of Planning, Management and Citizen Participation (Seplog), which led the process.

65 Cidades inteligentes (http://www.brasileconomico.com.br/noticias/cidades-inteligentes_106620.html)

66 Let's build a smarter planet (http://www.ibm.com/smarterplanet/us/en/smarter_cities/article/rio.html)

67 http://www.sebraemg.com.br/Geral/VisualizadorConteudo.aspx?cod_conteudo=6163&cod_area Superior=1806%20&cod_areaconteudo=2173

68 Why Mobile for Smart Utilities? — KEMA/GSMA, 2011. (<http://www.gsma.com/connectedliving/wp-content/uploads/2012/03/kemawhymobileforsmartutilitiesreport5july2011.pdf>)

69 Extracted from Smart Mobile Cities: Opportunities for Mobile Operators to Deliver Intelligent Cities — Accenture, Cisco and GSMA, 2011 (<http://www.gsma.com/connectedliving/wp-content/uploads/2012/03/intelligentcitiesreport0411lores.pdf>)

70 Rio Grande do Sul vota orçamento pelo celular (<http://www.guiadascidadesdigitais.com.br/site/secao/por-que-ser-uma-cidade-digital/experiencias-de-sucesso>)



3.3.6 mAgriculture

In addition to the benefits to agriculture productivity identified in Section 2.1.4, a number of more sophisticated propositions have emerged in Brazil (often called m-Agri), especially in relation to applications focused on plantation management. Two examples^{71,72} are identified below.

Controlling plantations

BASF, the world's leading chemical company and one of the largest manufacturers of agrochemicals in Brazil, provides a free mobile application, Digilab Mobile, to Android and iOS systems users. Farmers can capture images of potential pests, diseases and weeds with their smartphones and compare them to existing images in the database, which now has more than 200 files in 15 distinct cultures. The goal is to provide faster diagnoses in rural properties and facilitate the decision making process regarding an eventual pest or disease control, minimizing risks of losses.

Producers no longer need to send plant samples to the laboratory and wait many days to get a diagnosis. Just shooting a picture of a possible pest or disease with the phone, it is possible to compare it to information from the database, getting an instant, fairly accurate answer.

Increasing productivity for farmers through SMS

DatAgro is a Mobile Information Platform (MIP) developed by DataDyne.org, which allows the use of text messaging as a mean of access to information relevant to small farmers, who receive sales prices of products and crops for sale in the domestic markets. Farmers also receive agricultural information, weather forecasts, local news and relevant data from other information platforms.

The DatAgro project extends digital inclusion, to increase productivity for small farmers through an information system based on text messages, enabling in this way rapid and effective solutions to geographical isolation and increase connectivity to isolated rural areas with low population density and low income. DatAgro offers information received by agricultural producers to help boost agricultural production and its incorporation into the world of technology.



71 Um laboratório completo no telefone celular (BASF website)
http://www.agro.basf.com.br/agi/ms/apbrazil/pt_br/content/APBrazil/news_room/releases/13_06_2012

72 DatAgro: Mobile Information Platform for digital inclusion in Latin America increases productivity for farmers through SMS (e-agriculture website)
<http://www.e-agriculture.org/content/datagro-mobile-information-platform-digital-inclusion-latin-america-increases-productivity-f>

3.3.7 mAutomotive

mAutomotive services are becoming a reality in Brazil.⁷³ According to a recent study,⁷⁴ connections through Wi-Fi and 3G in cars will become standard in the next five years, and Brazil will likely be a market leader, with 25% of cars in the country connected by 2026.

Wi-Fi services in vehicle

In 2012, Vivo has partnered with Pássaro Marrom, a coach company, to start a pilot project offering Wi-Fi services in vehicles between São Paulo and São José dos Campos, a city 100km far from São Paulo. Vivo is focused on offering these services for executive and also chartered coaches.



First MVNO is created in the country to provide vehicle tracking

Besides automakers and transportation companies, Porto Seguro, one of the biggest insurance companies in the country, is also improving its customer service by creating the very first MVNO to obtain Anatel authorization to come into operation. This is a result of a partnership between Porto Seguro, Datora Telecom and TIM to provide the service through Porto Seguro Conecta and vehicle tracking is the first MVNO service to be available.

SIMRAV to fight vehicle theft

The Brazilian Traffic National Department (Denatran) has developed in partnership with contributors such as Anatel, insurance companies, SIM card makers and others has developed a system called SIMRAV (Integrated System of Vehicle's Automatic Monitoring and Register) to combat vehicle theft, by monitoring the vehicle using SMP network. It is expected that from January 2013 on, all the new vehicles produced in Brazil will have this device installed, but the activation of the tracking device will be optional. The SIM card doesn't have a previous telecom provider associated to it, thus the consumer can choose the designated operator and can change it at any time. At the beginning the device will only be applied for vehicles' position and tracking, however in the future this device could be used for other services such as customer service, e-Call, crash sensor, telemetry and others.

3.3.8 mInfotainment

In Brazil, the mobile entertainment industry is partnering with mobile operators to develop mInfotainment services. The major content industries see the mobile environment as a strong and safe distribution channel for digital content, which allows new business and new product development.⁷⁵

GOL offers mInfotainment during flights

GOL currently offers an individual on board entertainment service to customers that use tablets and smartphones. The service provides varied content with news and articles from newspapers and magazines, TV shows, games, sports and music channels for different interests. The access is performed during the flight and the content is automatically updated upon landing. Ten airports participate in the service and the system is deployed on 36 aircrafts. The company offers the product on about 250 daily flights, with more availability on flights between Rio de Janeiro and São Paulo.

73 Porto Seguro Conecta estima rastrear 450 mil carros até 2014. (<http://computerworld.uol.com.br/telecom/2012/08/24/porto-seguro-conecta-estima-rastrear-450-mil-carros-ate-2014/>)
Equipamento antifurto será obrigatório a partir de 2012. (<http://infogps.uol.com.br/blog/2011/10/20/equipamento-antifurto-sera-obrigatorio-a-partir-de-2012/>)

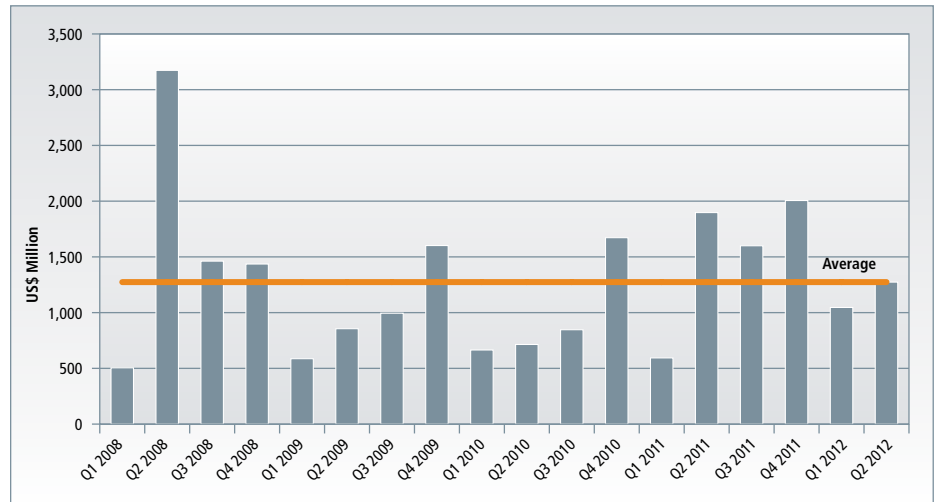
74 Internet para carros pode virar norma (<http://carros.ig.com.br/noticias/internet+para+carros+pode+virar+norma/4099.html>)

75 A indústria do entretenimento móvel no Brasil: por onde caminha o avanço das teles brasileiras? (Administradores.com website)
<http://www.administradores.com.br/informe-se/informativo/a-industria-do-entretenimento-movel-no-brasil-por-onde-caminha-o-avanco-das-teles-brasileiras/24659/>

Operators have committed to investing over BRL 25 billion as part of the recent quality plans

3.4 Operators have committed to significant network investment to meet the increasing demand
Despite the recent economic crisis, mobile operators' investment has remained steady and is forecast to increase in 2012.

Figure 55: Capex investments



Source Wireless Intelligence

In response to demand increases and as a result of Anatel's review of quality of service in Brazil, operators have set out their investment plans for the coming years.

