The Future of Telecom in Brazil

The digital dividend and its usage for broadband

CEMS Master in International Management

Nova School of Business and Economics

Work Project

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1 Brief Context Of The Business Project

Maksen is a consultancy firm focused in the telecommunication sector. The company started its operations in 2003, in Portugal, as a spin-off of Deloitte, on the wake of Sorbannes-Oaxley. In 2011, the company started operating in the Brazilian market, making use of its Portuguese-speaking workforce and close cultural bonds to expand its geographical reach. Currently positioned in the market between the strategic advisory and the more operational advisory, the company is still finding its space in the market. Maksen is presently working with seven clients in Brazil and is aiming to increase its brand awareness by publishing market studies, developed in partnership with universities. This project was developed within the scope of the referred market studies

Telecommunications are critical in fostering economic development, with a study by the World Bank estimating that a 10% rise in fixed telephony, mobile telephony or broadband penetration leads to an increase in gross domestic product of 0.73%, 0.81% and 1.38%, respectively, in low/middle-income countries. In the most recent publication by ITU[1], Brazil ranked 67th out of 157 countries in ITU's IDI[2], lagging other Latin American countries such as Chile, Argentina or Uruguay, a clear sign that Brazil needs to develop further its telecom platform. Given these two arguments, Maksen wanted to better understand the current state of the telecom market and infrastructure in Brazil, as well as what brought the country to today's situation and what could be improved going forward, especially considering investment and regulation.

In testing the initial hypothesis of under-investment, we concluded that between 1997 and 2012, Brazil, invested a total of $589 per capita, a mere 15% of the United States' investment and 32% of South Korea's. It was also concluded that Brazil had a more serious problem in the broadband area than in fixed or mobile telephony, which led to a change of the project's scope – focusing now on broadband.

With this in mind, it was interesting to understand how past actions greatly shaped today's market. The privatization period is of crucial importance, as it breaks the national company in twelve companies, establishes the telecom regulator and determines the laws and government plans that rule the market to today. The key takeaways from this period are that the competitive structure that Brazil adopted led to a low competitive environment, with high entry barriers and limited economies of scale.

[1] International Telecommunication Union
[2] Information and Communications Technology (ICT) Development Index

Furthermore, the universalization obligations were poorly designed, focusing solely in fixed telephony, generating inappropriate investment incentives for companies, which only invested in mobile telephony due to obligations arising from the spectrum auctions, and in broadband in highly profitable areas, leaving a considerable part of the population unserved. The period that followed was marked by a strong consolidation period, generating four dominant companies in the market, three of them owned by foreign global telecom players. This is important in understanding the low investment levels, as the companies' main subsidiaries are using their Brazilian subsidiaries as cash-cows to service debt and other obligations at the holding level.

Three sets of factors were then identified as contributing to the problem: regulatory, economic and social, encompassing fourteen issues in Brazil. Emphasis should be given to the high tax burden, non-deployment of government's investment funds, lack of regulation for infrastructure sharing and poor competition model. As a result of this, quality of service (QoS) is lower than desired, with telecom companies taking the top 5 positions of Brazilian companies by number of complaints; and several areas in the country are underserved, hampering economic and social development.

After identifying over 100 measures being implemented by other countries and crossing them with the fourteen aforementioned issues, the path for improvement in Brazil lies on six main topics: increasing investment, a more favourable tax system, a stronger competitive environment, infrastructure sharing, and simplifying and enforcing regulation. Based on this, a two-tiered hierarchy of priorities was established to tackle the different factors, targeting first regulatory factors, secondly economic and lastly social factors.

In order to gain traction for this development agenda, Brazil should focus its efforts in investments in new technology, especially WiMAX, to expand coverage and maximize spectrum usage, as well as investing in competitive regulation, enforcing its competition plan (PGMC) and more importantly, increasing the roll out speed of its infrastructure sharing platform, SNOA, viewed as a fundamental stepping stone for a stronger competitive environment.

As next steps, a special committee should be named to closely integrate the policies, actions and goals for all stakeholders to ensure a common and coordinated direction on all development initiatives.

