

# SUMMARY MESO STUDY: CONSTRUCTION OF ROADS, RAILWAYS AND OTHER UTILITY AND CIVIL ENGINEERING PROJECTS

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## ANALYSIS OF THE SECTOR IN BRAZIL

### Sector Development

The first railway of Brazil was opened in 1854. The railway covered a distance of 14.5 km (Williams, 2006). After this first railway, several other railways were built. The rail projects from mining areas to ports since the mid 1980s account for the bulk of the railroads (Mongabay, 1997). River transportation in Brazil only accounts for a minor part of the transportation of goods. Very big projects in Brazil, like the Itaipu dam in 1984, provide a lot of work in the construction sector.

### Demand conditions

#### Composition of demand

In Table 1: characteristics of the infrastructure of Brazil, the figures about the infrastructure of Brazil are given:

Type of infrastructure	Amount (CIA, 2010)
Railways	28,857 km
Roadways	1,751,868 km , paved: 96,353 km unpaved: 1,655,515 km (2004)
Waterways	50,000 km

Table 1: characteristics of the infrastructure of Brazil

Brazil has an extensive network of highways. The World Cup of 2014 will have a big contribution to the building of roads. Long-distance passenger rail transportation is almost nonexistent in Brazil (Bernasconi, 2009). Brazil is one of the world's leading dam-building nations, and is already highly dependent on hydropower for its electricity, with about 80% of its electrical energy coming from large dams (International Rivers, 2008).

### Shape and growth

The construction industry (including the housing industry) in Brazil had a turnover of 68,6 billion dollar in 2006 (Euclid Infotech Pvt. Ltd. , 2008). The complete Brazilian construction sector is worth 85 billion dollar at the end of 2010, driven by projects related to upcoming major sporting events in the country such as the 2014 FIFA World Cup and the 2016 Olympics in Rio de Janeiro (Saudi Gazette, 2010). The value added by the economic activity of the construction sector in Brazil is:

Year	Added value in US dollars (% of total added value) (United Nations, 2009)
2004	29,013,516,017 (5)
2005	37,059,385,989 (5)
2006	44,263,237,092 (5)
2007	55,377,384,658 (5)
2008	63,766,115,725 (5)

Table 2: Added value construction sector Brazil

The economic crisis also had its effect on Brazil. The total Brazilian economy, after two quarters on a downward trend in 2008/2009, bottomed out in the second quarter of 2009 and returned to growth (Real instituto elcano, 2010). The recovery of Brazil is remarkably fast, if you compare it with for example the Netherlands. The Netherlands is still in an economic crisis.

### International market

There are strong restrictions for other international companies to operate in Brazil (CBF, 2009). Many companies are not interested in exploring Brazil.

## Factor conditions

Factor conditions determine the nation's position in factors of production, necessary to compete in a given industry. The factor conditions consist of basic and advanced conditions and are discussed below.

### Basic factors

On the Brazilian market, there is a strong demand for machines and material for infrastructural projects (NL EVD Internationaal, 2010). The import of goods is encouraged because of the strong domestic currency and the stable economic position (Germany Trade & Invest, 2010). The availability of capital is good because in 2010, President Lula launched an 878 billion dollar program to improve the infrastructure of Brazil. (NL EVD Internationaal, 2010), (Grudgings & Nery, 2010).

Despite the economic crisis, the Inward Foreign Direct Investment (FDI) has increased the last months. It rose from 789 million dollar in January to 2.8 billion dollar in February (Goodman, 2010). According to the ABDI, Brazil is the fourth favorite estimate destination of FDI in the world, after China, USA and India (Brazilian Agency for Industrial Development (ABDI), 2009). Approximately 10% of FDI is part of the infrastructure sector (Business News America, 2006).

The labor market of infrastructure is a part of the sector 'industry'. In this sector, 27% of all the men are working and 13% of all the women. In the Netherlands this is respectively 30% and 8% (The World Bank, 2007). The monthly net income of the construction sector in Brazil is 225 dollar and in the Netherlands is 2,400 dollar (Worldsalaries). The labor productivity in Brazil is relatively low (21 percent of the US level in 2004) but their planning to generate higher labor productivity by using better education of the labor force (Prado, 2007). (Elstrodt, Fergie, & Laboissière, 2006).

### Advanced factors

Brazil has got problems with highly qualified labor. The average Brazilian worker has got six years of schooling which is little compared to an average of 12 years of schooling in Europe. Brazil has to pull in people from abroad but has difficulties with its language (Portuguese) (Parker, 2008).

The inflation rate in March 2010 was 5.17% and the basis interest rate was 8.75% in March 2010 (Trading Economics. Global Economics Research, 2010). The Real increased 30% compared to the US dollar in 2009 which stimulated the import, but made Brazilian export less competitive in the foreign markets (Merco Press, 2009).

The Gross Domestic Expenditure on R&D is approximately 0.91% and 1.78% for respectively Brazil and the Netherlands in 2005. Most of the Brazilian R&D expenditures were used for public R&D labs and universities and not or limited used for R&D infrastructure (Rodriguez, Dahlman, & Salmi, 2008).