Claro is investing an amount of BRL 3.5 billion in its services in 2012. Claro will also invest in 4G networks and, due to the increase of internet traffic in Brazil, América Móvil has committed to an investment of over BRL 1 billion to launch a submarine cable that will connect Brazil and United States, going through Rio de Janeiro, Salvador, Fortaleza, Central America and Miami. Claro is also developing a plan to comply with FIFA's World Cup requirements for monitoring, efficiency analysis, field operations, international roaming and consumer services.⁷⁶

Oi has committed to invest approximately BRL 5.5 billion in 2G, 3G and 4G (access and core) networks until 2014. Approximately BRL 1.7 billion will reportedly be invested exclusively in network quality improvement (without considering investments in support infrastructure such as IT, transportation network and other relevant investments). To reduce interruptions in personal mobile services, Oi is investing BRL 375.7 million between 2012 and 2014.⁷⁷

TIM has an investment plan of BRL 9.5 billion between 2012 and 2014. Of this, BRL 451 million is earmarked for quality improvements. Since 2011, TIM started a network improvement programme with a total investment value of BRL 1,000 million over three years (2011–2013). This project, alongside the expansion plan, will provide an increased capacity of approximately 33% in 2012.⁷⁸

Vivo's investment plan amounts to BRL 7.2 billion for years 2012–2014. While BRL 1.05 billion was spent on the 4G auction, around BRL 2.8 billion is estimated for network elements such as transportation, backbone, platforms, core and others, as well as BRL 3.3 billion for 2G, 3G and 4G access.⁷⁹

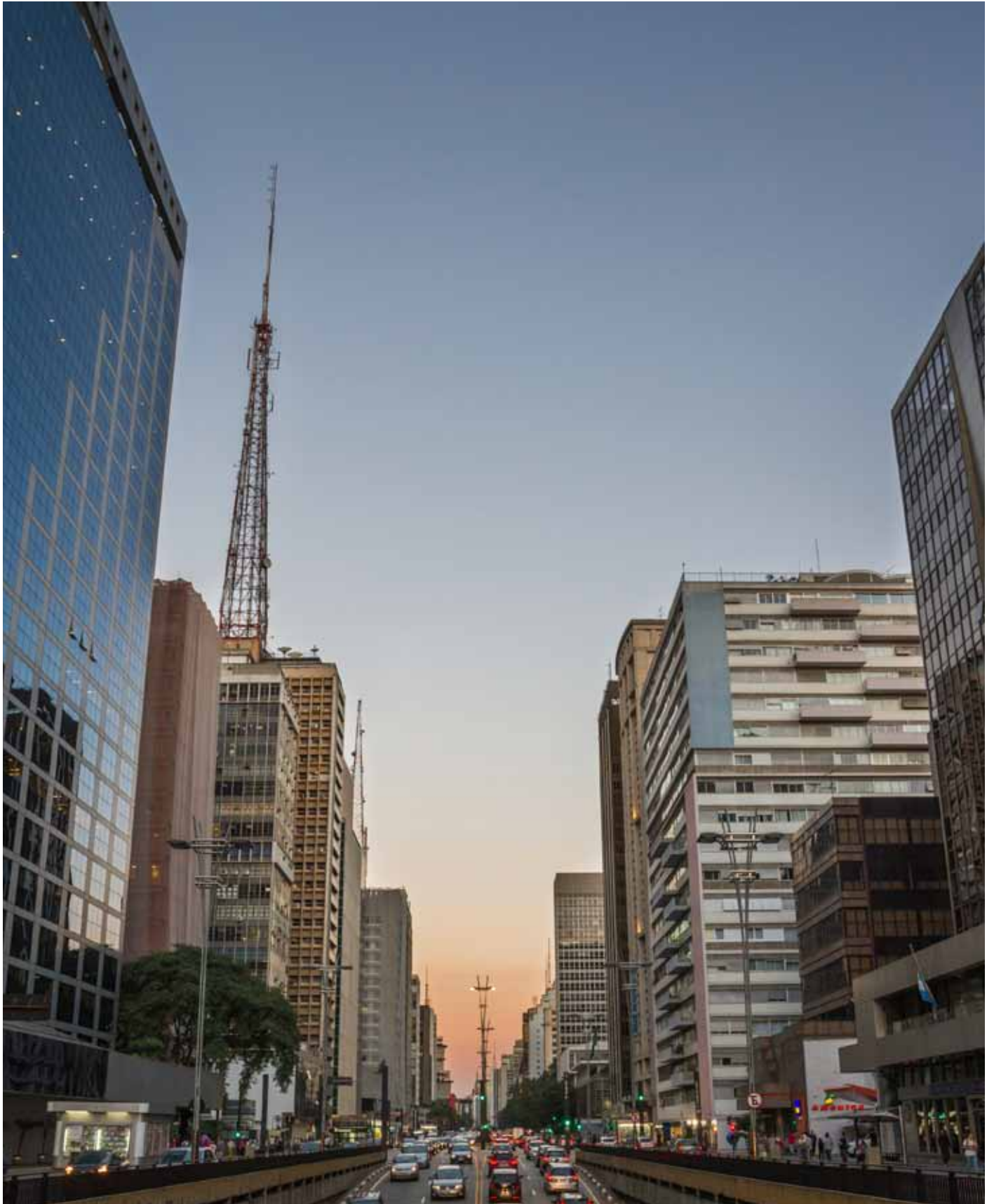
Overall, these operators will invest over BRL 25 billion (US\$ 15 billion) in the next two years. These plans also indicate the operators' commitment to the market. However, these plans face a number of hurdles for full implementation related to federal and local regulations and antenna installation that may affect network deployment and contribute to service quality deterioration.

76 [http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=281969&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20\(SMP\)%20do%20Grupo%20Claro&caminhoRel=null&filtro=1&documentoPath=281969.pdf](http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=281969&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20(SMP)%20do%20Grupo%20Claro&caminhoRel=null&filtro=1&documentoPath=281969.pdf)

77 [http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=281980&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20\(SMP\)%20do%20Grupo%20Oi&caminhoRel=null&filtro=1&documentoPath=281980.pdf](http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=281980&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20(SMP)%20do%20Grupo%20Oi&caminhoRel=null&filtro=1&documentoPath=281980.pdf)

78 [http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=281964&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20\(SMP\)%20da%20Tim%20Celular%20S/A%20&caminhoRel=null&filtro=1&documentoPath=281964.pdf](http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=281964&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20(SMP)%20da%20Tim%20Celular%20S/A%20&caminhoRel=null&filtro=1&documentoPath=281964.pdf)

79 [http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=283762&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20\(SMP\)%20da%20Vivo%20S/A&caminhoRel=null&filtro=1&documentoPath=283762.pdf](http://www.anatel.gov.br/Portal/verificaDocumentos/documento.asp?numeroPublicacao=283762&assuntoPublicacao=Plano%20Nacional%20de%20Acao%20de%20Melhoria%20da%20Prestacao%20do%20Servico%20Movel%20Pessoal%20(SMP)%20da%20Vivo%20S/A&caminhoRel=null&filtro=1&documentoPath=283762.pdf)



4 Regulation of the Brazilian mobile sector

This section discusses the main taxation and regulatory issues that characterise the Brazilian mobile telecommunications sector.

Despite being a highly competitive sector, and despite the economic and social benefits it delivers, the Brazilian mobile sector is strictly regulated and one of the most taxed worldwide.

ICMS on usage alone forces mobile consumers to pay almost 0.3 Real in tax for every Real spent on a phone call

4.1 Taxation on mobile consumers and operators is one of the highest worldwide

Mobile specific taxation applies in Brazil to both consumers and operators and taxation of mobile services in Brazil impacts consumer spend on mobile telephony more severely than other goods or services as well as companies' profits and revenues.⁸⁰

Consumer taxation in Brazil affects both the handsets and usage cost components of mobile consumers' spend.

Table 6: Mobile-specific taxation on consumers, 2011

| | | |
|----------------------|---------------------------|------------|
| Calls SMS Data | VAT (ICMS) | 27% |
| Handsets | VAT (ICMS) Import duty | 17% 20% |
| SIM cards | VAT (ICMS) | 18% |

Source: Mobile operators' data

ICMS⁸¹ on usage alone forces mobile consumers to pay almost 0.3 Real in tax for every Real spent on a phone call. Overall, the combination of operator and Teleco has reported that consumer taxation can raise tax on consumers to 43% of the total phone bill.⁸²

As states are free to set the ICMS, the rate applicable to calls, SMS and data varies from 25% to 35%. On average the ICMS rate applicable to mobile telephony is 27%, considerably higher than the standard ICMS usually levied by Brazilian states on other goods services, which averages 17%. As such, mobile communications are discriminated against by the government, and the differential taxation rate, an average 10% extra tax compared to other services, can be interpreted as mobile-specific taxation, a "luxury" contribution imposed on mobile consumers.

This risks deterring consumption: targeting mobile usage with a higher-than-normal ICMS provides negative incentives to customers, as governments often impose special taxes on goods for which they wish to discourage consumption, for instance tobacco or alcohol. In fact, there is widespread evidence of the benefits of mobile to consumers and to the wider economy. These taxes raise the costs of mobile for consumers, in particular hitting poorer sectors of the population, people who could derive the most social and economic gains from being connected.