2 Further Development of a Topic

2.1 Introduction

As was mentioned before, Brazil has a significant problem in its telecom market, specifically in terms of infrastructure. Throughout the project we always kept a macro view of the problem, avoiding going much into the more detailed aspects due to time constraints. During the business project, we learned that Brazil's biggest pain-point was in last mile infrastructure, based on specialists' opinions. Here, I will analyze this pain point in further detail and will offer some insight into the digital dividend, a phenomenon that is not being paid much attention to in Brazil yet. With the transition from analogue television signal to digital, the digital dividend could offer a significant and quick relief to Brazil's telecom network, offering additional spectrum for broadband usage and contributing to the country's economic development.

I will start by explaining what the digital dividend is and quantifying the infrastructure problem. I will then expand on the impact of the digital dividend and how it can help easing the problems Brazil faces, and more importantly, how it can influence economic development. I will wrap up with the challenges this topic faces in Brazil, from a technical and political point of view.

2.2 What is the digital dividend?

For many decades now, television broadcasting has been using significant parts of the spectrum, namely the UHF and in the VHF band[5], to deliver analogue signals to clients' houses. With technological development, analogue broadcasting has been losing importance, as new alternatives such as cable, ADSL and internet television allow for a delivery of many more programmes. This transition to digital signals has increased the quality and quantity of the content and services delivered, providing consumers with products such as High Definition Television (HDTV), nowadays easily found in our televisions. On top of all the (more) tangible benefits for consumers, digital signal is much more efficient in spectrum usage than analogue signal, which benefits both companies and consumers. As an example, and keeping things simple, the spectrum that is required to broadcast one channel using an analogue signal, allows for the transmission of up to 20 digital channels of equivalent quality, depending on the signal enhancement techniques employed. Because "international guidelines forbid the

[5] UHF: 470-862 MHz; VHF: 173-230 MHz

bandwidth used for digital programmes to go beyond the analogue channel bandwidth"[6], there is now new spectrum available without requiring the deployment of new infrastructure. It is this "new spectrum", the one made available from the transition from analogue to digital signal that is called the digital dividend. This is best understood with the chart below, by ITU:

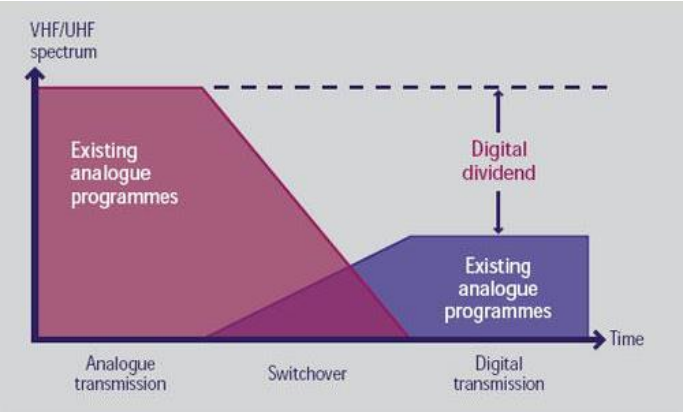


Figure 1 – The Digital Dividend

And what uses can this additional spectrum have? This additional spectrum can be allocated to a variety of purposes, including new terrestrial broadcasting services, mobile multimedia applications, mobile communications, and mobile broadband.

The objective of the next pages is to focus on its usage for mobile broadband in Brazil, as broadband was the main focus of the business project. Furthermore, given the Brazilian context, where broadband is still the underdog when compared to the other telecom services and the one with the highest impact in the economic development, it makes even more sense that this avenue be analysed to understand the potential impacts it can have on the country economic and social development.

2.3 An overloaded infrastructure hit by booming demand

To better explain why the digital dividend is important for Brazil, I will take a detour to briefly explain how the telecom network is structured and the cocktail of problems that are taking control of Brazil's network.

Considering that people often draw analogies to telecoms mentioning the "high-way of information", I will use similar parallelisms on roads to better explain the infrastructure network. Telecom infrastructure is divided in 3 parts: backbone, backhaul and access

[6] The Digital Dividend - http://www.itu.int/net/itunews/issues/2010/01/27.aspx - accessed 08/06/2014

(or last mile)[7]. Backbone is the central network, enabling the transmission of big data packs, usually connecting different countries and, within the same country, the biggest cities or the ones where traffic is heavier. As an example, submarine cables are part of the backbone. In a nutshell, backbone is the high-way of telecommunications, allowing for the free and quick flow of information over long distances. The second part, backhaul, connects the backbone and the access networks, bringing information to the final part of the infrastructure. As an example, backhaul brings the network from the backbone straight to the boxes outside buildings, to the telecom antennas that can be seen around us or to the satellites. Looking at roads, backhaul are the secondary roads, the one that connect highway and cities. These cities have their streets and avenues, or last mile infrastructure, which are composed by the cables inside a building, or the antennas that send the signal to our mobile phones.