## Firm strategy, structure and rivalry

### Market

Between 2000 and 2007, the investments are around two percent of the GDP, which means that it was in 2007 around 27 billion euro (GDP of 1.35 trillion euro (CIA, 2010)). In 2007 the government launched the Programa de Aceleração de Crescimento (PAC; in English Growth Acceleration Program). The PAC is an important program in Brazil, where a growth in economy has to be established. The investment planned for PAC between 2007 and 2011 is 518 billion US dollar (Prado C. , 2009). The infrastructure gets a large part of the investment, around 100 billion dollar (Business News America, 2006).

Of this 100 billion dollar, 58 billion dollar will go to the transportation infrastructure. This is building roads, expanding roads and the maintenance. Railroads will get 24 billion dollar. Other parts will get just a small share of these investments. Ports (2.5 billion), airports (1.6 billion), waterways (1.4 billion) rural road equipment (1.0 billion)

The current status of the infrastructural investments is that 9% is completed, 85% is under implementation, 5% having difficulties in implementation and 1% presenting serious difficulties in implementation. These difficulties are mainly because of the financial crisis (Prado C. , 2009).

### Structure

The investments for infrastructural projects are done by the private sector and the public sector. The private investment is almost the same as the public investment. The public investment can be divided in

two groups, the federal government and the state-owned companies. The state-owned companies invests twice the investment of the federal government. (Prado C. , 2009) It is obvious that both public and private companies are very important. But how do they work together?

Most of the important projects in Brazil are an initiative of the government. In the past, almost every project was done by the government itself, or offered as a traditional concession. The last few years, a shift is taken place. In 2004 the government came up with a public private partnership (PPP) act. This act was postponed several times so it seemed to be not a success. But in the main time, some states came up with the idea to make a PPP without the federal government, but with the state government and the companies. The states São Paulo, Bahia and Minas Gerais made PPP constructions and that was successful. The concept of PPP was absorbed positively and is slowly integrating in Brazil (Franco, 2007).

### **Competition**

The railway network in Brazil was owned by the government till 1996. Since the government had no competition, it was an inefficient company and the prices of the freight and passenger transport were too high, compared to private companies in other countries. Between 1996 and 1998 the freight network was privatized completely and is performing more efficient than before, but the passenger and freight on the rail is decreasing. Therefore it is hard to say if the privatization of the railway network was a success (Estache, Goldstein, & Pittman, 2000).

A part of the roadway network is also privatized in Brazil. Some highways are owned by the state but during a contract period exploited by private companies, which make it a toll-road. This causes competition, because the growth in vehicle traffic makes it an interesting market for investors (Waggoner, 2008).

### **Related and supporting industries**

The presence of related and supporting industries are important for many firms because they are critical for the growth of that particular industry. Presence of related industries with a strong competitive position will guarantee a more attractive industry. A strong sector will take along horizontally (related) and vertically (supporting) related industries in its development.

#### **Supporting industries**

Supporting industries are the supplying and service organizations, for example the government, the suppliers and the universities. It is also said that those industries are vertically related because they supply the construction industry.

The rail industry has been one of the most heavily regulated sectors of the economy. The government controlled entry, exit, prices, technology, operating practices and ownership on the grounds. (A. Estachie, 2001) During the 1990's the Ministry of Transport consessioned the rail services out to the private sector, while they still can influence the railway system with regulations. (Campos, 2001)

About 18,8% of all engineering graduates have studied construction and public works and about 21,7% mechanics. So civil engineers take a big part in the world of engineers. Therefore the civil construction industries are one of the biggest branches which employs engineers. (Gutierrez, 2009)

Another supporting industry can be the suppliers, because of their knowledge of the construction materials. But also banks (supporting the loans) and IT-firms (making software) can be supporting industries.

#### **Related industries**

Related industries are the possible clusters in which firms can share activities in the value chain. Industries with a strong cluster can take advantage of synergy effects within integrated clusters. It is also said those industries are horizontally related because they can work together or against each other in a competitive market.

The SISIND Project (System of Quality and Productivity Indicators for the Construction Industry) was established in 1993. The aim of this project was to disseminate performance measurement system for the sector. The SISIND Project has been focused on small sized construction firms, since they correspond to a very large percentage of the industry in Brazil both in terms of the number of companies and output. Since the launching of SISIND, several construction firms have joined the project and participated in training

courses aimed at enabling managers to implement the proposed measures in their organization. A database including data of approximately 80 companies and 200 projects has been created. (Dayana B. Costa)

## Government

Brazil has a large road network, but only a small part is paved. This poor condition of the current infrastructure impedes the productivity, economic growth and the competitiveness of the country (NL EVD Internationaal, 2008). With the use of Public Private Partnerships and investments, the government wants to improve the transport sector.

The government is stimulating the sector by cutting taxes for construction materials (Fox Business, 2010). Another important influence of the government is the PAC program, which is already mentioned in the latter paragraphs. In 2007 the government launched this program. It is launched to create a growth in the economy due to investments (Prado C. , 2009).

## Chance

The chance variable in Porter's diamond can have a big influence on the markets. Examples of chance are war, political changes and climate factors.