Taxation on handsets in Brazil differs depending on whether the handsets are imported or locally assembled. The majority of handsets sold in Brazil are currently assembled locally by international handset manufacturers. These producers are subject to a 20% IPI⁸³ on imported components and to an 18% ICMS, but not to PIS and COFINS.⁸⁴ This tax break represents a positive development and can contribute to extending the availability of handsets.

Mobile operators are also subject to heavy taxation on both their profits and revenues, as shown in the table below.

⁸⁰ A more in-depth analysis of taxation on mobile telephony in Brazil will be presented in the forthcoming GSMA/Deloitte paper entitled "Mobile telephony and taxation in Latin America"

⁸¹ Imposto sobre a Circulação de Mercadorias e Serviços de Transporte Interestadual e comunicação.

⁸² http://www.teleco.com.br/en/en_tributos.asp

⁸³ Imposto Sobre Produtos Industrializados, Brazil's excise tax

⁸⁴ PIS and COFINS are taxes paid by operators that impact consumers prices, as described in detail below.

Table 7: Taxation on mobile operators, 2011

| | | |
|-------------------|--|--|
| Taxes on profits | Corporation tax | 34% on profits |
| Taxes on revenues | PIS ⁸⁵ /COFINS ⁸⁶ | 3.65% on revenues from calls, SMS and data, 9.25% on revenues from SIM cards and handsets |
| | Universal service fund contributions: FUST and FUNTTEL | 1% and 0.5% of revenues from calls, SMS and data |
| | Spectrum licence fee | Every two years, after the expiry of the first license, mobile operators pay 2% of the net revenues from the previous year |
| Other | FISTEL clients | BRL 26.8 for each new subscriber; in addition to BRL 13.4 for each customer from the previous year |
| | FISTEL equipment | BRL 1,500 for each new BTS equipment installed; BRL 750 for each existing base stations |

Source: Mobile operators' data

Taxation has been labelled as 'irrational' by the Brazilian Communication Minister, as taxes are often levied more than once on the same service

As can be seen from Table 7, operators are subject to a host of complex taxes that affect profits but are also levied on revenues and are dependent upon the number of customers each operator gains and the number of sites they install.

Taxation levied on revenues is atypical in more developed markets and creates a number of inefficiencies for consumers. In particular, by directly reducing EBITDA of a company, taxes on revenue impact directly a company's profitability. In addition, taxes levied on the number of sites contribute to raise the cost of each site and risk reducing incentives to invest. Ultimately, these taxes heavily impact the operators' costs per user. The FISTEL client tax in particular considerably raises operators' cost for each prepaid user, and creates a relevant burden as 80% of mobile connections in Brazil are prepaid. Nevertheless, the FISTEL client tax requires operators to pay the same fixed amount for each of their clients, independently of the traffic revenue generated by the customer.

In addition to raising service costs, this uncoordinated set of taxations and regulations at both national and local level raises uncertainty for mobile operators with potential negative consequences on network investments.

Tax pressure on the telecom sector has recently been criticised by the Brazilian Minister of Communications in a recent interview.⁸⁷ According to the Minister, taxation is "irrational" as taxes are often levied more than once on the same service and are currently limiting the expansion of the sector in Brazil. In fact, in countries such as Brazil where consumer taxation on mobile telephony is notably high, reducing taxation has the potential to provide numerous positive effects, including to government revenues, as the growth in service consumption that results from the reduction of a particularly high tax generates tax revenues that can compensate the initial loss. For example, a reduction in the ICMS rate on calls and data could act to raise the level of mobile usage in Brazil to levels more similar to other Latin American countries. For instance, in Ecuador and Uruguay (which exhibit higher usage per subscriber than Brazil), usage increased notably when government reduced mobile specific taxation. An increased tax base on usage would also be coupled with increased economic activity. A well-documented positive relationship exists between increases in mobile penetration and mobile usage and GDP growth rates, due to the beneficial effects on the economy and on its productivity as discussed earlier in this study.⁸⁸ As such, a combination of positive direct and indirect effects can arise as a result of tax reductions.

Reducing mobile specific taxation may prove tax neutral for the government in the medium term as taxation reductions may increase total usage and stimulate economic activity, triggering further tax revenues for the government

85 Programa de Integração Social

86 Contribuição sobre a Remuneração dos Empregados e Contribuintes Individuais.

87 <http://www.estadao.com.br/noticias/impreso,o-custo-das-telecomunicacoes,-877722,0.htm>.

88 See, for example, the Deloitte/GSMA paper "What is the impact of mobile telephony on economic growth?", September 2012.



High taxation is also inhibiting service development, as services that can be offered using mobile telephony as a support platform would end up attracting additional mobile specific taxes and specific regulations (e.g. customer service requirements) affecting mobile telephony. This increases the burden for local businesses, risks reducing opportunities to develop new commercial propositions, and according to operators is proving a burden to growth in M2M services, which can have positive impacts on productivity and the economy. The recent proposed legislation change that suspends two taxes on these services is a positive step for industry (e.g., FISTEL client tax will drop by approximately 80%).⁸⁹ More legislation along these lines could contribute to releasing further benefits for consumers and the economy.

As the Communications Minister recently indicated, a reduction of this pressure would double the current rate of market growth.⁹⁰ The potential benefits of relieving this taxation are therefore substantial, as tax reductions and rationalisation could drive further consumption (the average mobile user in Brazil consumes around 40% fewer minutes than its Mexican peer) and investment in productivity-enhancing commercial services. Taxation reductions could also contribute to widen access to mobile services and increase digitalisation and social inclusion, thus meeting one of the key objectives of the National Broadband Plan.

Strict coverage and quality of service obligations combine with uncoordinated regulations at federal and local level

4.2 The telecommunications sector is strictly regulated

Competition in the telecoms sector was introduced in Brazil in 1995. In 1997, the General Telecommunications Law (LGT) introduced a structured regulatory framework for the competitive telecommunication sector.

Based on two fundamental principles, universal coverage and competition, this legislation brought fundamental changes to the telecommunications industry in Brazil. The universal coverage principle aims to provide access to telecommunications services to all citizens, regardless of location or economic condition.⁹¹ The main goal of the competition principle is to overcome monopolistic situations in the market by building and maintaining a competitive environment for market participants and encouraging new market entrants. To achieve its main goals of universal coverage and protection of competition, the LGT also established a regulatory agency for telecommunications services, Anatel.

Brazilian operators are subject to stringent regulation, in particular relating to coverage obligations and quality of service provisions. In addition, certain licenses require operators to run a retail store in every serviced area that has more than 100,000 inhabitants, further increasing operators' costs. These significant obligations, as well as Anatel's recent interventions on operators' investment plans, may have contributed to the perception that regulation is affecting business confidence in the sector.

The most urgent issue that operators are now facing is the host of uncoordinated and complex federal and local regulations that affect network deployment and site and antenna installation. This has recently caused network congestion and quality-of-service issues for operators, with repercussions on their licence obligations. Spectrum, subscriber security and roaming regulations are also discussed below.

⁸⁹ Anatel

⁹⁰ <http://www.estadao.com.br/noticias/impresso,o-custo-das-telecomunicacoes-,877722,0.htm>

⁹¹ Mobile services are not subject to universal service obligations in Brazil

4.2.1 Infrastructure regulations

The single biggest obstacle to network deployment identified by the mobile community is the multitude of uncoordinated regulations and limits on base stations and antenna installation.

A complex web of permissions from local and federal authorities, often with long approval times may mean that, when investment is signed off from an operator, it may take well over a year for a site to be made operational.

In addition to planning approvals, regulations on frequency limits for electromagnetic waves can also be extremely costly for mobile operators. By affecting the power at which each base station can operate, these provisions affect network coverage and quality of service. Operators have reported that frequency regulations in Brazil are also particularly complex⁹² and uncoordinated between a number of national and local government bodies: since each local authority has the flexibility to determine their own policies, there are more than 250 different antenna policies in Brazil.

These multiple legislations⁹³ are often contradictory and are supervised by different organisations, making compliance from mobile operators increasingly complex and uncertain, and leading to issues with quality of service.

As traffic is growing exponentially, long approval times that delay site installation mean that network deployment cannot keep up with market demand. Where this happens the existing base stations may face increasing congestion, potentially leading to a deterioration of service quality. This has created issues with Anatel recently and has led to a review of operators' investment plans.

MNOs have been advocating the implementation of a single national installation law⁹⁴ to reduce uncertainty and complexity and foster investment. Positive developments have been witnessed recently, as new comprehensive environmental legislation is being discussed in relation to urban, environmental and health regulations associated to antenna installation, including infrastructure sharing⁹⁵ ("the Antenna Law"). If approved, this legislation will centralise regulations and add coordination to relieve the existing complexity, increasing network congestion in existing base stations.