During the business project, we had the opportunity to talk with different experts on the Brazilian telecom market, and they all pinpointed the last mile infrastructure as the weakest link in Brazil. The digital dividend is of particular importance when considering the status of last mile connection and its usage for mobile broadband.

If one considers that there is already a shortage of supply in terms of access today, the growing number of people accessing digital contents on-the-go and interacting through data-driven applications, such as WhatsApp, Facebook, YouTube are of no assistance. The country is also rolling out its 4G/LTE network, which demand much more spectrum and antennas than 3G demanded, but instead of facing a friendly regulatory environment, regulation is very complex, costly and yields a very lengthy process. All this together created the perfect environment for a telecom blackout.

Putting numbers to the assertions made on the last paragraph is helpful in understanding how critical the shortage of access infrastructure is[8]. At the end of 2013, Brazil had 66,066 cell sites spread around the country, while the United States (USA) had 301,779. To put things into perspective, Italy had approximately as many installed antennas as Brazil – Brazil is over 28 times bigger than Italy. Considering the number of active mobile chips, Brazil has, on average, 4,128 mobile phones connected to each antenna, versus 1,082 in the USA. Looking at other countries, Brazil is at an even bigger disadvantage, with Spain having 460 and Japan 300 mobile phones per cell site.

[7] The terms “last mile” and “access” will be used interchangeably
[8] See appendix 1 for full disclosure of the numbers

Considering that a new antenna costs, on average, BRL 300,000, a rough estimate indicates that Brazil would need to invest approximately BRL 56 billion, just considering new antennas. Looking past the supply side and into the demand side, the evidence of past and forecasted growth in mobile data usage is overwhelming. In 2013 alone, mobile traffic grew 3.3 times faster than fixed traffic. Mobile data traffic for that year was 38.8 petabytes per month, almost doubling from 2012. If one compares to 5 years earlier, 2008, mobile traffic is 41 times bigger. Now looking five years forward, to 2018, mobile traffic is expected to grow 11 times, corresponding to a CAGR of 63%. This growth is supported by the growth in smartphone usage, with 19.8 million devices added in 2013 alone; smartphones now represent 18% of the connected devices, and are expected to represent 63% by 2018, as people change from 2G (GSM) to 3G (WCDMA) and 4G devices[9].

With these staggering figures, it is easily understood how Brazil is underserved and crying for added spectrum capacity. With the rolling out of its 4G/LTE network happening using the 2.6GHz band, Telebrasil estimates that for every antenna needed for transmitting the 3G signal, under the 4G/LTE network 4 antennas will be needed. In the face of this infrastructure shortage, Brazilian companies still have one more hurdle to overcome if they want to invest in new antennas: regulation. Currently, in Brazil, there are over 250 laws governing the deployment and operation of antennas, with an overlap of municipal, state and federal reach, leading to an antenna taking 18 months to be approved and deployed. With many of the rural population having coverage but very low quality of service (high number of interruptions and coverage outages, higher prices), an increase in the available spectrum is very important for Brazil's development.

2.4 Digital dividend benefits

Craving for additional spectrum, it is clear that Brazil needs to find a solution to complement the required investments, to ensure better quality of service in urban areas and expand coverage in rural areas. An efficient allocation of the digital dividend spectrum is key to assist in the achievement of the two aforementioned goals, as the government, as well as Anatel, wishes to push towards a massification of the 4G/LTE coverage.

[9] See appendix 2 for further detail on the migration

Operating in a low frequency band (700MHz), the digital dividend is able to deliver a larger coverage area per antenna/cell site, than the current assigned band. To better understand the relationship between frequency, range and number of required antennas/cell sites, see the chart below by Telebrasil:

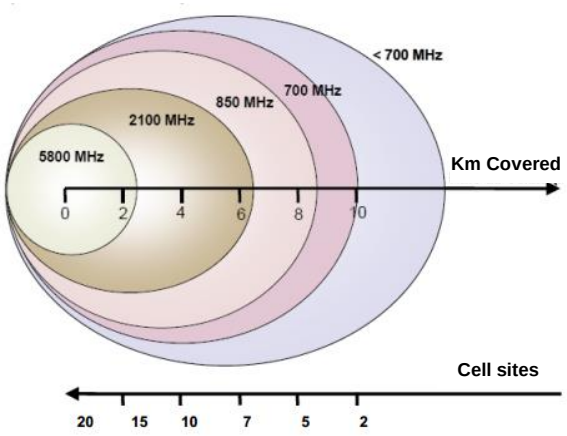


Figure 2 – Spectrum coverage & cell sites

This relationship means that there is a lower cost associated with rolling out the 4G/LTE network using the 700MHz band, as less cell sites are required, with the potential to generating lower prices for consumers. Considering the vast continental platform of Brazil, ensuring that all population has access to broadband is critical due to its impact in social improvements. Looking at 5 dimensions that benefit vastly from broadband, such as education, health, financial inclusion, access to public services and information inclusion, a study by the GSMA concluded that allocating the spectrum to mobile broadband services was likely to have a high impact on all 5 dimensions. Given that throughout the business project was concluded that the level of social development of a country influences its adoption of new technologies, which in turn support economic development, it makes total sense that the allocation of the digital dividend to mobile broadband yields such high impact.

Past the social dimension and into the economic one, it is expected that the application of the digital dividend towards broadband will also yield a substantial impact, both direct and indirectly.

As direct benefits, one can expect to obtain improvements in productivity, in companies' competitiveness and also in GDP, as new investments in equipment are made and jobs are generated. At a more indirect level, one can expect an increase in collectable taxes and fees, especially considering the high level of telecom taxation in

Brazil; indirect employment can also be expected, as the network development requires labour. According to a study by Telecom Advisory Services, the allocation of the digital dividend is expected to yield a positive impact in Brazil's economy of USD 1,393 million (36% is indirect), and generate approximately 4,300 jobs per annum. It is also expected to yield the government approximately USD 1,322 over a period of 8 years.

2.5 Conclusion

In order to take full advantage of digital dividend, Brazil still has a long way to go. The first step Brazil has to take is clearing the spectrum, because broadcasting and mobile signal cannot co-exist in the same band without provoking some distortions. The full switching from analogue to digital signal is only expected to be completed by 2016, but the regulator has already stated that the process is likely to be delayed. A proposed solution to this problem is the implementation of the broadband signal in the UHF band, leaving the VHF to broadcasters. Further investigation should be done in this field, analysing possible filters that allow the co-existence of the television and broadband signal. This should allow for a quicker implementation of the digital dividend.

Past the technical limitations, one must bear in mind the political backdrop that exists in Brazil. Throughout the business project we witnessed how the government has always been very inefficient when it comes to decision making, with poor governance mechanisms. Like all other decisions, the allocation of the digital dividend will be a highly political decision, as there are many influential parties with their skin in the game. Currently there is a lockdown between the regulator and Communications Ministry and the mobile operators, with a natural interest in this area; the fixed operators, seeking subsidies from the government to enter in the auctioning of the digital dividend; and the TV operators, who want to keep as much spectrum as possible and are playing with the analogue-digital switchover. To make matters worse, the national treasury has intervened and will not set a minimum price for the auction until the lockdown is solved, creating further uncertainty for operators.

All in all, the digital dividend can bring tremendous economic and social benefits, as it allows for the massification of mobile broadband. However, the political environment in Brazil is likely to hamper the process, delaying the implementation of the digital dividend and keeping part of the population far from the digital revolution.

3 Reflection on learning

3.1 Previous knowledge from the masters program

Analysing my experience from the business project, I arrive at the conclusion that throughout the entire project I never employed any tool or framework learned during the Masters in Finance or the CEMS MIM.

However, the experience acquired from having completed many courses that were case-driven was paramount. First, the way case-studies were tackled ended up being very similar to the way our business project came to light. The analytical process behind coming up with a structure that was coherent and made the document flow like a story was very important. Moreover, having had professors with vast academic and professional experience, during the masters, was critical in developing strong communication and presentation skills. These skills proved essential on the day-to-day interactions with people from Maksen, either being in our brain-storming sessions or when we were engaged in discussions about the direction of the project.