In parallel, as a result of recent delays in network deployment for the World Cup,⁹⁶ the Brazilian minister of Communications (MiniCom) is running a series of initiatives to coordinate telecom infrastructure regulations across municipalities, focussing in particular on the four main World Cup cities (Sao Paulo, Rio de Janeiro, Porto Alegre and Belo Horizonte), where approval processes can take more than 10 months to approve.

Federal and local frequency regulations are creating further obstacles to site deployment

Traffic has been increasing more quickly than the local authorities' site installation approval times. As base station installation is delayed, potential network congestion and quality of service issues may arise

An updated and uniform legislation could add regulatory certainty to investors and contribute to accelerate investment

⁹² Law N° 11.934 of 2009 and Resolution N° 303 of 2002 published by Anatel, and revised after the Law n° 11.934, which regulates the limits of the occupational and general population exposure to electric, magnetic and electromagnetic fields in the radiofrequency band between 9kHz and 300 GHz

⁹³ Operadoras voltam a cobrar lei nacional para instalação de antenas. <http://computer-world.uol.com.br/telecom/2012/08/03/operadoras-voltam-a-cobrar-lei-nacional-para-instalacao-de-antenas/>

⁹⁴ Operadoras voltam a cobrar lei nacional para instalação de antenas. <http://computer-world.uol.com.br/telecom/2012/08/03/operadoras-voltam-a-cobrar-lei-nacional-para-instalacao-de-antenas/>

⁹⁵ Project of Law N° 293 of 2012

⁹⁶ Project of Law N° 293 of 2012

Operators have invested nearly BRL 3 billion in the recent auction for this spectrum

In addition, regulations on infrastructure sharing are also inefficient. Infrastructure sharing represents an important opportunity for operators and consumers to benefit from investment undertaken by one of the operators. Allowing infrastructure sharing could be key to the next wave of network investment by operators, in particular as the growing demand for broadband and the need to provide capacity in advance of the World Cup and Olympic Games will require an increasing number of base stations to be added quickly. However, infrastructure sharing should not be overly regulated and access should not be mandated, as the threat of access obligations would risk reducing incentives for investment.

Mobile operators are concerned that the regulations surrounding infrastructure sharing in Brazil are outdated and complex, as highlighted below.

- The telecom sector general competition framework (Plano Geral de Metas de Competição), which is currently under consultation by Anatel, determines competition provisions among the service providers.⁹⁷
- Non-mandated sharing between mobile operators is subject to certain provisions determined by Anatel,⁹⁸ which are currently being reviewed.
- Infrastructure sharing between energy, telecommunication and petroleum providers is subject to specific regulations.⁹⁹

In consideration of the significant investment and network roll out that will take place to update 3G and 4G networks, an updated and uniform legislation could add regulatory certainty to investors and accelerate investment.

4.2.2 Spectrum

As discussed in Section 3, spectrum availability will be a key enabler for the success of mobile broadband in the medium term.

In Brazil, the total spectrum utilised by mobile operators is approximately 500MHz, in particular following the recent 2.5GHz and 450MHz auction.

While this is more than typically available in other Latin American countries, a study carried out by the International Telecommunication Union (ITU)¹⁰⁰ estimates that in 2015, mobile telecommunications services will need over 1GHz of spectrum to meet market demands. Following the ITU recommendation, Anatel launched in 2009 a public consultation in order to define 140MHz of additional spectrum to MNOs in the 2.5GHz band (2500MHz to 2690MHz), which was auctioned in June 2012. Dedicated to mobile data, this additional bandwidth will be crucial for mobile data transmission and the availability of LTE at both the 2014 World Cup and the 2016 Olympic Games in high-demand urban areas.

However, the 2.5GHz band's technical properties are such that it can be used to increase capacity in dense urban areas, but is not suitable to provide coverage for mobile broadband nationwide. As such, in the medium term, more suitable spectrum needs to be made available to ensure that mobile broadband can be successfully provided. The 700MHz band, known as the Digital Dividend, has ideal properties for mobile broadband coverage and combines effectively with the 2.5GHz band for seamless availability of 4G services. The recent 2.5GHz auction and an analysis of the key economic benefits that allocating the Digital Dividend to mobile service would generate are discussed below.

⁹⁷ Anatel aprova consulta pública sobre o Plano Geral de Metas de Competição. <http://www.anatel.gov.br/Portal/exibirPortalNoticias.do?acao=carregaNoticia&codigo=23195>

⁹⁸ Regulation Nº 274 of 2001

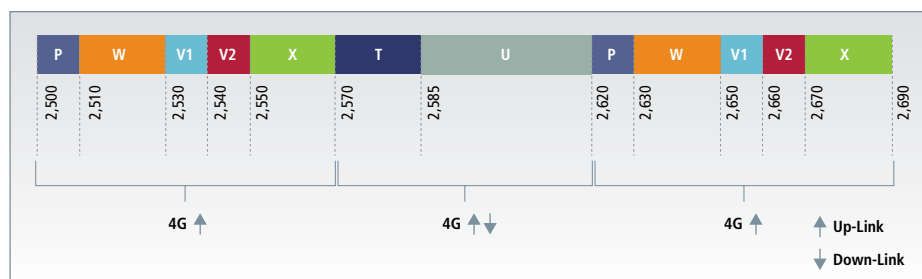
⁹⁹ Joint Regulation Nº 001 of 1999 and Nº 002 of 2001

¹⁰⁰ UMTS Forum Report #40 (2006): "Development of spectrum requirement forecasts for IMT-2000 and systems beyond IMT-2000 (IMT-Advanced)."

The recent 4G auctions

On 5 June 2012, Anatel held an auction of 4G frequency in the 2.5GHz band, consisting of four national lots for the sub-bands W, X, V1 and V2; and lots for mobile local areas for the frequencies available in the sub bands U+T and P.

Figure 56: 4G frequency lots



Source: Teleco, 2012

Spectrum in the 2.5GHz band will not be sufficient in the medium term to provide mobile broadband nationwide

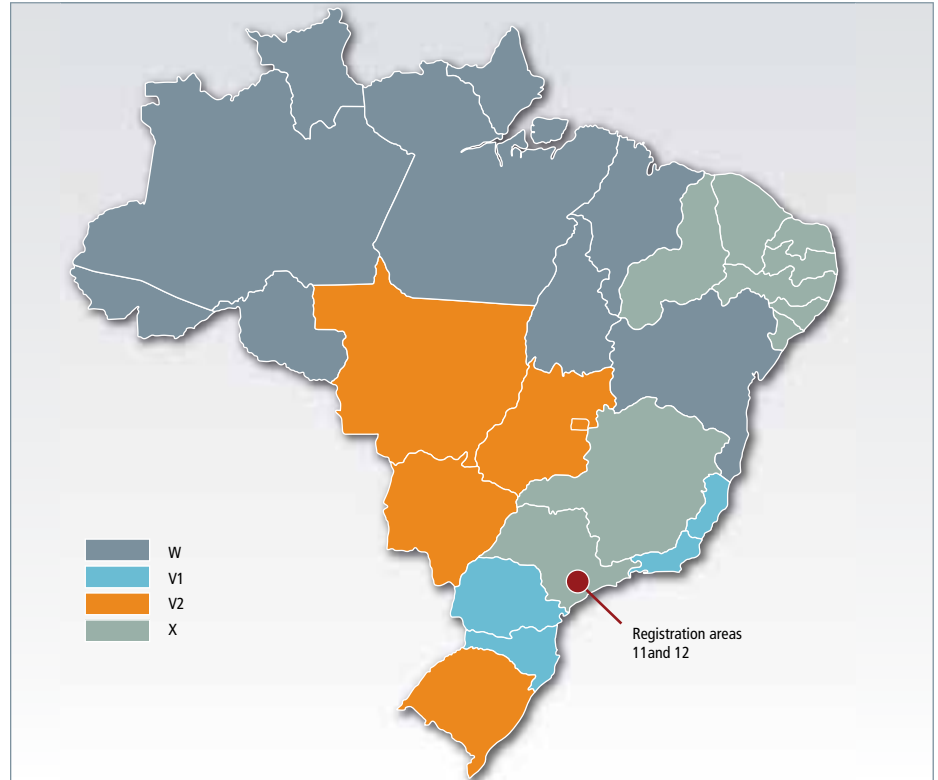
Table 8: 2.5GHz auction results

| Provider | Payment (BRL m) | Acquired frequencies |
|--------------|-----------------|--|
| Vivo | 1,050 | X Band (20+20 MHz) nationwide |
| Claro | 988.8 | W Band (20+20 MHz) nationwide 19 lots of P band |
| TIM | 382.2 | V1 Band (10+10 MHz) nationwide lots of P band |
| Oi | 399.8 | V2 Band (10+10 MHz) nationwide 11 lots of P band |
| Sky | 90.5 | 12 lots of U band |
| Sunrise | 19.0 | 2 lots of U band |
| Total | 2,930 | |

Source: Teleco, 2012

The band 450–470MHz was offered along with nationwide lots in the 2.5GHz bands. The area divisions for this service are illustrated below.