3.2 New knowledge

When I selected this project, I did it because it seemed quite different from anything I had done until then, a challenge I was seeking to have with this experience. In addition, this was a topic that I am extremely passionate about: telecommunications and technology; that allowed me to know the Brazilian reality in depth and provided constant interactions with Brazilian professionals. I believe all these factors came together, and the business project was a very enriching experience.

Throughout the project, I greatly developed my project management and leadership skills, as I was the member of the team coordinating our workflow and making the bridge with Maksen. Due to the constant interactions and our brain-storming sessions, I learnt several new tools, such as the Structure-Conduct-Performance (SCP) paradigm and the Delta model. While the Delta model took on a very small role, the SCP was instrumental in allowing us to structure the story we were telling and in tying together all our analyses, ultimately being a powerful tool for us to draw solid and informed conclusions. We started by analysing the market structure – the foundations of the industry that determined the behaviour of participants; we then analysed the conduct of these same players as a reaction to the market structure; finally we assessed the performance of the whole system. In the end, we were able to understand the 14 issues

that are causing the underdevelopment of the Brazilian telecom market. In addition to the aforementioned learning points, I also developed extensively my knowledge about the Brazilian particularities (such as the high level of disfunctionality that exist in the government decision-making processes) and the ins-and-outs of the telecom industry.

3.3 Personal experience

During the whole project, I consider that my past experiences in investment banking and in strategy allowed me to take more of a leadership role within the team, ensuring that the document was consistent and that a coherent story was being told. Throughout the project, we had to deal many times with uncertain (or even lack of) information and here the motto "perception over precision" was extremely important. This means that more than performing complex analyses, in a consulting project what matters is that the reader is able to follow the story and that message is simple and easily understood.

Being the only member of the team that was able to fluently speak Portuguese, Spanish and English was incredibly valuable, as most of the available information was in Portuguese, but at times proved to be too big of a burden, resulting in me over-worked and at times even frustrated. Sometimes, people at Maksen would send us complex emails in Portuguese, leaving me to translate it for the rest of my group. I believe that this led my peers to sometimes lose engagement in the project, and made me engage in a sort of micro-management of my peers' activities – clearly a mistake.

3.4 Benefit of hindsight

In retrospective, there is one thing I would certainly have done differently, which would have been being in closer contact with Maksen from the beginning, working on a more frequent basis from their offices. This changed with the development of the project and ended up being instrumental in getting a deep understanding of the particularities of the Brazilian market, as we interacted much more with the company's consultants.