Figure 57: 450MHz area division

Source: Teleco, 2012

According to the auction rules, the first lot offered was in the 450MHz band, to provide mobile telephony services in rural areas. As no offer was presented for this lot, the four companies that bought the national lots are now obligated to invest in rural areas. The division of the 450MHz band was as follows:

- Lot W, acquired by Claro: investments in Maranhão, Bahia, Greater São Paulo and in all North regions. This region exhibits many natural barriers and many isolated cities, thus requiring a significant investment effort.
- Lot X, acquired by Vivo: this covers rural areas around São Paulo, Minas Gerais, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Sergipe e Alagoas, as well as a number of less developed areas.
- Lot V1, acquired by TIM: investments in areas including Santa Catarina, Paraná, Rio de Janeiro and Espírito Santo.
- Lot V2, acquired by Oi: investments in Rio Grande do Sul, Mato Grosso, Mato Grosso do Sul, Goiás and Brasília.

In addition to these substantial investments, the coverage commitments relating to the 2.5GHz band are summarised below.

Table 9: 2.5GHz coverage obligations

| Term | Coverage |
|---------------|---|
| April 2013 | All the host cities of 2013 Confederation Cup. |
| December 2013 | All the host cities and sub-host cities of 2014 World Cup. |
| May 2014 | All the capitals and municipalities with more than 500 thousand habitants. |
| December 2015 | All the municipalities with more than 200 thousand habitants. |
| December 2016 | All the municipalities with more than 100 thousand habitants. |
| December 2017 | All the municipalities with the numbers of habitants between 30 thousand and 100 thousand.* |

*There will be at least 1 operator in the 2.5GHz band in all municipalities and technological conditions equivalent to 3G will be offered.
 Source: Teleco, 2012

Operators invested significantly in these bands, and overall the government achieved revenues of BRL 2.9 billion (US\$ 1.4 billion) from the auction.

The 700MHz band

As noted above, the 700MHz band would in the medium term complement the 2.5GHz band to provide nationwide coverage for mobile broadband.

The 700MHz frequency range is currently used by television broadcasters, but it can be made available following the switchover of analogue television in 2016. Anatel is conducting a study, planned to be concluded by mid-2013, to inform a decision around whether to make this frequency available to telecommunication providers or television broadcasters.

The GSMA and TAS have recently undertaken a detailed study¹⁰¹ on the incremental benefits of allocating the 700MHz band for mobile services as opposed to broadcasting services in Latin America. Allocating the 700MHz band for mobile would provide a higher number of benefits to the Brazilian economy and society than if the band were allocated to broadcasting as a result of a number of key factors.

The key technical benefits identified in the study include the provisioning of increased capacity to wireless services in order to meet the growth of data traffic, while increasing broadband coverage. Given the propagation characteristics of signals in the 700MHz band, allocating this spectrum to mobile broadband will facilitate broadband service in rural areas of Brazil, with the resulting positive social impact. Indoor signal reception in urban areas will also be improved.

The additional economic contribution of allocating the band to mobile as opposed to broadcasting to the ICT ecosystem and the public economic benefit has also been found to be substantial. These contributions include the additional network investment (network equipment, construction industry, information systems, etc.) taking place to increase broadband coverage, benefitting players in the wider mobile ecosystem. Significant savings would also be generated if additional broadband coverage in unserved areas were to be achieved through the use of the 700MHz band, which has a better signal propagation. This is a key benefit as the utilization of the 700MHz band allows the increase of speed of deployment of broadband services: if this band were not available for mobile broadband services, the deployment of 4G technology would have to be achieved using higher spectrum bands (1800MHz, 1900/2100MHz, 2500MHz), which will require a larger number of radio base stations. Conversely, a smaller number of sites would also result in lower operations and maintenance expenses. Finally, a smaller number of sites would reduce the level of potential conflict due to the location of towers and antennas. Potential benefits would also accrue to the public treasury as a result of the licensing of spectrum to private sector firms, while the positive effects of the network savings would contribute to falling retail pricing, which would benefit consumers.



The 700MHz band has ideal technical properties to provide LTE services nationwide

The 700MHz band, as it is harmonised internationally, allows significant scale economies on equipment and terminals

101 GSMA/AHCIET, "Beneficios Economicos del Dividendo Digital para America Latina", 2011



Allocating the 700MHz band to mobile instead of broadcasting would provide an additional direct and indirect contribution to GDP of US\$ 5.3 billion, would generate an extra 4,300 job opportunities and may lead to extra revenue for the government of US\$ 1.3 billion

In addition, a number of social and economic impacts are realised if the 700MHz band is allocated to mobile. A significant direct contribution to GDP would arise as a result of the offer of additional goods and services enabled by the 700MHz spectrum, as well as the spillover effects and positive externalities generated in other sectors of the economy. This would lead to further direct and indirect employment generated as a result of these services to additional taxes.

The expansion of wireless broadband to unserved zones will allow the population currently without coverage to gain access to increased educational resources, improved health services, and better financial services. Wireless in rural areas will enable the efficient provision of public services at a greater speed of access, improving the interrelationship between civil society and governments. Allocating the 700MHz band to mobile telephony would therefore contribute to broadband expansion in Brazil and to service coverage enlargement, especially outside of major urban centres. Additionally an improvement in the quality of service would follow, driven by the increased frequencies availability for 4G.¹⁰²

The study finds that, if the 700MHz was allocated to mobile services in Brazil:

- Broadband coverage resulting from increased availability of mobile broadband would increase to 95%.¹⁰³
- More optimal deployment and operation of new networks would result in a reduction of capital investment of US\$ 1.6 billion compared to deployment of infrastructure in higher frequency bands, while achieving better coverage.¹⁰⁴
- The additional net contribution to the ICT ecosystem (acquisition of spectrum, equipment, and services) would be in excess of US\$ 4 billion compared to the contribution generated by broadcasting.¹⁰⁵
- Direct (additional revenues to the industry) and indirect contribution (positive externalities) to GDP would exceed the contribution generated by broadcasting by US\$ 5.3 billion.¹⁰⁶
- Over 4,300 extra jobs, compared to 1,200 if the band remained with broadcasters, would be created.¹⁰⁷
- The government would collect an extra US\$ 1.3 billion in tax¹⁰⁸ than if the band was allocated to broadcasting.
- The additional consumer surplus would amount to US\$ 2.3billion.¹⁰⁹

The use of the 700MHz band is therefore critical to both meet the growing Brazilian demand for broadband network and to generate further economic growth. If the 700MHz band were to be allocated to mobile operators to provide mobile broadband services, the country would follow a global trend of the allocation of this frequency for mobile services. Recently, the World Radiocommunication Conference in Geneva allocated this band to mobile services. If Brazil made a similar determination, operators and consumers could also enjoy the benefits from the economies of scale that the standardisation of both terminals and equipment for this band would deliver, thereby allowing operators to develop services in this band more quickly and at lower costs.

As such, the 700MHz Digital Dividend is key to the development of future mobile services, and would also allow the government to meet its universalisation and digitalisation targets, while expanding mobile broadband throughout the country.

102 Destinação da faixa de 700MHz para serviços móveis impulsionará a expansão da banda larga no Brasil <http://www.paineltelebrasil.com.br/noticias>

103 GSMA/AHCIET, "Benefícios Economicos del Dividendo Digital para America Latina", 2011, Figura C

104 Ibid. Table 6-13

105 Ibid. Tables 6-33, 7-21.

106 Ibid. Tables 6-33, 7-21

107 Ibid. Tables 6-33, 7-21

108 Ibid. Tables 6-33, 7-21

109 Ibid. Tables 6-33

4.2.3 Security regulations

Mobile operators are also affected by a number of strict obligations with regard to the security of SIM cards, which generate significant compliance costs for them. Two areas of regulation have emerged in the last few years:

- SIM fraud obligations. Operators in Brazil have an obligation¹¹⁰ to identify fraud in personal mobile service provision. MNOs participate in a fraud prevention programme, which imposes significant costs on them. While users are not charged in case of personal mobile service fraud, mobile operators are left with these costs and must ensure that the service is re-established in the same conditions previous to the fraud.
- SIM theft. To reduce theft of mobile phones and related crimes in Latin America, MNOs have joined local governments in an initiative that involves sharing the International Mobile Equipment Identity (IMEI) information of stolen mobile devices, with the objective of blocking SIM cards of stolen phones, making them difficult to sell and re-use. This programme creates additional, significant costs for operators and the complete implementation of this agreement is expected in March 2013.¹¹¹

Another area of potential regulation that is being considered by Anatel is that of location services. As this service is still developing, mobile operators are concerned about the threat of potential obligations imposed on them with regards to these services. Anatel is also considering obligations for mobile operators in relation to emergency calls, which operators regard as particularly burdening.

4.2.4 Roaming regulations

The expansion of the Brazilian economy and the rapid increase in per capita income have increased the number of incoming and outgoing mobile consumers travelling for business or leisure purposes. This makes roaming one of the most relevant regulatory issues.

As the Latin American mobile markets develop, the GSMA and mobile operators¹¹² have identified a number of structural and technical barriers that affect roaming:

- Double taxation (in the country of origin and destination) of roaming calls. Few agreements have been reached to prevent double taxation in Latin America, and some operators report that tax treaties in existence are operationally difficult to implement. According to the GSMA, double taxation remains on 72% of roaming routes in South America.
- Fraud. This remains a major financial concern for operators, despite increased eradication efforts. The GSMA has estimated that this is causing losses of up to 5% of total mobile revenues in Latin America and up to 25% can occur while users are roaming.
- Where international gateways¹¹³ are not liberalised, their costs make up a significant proportion of total roaming costs. Even with volume growth, operators are concerned that there is no bargaining power for operators working across monopolised gateways.

Legal and technical developments are required to remove double taxation, combat fraud and liberalise international gateways. Combating these barriers could take precedence over any implementation of roaming regulation, as these issues artificially inflate roaming charges in individual countries.

Removing double taxation, fraud and technical barrier could take precedence over any roaming regulations

110 Resolution N° 477, Personal Mobile Service Regulation, Anatel

111 Operadoras se unem para coibir roubo de celular na América Latina (18 July 2012). <http://www.telegestao.com.br/noticias/operadoras+se+unem+para+coibir+roubo+de+celular+na+america+latina>

112 International roaming explained – Latin America / GSMA (<http://www.gsma.com/latinamerica/mobile-roaming-latin-america/>)

113 International gateways are the facilities through which international calls are sent and received



Regulating on the roaming elements of the tariffs reduces operators' flexibility to tailor their services for the mass market. Regulating roaming may also be interpreted as a move away from successful liberalisation of telecommunications markets, which has promoted technological development and economic progress over the past two decades.

At this stage of market development in Brazil and with a number of key challenges ahead, roaming regulation risks reducing the positive contribution of the industry to the economy and to Brazilian consumers.

4.2.5 Other environmental obligations

In addition to regulations enacted by Anatel, MNOs are subject to policies from the Environment National Council (CONAMA). An important regulation¹¹⁴ that operators are subject to deals with mobile phone batteries and recycling, and operators have created a number of programmes to meet these obligations.

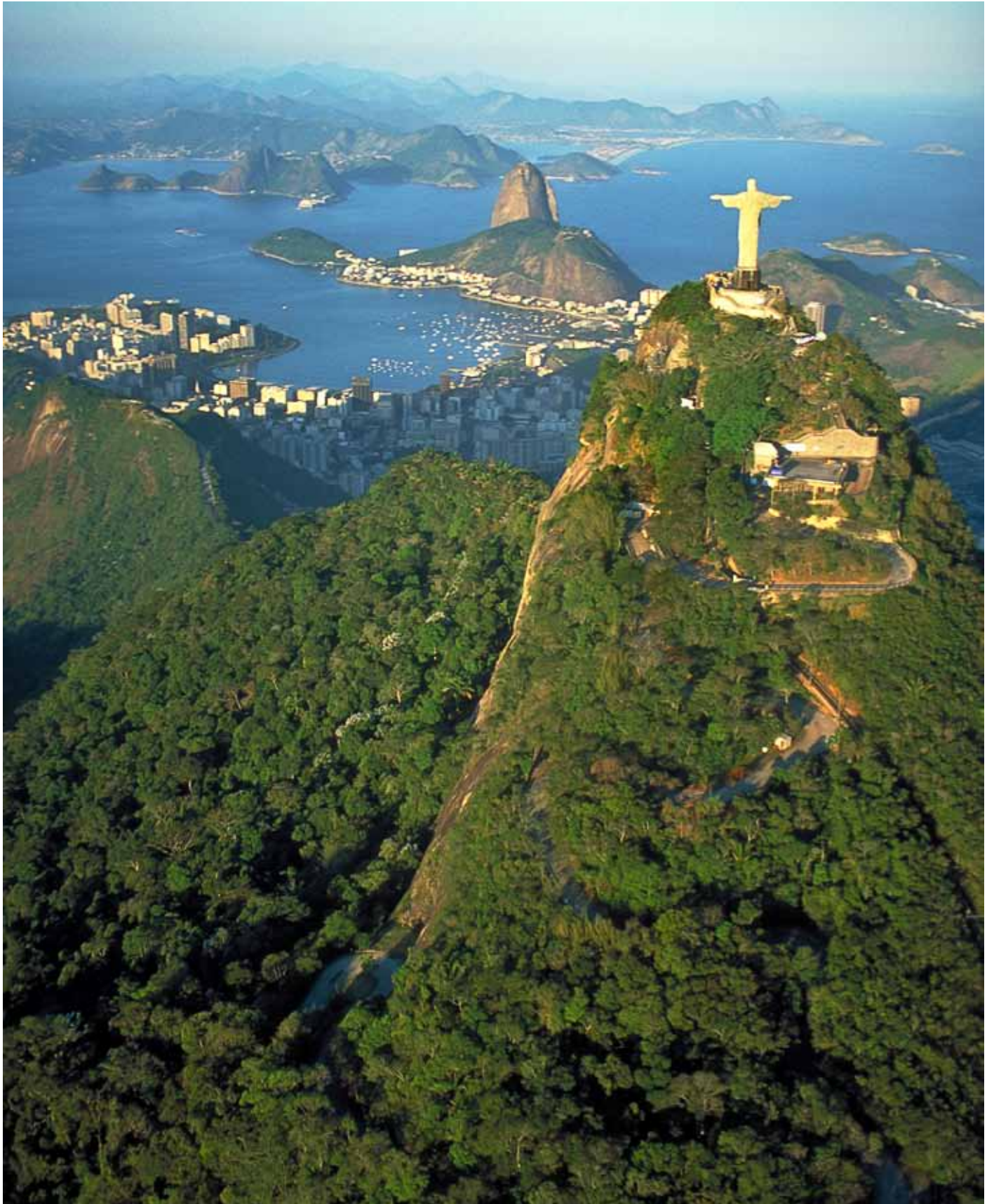
Table 10: MNOs' green initiatives

| Provider | Initiative name | Description |
|----------|--|---|
| Vivo | Recicle seu celular (Recycle your mobile phone) | Promotes the recycling and reverse logistics of mobile phones, accessories and batteries through collection at Vivo's Stores, authorized stores and Vivo's resellers. |
| Claro | Claro Recicla (Claro Recycles) | Launched in March 2008 it aims to contribute to the socio environmental awareness on the importance of disposing correctly of electronic wastage, especially mobile phones, batteries and accessories. ¹¹⁵ |
| TIM | Programa Recarregue o Planeta e Programa Papa-Pilhas (Recharge the Planet and Collect Batteries Programmes) | Both are focused on the collection of batteries, mobile phones and other accessories to guarantee proper disposal. |
| Oi | | Offers collecting baskets for mobile phones, batteries and accessories in their stores. |

Source: Mobile operators' data

¹¹⁴ Resolution N° 401 of 2008 published by it determines the maximum limits for Lead, Cadmium and Mercury for portable cells and batteries sold in national territory and the criteria and standards for its appropriate environmental management http://www.mma.gov.br/estruturas/a3p/_arquivos/36_06112008094848.pdf

¹¹⁵ Claro Recicla: <http://www.claro.com.br/porta/Artigo.do?method=showArtigo&channelId=6b89603541203110VgnVCM1000000a08150aRCRD&origem=Conheça+a+Claro&item=Claro+Recicla>



5 A roadmap for growth and social and digital inclusion

This section concludes the report by summarising the key areas of growth for mobile telephony and by presenting a set of suggestions that could promote such growth and drive the Brazilian economy and society into the next stage of development.