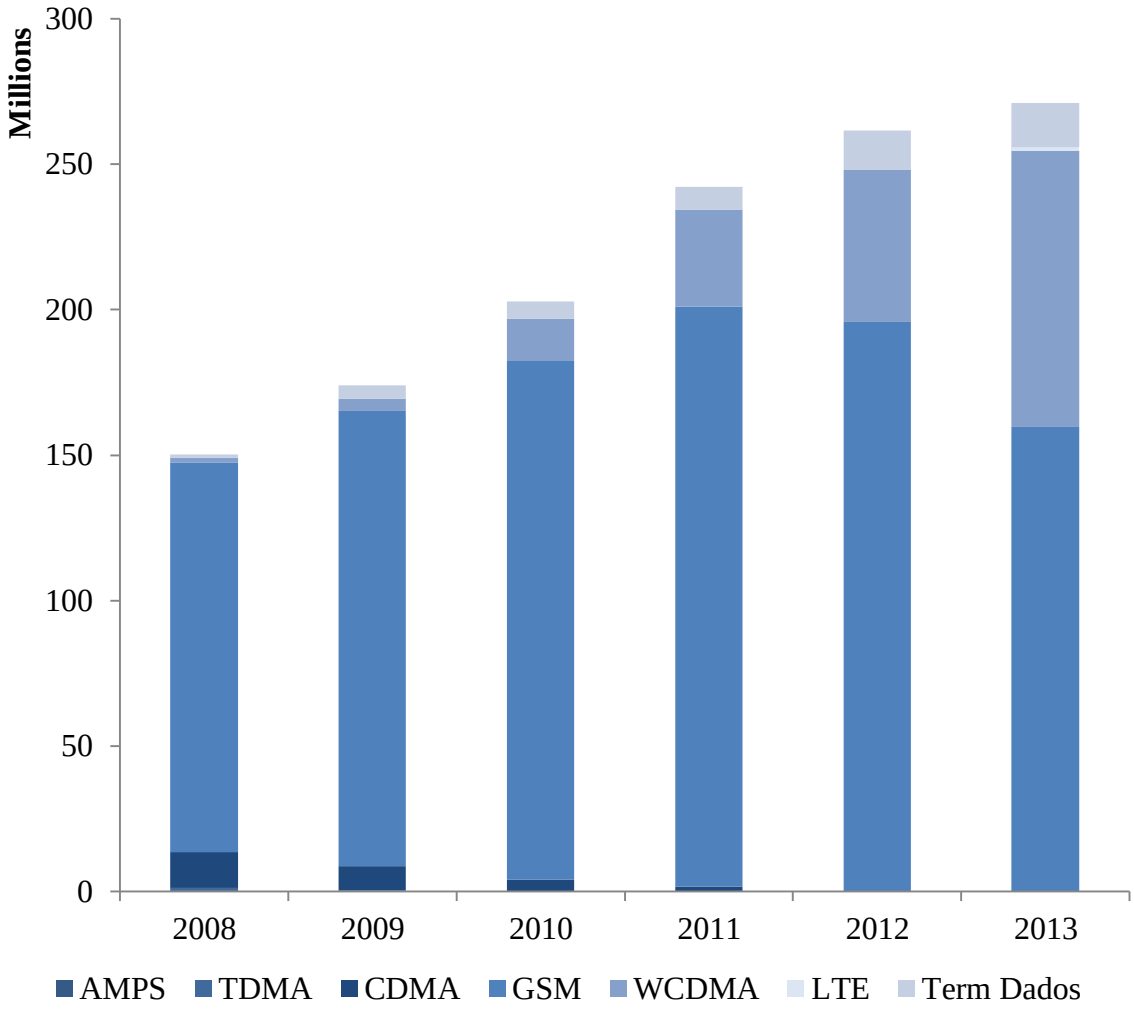
On the brightside, something I felt that worked against the whole dynamic of the group ended up being highly valuable – being the only portuguese speaker. As such, while having to go through all the materials by myself was a gruesome task, in the end it allowed me to get a better understanding of the whole business project and the telecom industry. Furthermore, as I aspire to work in the TMT sector (telecom, media and technology), the business project will certainly be a great asset in future professional endeavours, as the Brazilian market develops and new companies seek to enter it.

4 Appendix

Appendix 1 – Cell sites in Brazil

SMP	State	Cell Sites	Active Chips ('000)	Chips/ Cell Sites
I	Rio de Janeiro	7,300	24,182	3.313
	Espírito Santo	1,348	4,497	3.336
	Minas Gerais	7,016	26,273	3.745
	Amazonas	1,022	4,100	4.012
	Roraima	119	506	4.252
	Pará	1,601	9,160	5.721
	Amapá	180	933	5.183
	Maranhão	1,064	6,422	6.036
	Bahia	2,915	18,146	6.225
	Sergipe	533	2,732	5.126
	Piauí	749	3,978	5.311
	Ceará	1,938	11,073	5.714
	Rio Grande do Norte	912	4,562	5.002
	Paraíba	943	4,941	5.240
	Pernambuco	2,394	12,544	5.240
	Alagoas	853	4,017	4.709
II	Paraná	3,891	14,727	3.785
	Santa Catarina	2,508	8,858	3.532
	Rio Grande do Sul	4,699	16,308	3.471
	Mato Grosso do Sul	875	3,831	4.378
	Mato Grosso	1,094	4,607	4.211
	Goiás	2,162	9,370	4.334
	Distrito Federal	1,555	6,157	3.959
	Tocantins	433	1,945	4.492
	Rondônia	406	2,404	5.921
	Acre	189	913	4.831
III	São Paulo	17,367	65,538	3.774
Brasil		**66,066**	**272,724**	**4.128**

Appendix 2 – Evolution of Mobile Chips service



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