5.1 Three key areas for growth and regional leadership

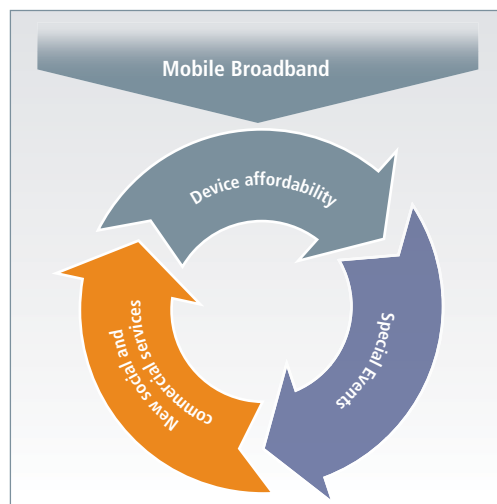
As set out above, the Brazilian mobile market is set for unprecedented growth in the near future as it increasingly extends its leadership in Latin America. By far the largest market in terms of connections and mobile broadband, commercial and social opportunities that will develop in Brazil over the next years will shape the industry in the region, contributing to its economic and social development.

As the market undergoes a set of significant changes, mobile broadband will establish a new standard that will transform economies and societies in Latin America. As operators are investing in spectrum and networks that can support mobile broadband, three key areas of revenue growth will support profitability and investment, in turn leading to more growth:

- Increased affordability of smartphones and tablets will extend the customer base, allowing most customers to use mobile broadband and the new social and commercial services associated with it.
- The special events occurring in Brazil in the next four years will increase demand for services and boost operators' revenues from two sources. Domestic demand will be boosted by a number of side events during the World Cup and the Olympics, in addition to demand to remain connected following these events. Visitors from countries all over the world, including the press, will substantially increase demand.
- New social and business services from mobile technologies will become increasingly popular. In particular, mPayments are expected to be available soon in retail points, transport facilities and for special events. As services develop on social platforms, local applications are developed and opportunities for revenue generation will also increase.

Brazil's leadership in mobile connectivity will face the challenge of an unprecedented demand increase

Figure 58: Interdependent sources of growth in the mobile market



Each of these opportunities will be driven largely by market forces and consumer demand. As standards and habits develop in Brazil, these are likely to extend across to other countries in the region. What happens in Brazil will influence the whole of Latin America, with opportunities for the Brazilian economy and for players in the local mobile ecosystem to strengthen their position as regional leaders.

5.2 Existing barriers to growth can be removed by supportive policies

Governments and regulators see mobile telephony as an opportunity for social and digital inclusion, and realise that mobile telephony is a key enabler for the whole economy, especially as special events and new social and commercial services increase consumers' willingness for connectivity and create opportunities for growth.

For these growth opportunities to materialise, the government and regulator need to ensure that hurdles for mobile operators and mobile consumers are minimised. Today, there are three obstacles that may act as barriers to growth in Brazil:

- On the demand side, mobile-specific consumer and operator taxes contribute to increased service costs. This creates a barrier to consumption of basic mobile and mobile broadband services, particularly for poorer segments of the population.
- On the supply side, a complex and unpredictable regulatory framework may be holding back investment and site deployment, and development of new services. In particular, lack of coordination between federal and local agencies adds complexity and delays for network roll-out, potentially affecting quality of service.
- In the medium term, industry growth depends on further spectrum availability. Spectrum constraints may act as a barrier to the development of mobile broadband, as lack of spectrum requires operators to incur extra network costs to extend service coverage.
- Finally, regulatory complexity and uncertainty in the country may contribute make additional investment unattractive.

Governments and regulators could see mobile telephony as an opportunity for social and digital inclusion, and realise that mobile telephony is a key enabler for the whole economy

Below is a set of suggestions on how these barriers could be reduced.

5.2.1 Reducing inefficient taxation to increase access and usage

Currently, taxation on mobile operators and consumers is highly inefficient, largely as a result of double taxation procedures affecting both consumers and operators. One of the highest levels worldwide, taxation of the mobile sector in Brazil contributes significantly to the cost of mobile ownership for consumers, affecting those on lower incomes the most — those who stand to benefit the most from access to mobile telephony and mobile broadband.

Reductions in taxation can act to decrease service prices and extend mobile services to small business and local entrepreneurs

To ensure that taxation does not become an obstacle to further growth and universal access to new broadband services, targeted tax reductions could be considered. Positive changes to taxation have occurred recently, especially in relation to M2M services, which could be applied similarly to consumer and operator taxes. For example, easing ICMS on consumer services and reducing corporate taxation directly levied on revenues could promote increases in access and usage from consumers across all social and income levels.

Crucially for the government, reducing taxation in a country such as Brazil could prove tax-neutral for the government's revenues in the medium term. Where taxes are unusually high, tax reductions may substantially increase penetration and usage, as recently witnessed in countries such as Uruguay and Ecuador. This may increase the tax base for the government, and, as connectivity expands, a "multiplier" effect occurs whereby more users will consume more services, including the new social and commercial opportunities that mobile broadband provides, generating further revenues for government.

As such, supportive taxation policies could contribute, by extending penetration and usage and by promoting new services, to increase access, social and digital inclusion and government revenues.

Efforts to approve site deployment could be prioritised

5.2.2 Simplification of regulation and approval times for site deployment

Approvals for site and antenna deployment have been identified as the single biggest obstacle to investment by the mobile community. As capacity increases are urgently required, especially in the 12 World Cup cities, complex and uncoordinated federal and local regulations and approval processes on site deployment could be simplified.

Positive steps have recently been made in relation to the Antenna Law and to MiniCom's efforts to facilitate approval process in four key World Cup cities. As these constraints remain severe and pose a threat to the success of the World Cup events, priority could be given to the approval of this new homogenous and coordinated legislation

In general, coordination between local and national bodies could also be improved to avoid double regulations at both local and national level. This is important also in relation to taxation.

In the medium term, the 700MHz band will enable growth for the mobile sector and the Brazilian society

5.2.3 Allocating the 700MHz Digital Dividend to mobile services in the medium term

Spectrum will become an even more vital input to the success of the industry and to the success of the governments' digital and social inclusion programmes. It is therefore important for investment certainty and for sector growth that the government sets out a clear and efficient view on the future spectrum allocation for the mobile industry:

- Access to the right frequency bands is required: the government recently undertook the auction of the first 4G frequency. Allocating the 700MHz band in the medium term to mobile in line with recent international decisions would contribute to sector growth. Scale economies would also materialise, benefitting consumers through more affordable terminals as well as operators through cheaper equipment, which would in turn drive further investment.
- Access to sufficient bandwidth is also needed: the strain on demand posed by Brazil's economic growth will require in the medium term an increasing amount of spectrum for mobile services. Governments in the USA and Europe are already working to make an extra 500MHz of spectrum (in addition to the Digital Dividend) available to operators, and Brazil could follow closely to extend its leadership in the connected economy.
- Spectrum award procedures must be efficient and transparent: an efficient, fair and transparent award design contributes to a successful outcome for consumers.
- Coverage obligations must be reasonable and should be framed in the context of the increasing sector competition.
- Spectrum prices could be considered with a view to promoting service demand. High spectrum prices deter investment, and, when coupled with onerous coverage obligations, risk reducing the benefits to the economy and consumers.

5.2.4 Implementing a transparent, predictable and supportive regulatory regime

Mobile broadband requires significant investment from operators to acquire spectrum and upgrade and extend their existing networks. To make the best use of LTE technology, new high specification equipment must be installed, especially in the light of the expected boom in demand. However, as a result of the economic crisis, investment funding has been harder to obtain, and a key factor that global investors consider when deciding to invest in telecoms is whether a modern, transparent and predictable regulatory regime is in place.

Brazil shows one of the heaviest regulation regimes on mobile operators worldwide, with a number of intrusive regulatory specifications ranging from detailed coverage obligations to obligations on retail policies. Operators are also concerned that a number of jurisdictions impose double regulations and that the overall impact of different obligations is not considered as a whole. In addition, recent determinations on quality of service and levels of investment may have further contributed to increase the perception of a risky investment environment.

To ensure investment in the sector continues and foreign investment is attracted, increased transparency and certainty in regulatory frameworks could be considered:

- Competition policy should take precedence over regulation. Where competition is healthy, regulation should be kept to a minimum and only address those circumstances where market competition has not delivered a beneficial outcome.
- Consultation. All regulatory decisions should be adopted through a transparent and consultative process, allowing stakeholders an equal opportunity to provide feedback in a transparent way.
- Application of 'economic benefit' principle. Regulatory policies should be based on the 'economic benefit' principle, whereby costs and benefits of a proposal are estimated transparently for all affected parties, and a decision to regulate is made only where benefits to the society as a whole outweigh costs.
- Time horizon. Regulatory decisions should take a long-term view of the market and last for a sufficiently long time. This would allow operators and investors to plan investment and returns more efficiently.

Regulatory certainty can stimulate further investment and accelerate the pace of 4G availability

5.3 A collaborative approach between government and operators can maximise the benefits from growth

The mobile industry in Brazil is an enabler of economic and social development. Affordable mobile broadband will bring immense advantages to Brazilians of all income and education levels, and a host of new services in all economic areas, from transport, banking, commercial transactions, to health and education, will lead to a wave of transformation in the way in which Brazilians communicate and live their lives. Brazil faces a number of economic and social challenges in the next years, including the successful delivery of the World Cup and Olympic Games.

By working in partnership, mobile operators and the government can continue the remarkable success story of this industry, extend its unique benefits across Brazil and boost Brazil's international image.

A number of important policy developments have occurred recently. The proposed Antenna Law is an important step to unblock site deployment, while the recent proposed reductions in taxation for M2M services and the recent 4G auction have moved the sector forward. In parallel, operators have increased national coverage and extended 3G networks to a sizeable amount of the population, and have invested in numerous social solutions (e.g., mHealth, mLearning) and commercial propositions.

Continuing along this path, governments and regulators could consider easing existing taxation and regulation policies to release the full potential of this industry, while continued investment from operators will soon bring mobile broadband to all mobile customers in Brazil.

By working in partnership, the mobile operators and the government can continue the remarkable success story of this industry, extend its unique benefits across Brazil and boost Brazil's international image

Appendix A Mobile operators in Brazil

The section below provides a summary of each operator.

5.3.1 Claro

| | |
|-----------------------------|--|
| Foundation: | 2003 |
| Headquarters: | São Paulo, SP - Brazil |
| EBITDA: | BRL 7.9 Billion |
| Products: | Mobile and landline operator, Broadband internet and cable TV. |
| Mobile Technologies: | 2G (TDMA, GSM-GPRS/EDGE), 3G (WCDMA/HSDPA/HSPA+), Push to talk |



Claro is a mobile operator that operates in 19 countries in Latin America, including Brazil. It is controlled by the Mexican company América Móvil, one of the five largest mobile telephony groups in the world, with over 172 million customers worldwide.

Claro operates nationally across all states and the Distrito Federal. The carrier is present in over 2,700 cities, with infrastructure and digital coverage with GSM technology. The operator has roaming agreement for voice services in over 160 countries and more than 130 for data traffic across five continents.¹¹⁶

Claro offers data services through its GSM network using GPRS / EDGE technology. Claro began operating its 3G network (WCDMA) in 2007. In Q2 2012 the operator had 3G coverage in over 945 cities.

Claro added 8.7 million customers throughout 2011 and ended the year with 60 million mobile telephony customers.¹¹⁷

5.3.2 Nextel

| | |
|-----------------------------|------------------------------------|
| Foundation: | 1997 |
| Headquarters: | São Paulo, SP - Brazil |
| EBITDA: | US\$ 988 million (2011) |
| Products: | Mobile operator, data transmission |
| Mobile Technologies: | IDEN |



Nextel is part of NII Holdings Inc., founded in the United States of America, with operations in Latin American countries such as Argentina, Chile, Mexico and Brazil. In Brazil, its operation started in 1997 with an investment of BRL 3 billion.¹¹⁸

Nextel in Brazil is present in 356 municipalities in the states of São Paulo, Rio de Janeiro, Minas Gerais, Paraná, Santa Catarina, Rio Grande do Sul, Goiás, Bahia, Ceará, Pernambuco, Espírito Santo e Brasília.¹¹⁹

5.3.3 Oi

| | |
|-----------------------------|---|
| Foundation: | 1998 |
| Headquarters: | Rio de Janeiro, RJ – Brazil |
| Market Value: | US\$ 8.5 billion (July 2012) |
| EBITDA: | BRL 8.8 billion (2011) |
| Products: | Mobile and wire line operator, data transmission services (broadband internet) and pay TV |
| Mobile Technologies: | 2G (GSM/GPRS/EDGE); 3G (3G WCDMA/HSPA and HSPA+); 4G (LTE) |



Oi is the largest fixed telephony company in South America based on the total number of lines in service. Oi added 5.7 million customers throughout 2011 and ended the year with 69.7 million customers, of which 45.5 million were mobile. Oi covers 5,565 cities across Brazil, including all state capitals and the Federal District.

In December 2009 Anatel authorized Oi to purchase Brazil Telecom for BRL 5.86 billion. Currently the company is controlled by Telemar Participações S/A.

¹¹⁶ Intellinet

¹¹⁷ Wireless Intelligence

¹¹⁸ Sobre a Nextel, Nextel (2012). (http://www.nextel.com.br/NextelWebsite/conheca_nextel.aspx)

¹¹⁹ Telefonía Celular – Operadoras – Nextel, Telemar (2012).

5.3.4 TIM

| | |
|-----------------------------|---|
| Foundation: | 1998 |
| Headquarters: | Rio de Janeiro, RJ - Brazil |
| Market Value: | BRL 19.7 billion (2012) |
| EBITDA: | BRL 4.6 billion (2011) |
| Products: | Mobile and landline operator and Broadband internet |
| Mobile Technologies: | 2G (TDMA, GSM-GPRS/EDGE), 3G (WCDMA/HSDPA) |



TIM (Telecom Italia Mobile) is a mobile phone company based in Italy, active also in Brazil. TIM Brazil consists of two companies: TIM Celular SA and Intelig, both controlled by TIM Brazil SA (holding).

TIM in Brazil achieves national mobile coverage using GSM and TDMA technologies. TIM also has authorization to provide long distance service National and International in Brazil. In June 2007 TIM obtained an authorization from Anatel to provide local fixed telephony in Brazil.

TIM Brazil added 13 million customers throughout 2011 and ended the year with 64 million customers in mobile telephony.¹²⁰

5.3.5 Vivo

| | |
|-----------------------------|--|
| Foundation: | 2003 |
| Headquarters: | São Paulo, SP - Brazil |
| Market Value: | BRL 50.3 billion (2011) |
| EBITDA: | BRL 10.4 billion (2011) |
| Products: | Fixed and mobile telephony, data transmission and VAS, pay TV, among others. |
| Mobile Technologies: | 2G (CDMA One, GSM/EDGE) and 3G (WCDMA/HSDPA, HSPA+, CDMA 1XEVDO) |

Telefónica

vivo

The operator was formed by a merger of the former state mobile phone operators existing in Brazil. It was established as a partnership between Portugal Telecom and Spain's Telefónica. Telefónica acquired a majority of the company in July 2010. Vivo operates in all states of the country.

As of 2Q/2012, Telefónica Vivo serves more than 90 million customers, 75 million mobile and 15 million fixed. Telefónica Vivo is present in more than 3,000 municipalities throughout Brazil.

Appendix B About This Study

The Brazil Mobile Observatory is a joint research study between the GSMA, Deloitte and Wireless Intelligence. Any questions about the content of this document can be directed to the authors of the study.



About the GSMA

The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators, as well as more than 200 companies in the broader mobile ecosystem, including handset makers, software companies, equipment providers, Internet companies, and media and entertainment organisations. The GSMA also produces industry-leading events such as the Mobile World Congress and Mobile Asia Congress.

For more information, please visit the GSMA Latin America website at www.gsma.com/latinamerica and GSMA's corporate website, www.gsma.com.

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Acronyms and Abbreviations

| Acronym | Description |
|---------|---|
| 4G | Fourth-generation mobile telecommunications |
| ADSL | Asymmetric Digital Subscriber Line |
| Anatel | The national telecommunications agency of Brazil |
| ARPU | Average revenue per user |
| BRIC | Brazil, Russia, India and China |
| BRL | Brazilian Real, also R\$ |
| CAGR | Compound annual growth rate |
| capex | Capital expenditure |
| CONAMA | Environment National Council |
| EBITDA | Earnings before interest, taxes, depreciation and amortisation |
| FTE | Full-time equivalent, referring to the number of employees |
| GSM | Global System for Mobile Communications, the second-generation standard for wireless communications |
| ICMS | Brazilian value-added tax on products and services |
| IMEI | International Mobile Equipment Identity |
| ITU | International Telecommunication Union |
| LGT | General Telecommunications Law of 1997 |
| LTE | Long-Term Evolution, the fourth-generation standard for wireless communications |
| M2M | Machine-to-machine |
| MNO | Mobile network operator |
| NFC | Near Field Communication |
| OECD | Organisation for Economic Co-operation and Development |
| opex | Operational expenditure |
| Pb | Petabyte |
| PDA | Personal digital assistant |
| PNBL | Plano Nacional de Banda Larga, Brazil's national broadband plan |
| SMC | Cellular Mobile System |
| SME | Small and medium-size enterprises |
| SMP | Personal Mobile System |
| TIM | TIM Brasil, a subsidiary of Telecom Italia Mobile |
| WAP | Wireless Application Protocol |
| W-CDMA | Wideband Code Division Multiple Access, a third-generation telecommunications standard |

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September 2012