Opportunities for Brazil are the upcoming sport events (2014 FIFA World Cup and 2016 Summer Olympics) that stimulate the sector and improve the image of Brazil. Threats are the politics (the upcoming elections), natural disasters (e.g. mud slides in Rio de Janeiro) and the economic crisis.

## ANALYSIS OF THE SECTOR IN THE NETHERLANDS AND COMPARISON BRAZIL

### Sector development

In 1839 the first railway in the Netherlands was opened. This railway connected Amsterdam with Haarlem, and was used for passenger transport. More railways followed, and around 1900 railway was the most important transportation mode in the Netherlands. Since 1938 the railways were controlled by the Dutch Railway association, the NS. In 1995 the NS was privatized by the Dutch government (entoennu). The Netherlands has a long history of water management and water use for transportation.

### Demand conditions

#### Composition of demand

See Table 3: characteristics of the infrastructure of the Netherlands for the lengths of the types of infrastructure of the Netherlands.

Type of infrastructure	Amount (CIA, 2010)
Railways	2,896 km
Roadways	136,827 km (2008) (all paved)
Waterways	6,215 km (2007)

**Table 3: characteristics of the infrastructure of the Netherlands**

The Netherlands has less railways, roadways and waterways. However, railways are used for passenger transport through the whole country, as in Brazil railways are mainly used for cargo transportation. Also, the Netherlands have more paved roadways than Brazil. Brazil is one of the leading dam-building nations. The Netherlands have a lot of knowledge about water management and for example dykes.

### Shape and growth

The utility and infra construction is approximately 62 billion dollar, that's a bit over 4 % of the GDP (2007). (Sectoraal Steunpunt Arbeidsmarkt Flevoland, 2007) The added value of the construction industry as a part of the total added value of all economic activities, can be seen in table 4.

Year	Added value in US dollars (% of total added value) (United Nations, 2009)
2004	29,180,557,884 (5)
2005	30,576,282,147 (5)
2006	33,201,159,561 (6)
2007	38,786,676,019 (6)
2008	44,779,745,751 (6)

**Table 4: added value of the construction sector of the Netherlands**

In 2006, the Dutch construction industry had a growth of 1,1 percent in the last quarter of 2006. (Bouwereld.nl, 2007), and faced a decrease of 6 % in 2009 due to the economic recession (Z24, 2009). Expected is that the Dutch construction industry will decline with 10 percent in 2010 (Z24, 2009).

### International market

In the Netherlands, building projects with a value higher than 5 million euro have to be a European tender. Brazil is a member of the Mercosur, which is regional trade agreement between Brazil, Argentina, Paraguay and Uruguay. Some Brazilian construction firms are also active in other South American countries, e.g. Andrade Gutierrez in Venezuela (Tendersinfo, 2009).

### Factor conditions

#### Basic factors

Unlike Brazil, the Netherlands wants to economize on the sector infrastructure (Sectoraal Steunpunt Arbeidsmarkt Flevoland, 2007).

The Netherlands are ranked fifth in FDI Inflows, so a smaller FDI than Brazil (Netherlands Foreign Investment Agency, 2006). The labor costs and energy prices in the Netherlands in the construction sector are much higher than that in Brazil (2005 World-wide Electricity Prices for Industry, 2005), even as the labor productivity in the Netherlands (Ministerie van Sociale Zaken en Werkgelegenheid, 2010). As mentioned above, the labor productivity of Brazil in 2004 was 21 % of the US level. In 2004, the labor productivity was higher than that of the US (McGuckin & Ark, 2005).

#### Advanced factors

As mentioned above, there is no problem finding highly qualified labor in the Netherlands. The R&D expenditure in percentage of the GDP in the Netherlands is twice of that in Brazil.

The interest rate and inflation rate in the Netherlands are both 1% and are below the rates of Brazil (Trading Economics. Global Economics Research, 2010).

### Firm strategy, structure and rivalry

#### Market

The rate in the Netherlands is around 10 percent of the GDP, which is 47 billion euro (Sectoraal Steunpunt Arbeidsmarkt Flevoland, 2007). The last few years, the absolute investment in the infrastructure is twice as high in the Netherlands as in Brazil. There are a few reasons why the investment level is so low in Brazil:

- High level of current expenses (and growing)
- High level of taxes (and growing)
- Lack of good regulatory framework and strong institutions
- Highly volatile macroeconomic environment until the end of the 90's

Based on the points above, Brazil needs to change its fiscal adjustments and its regulatory framework to create some room for investments. This is done by the government in the PAC. As mentioned earlier, this program needs to create a growth in the economy due to investments (Prado C. , 2009).

#### Structure

In the Netherlands the PPP-construction is used a lot for big projects. Mostly this is done under the conditions of DBFM (Design, Build, Finance and Maintenance). This is the same as in Brazil. There are no numbers available about the percentage how often PPP is used, but it looks like that the implementation is further and the construction is more common in the Netherlands than it is in Brazil.

## **Competition**

In the Netherlands the railway is privatized, this is also the same in Brazil. However, in the Netherlands there is no real competition for passenger transport, since it gives no profit. For freight transport there is a competitive market in the Netherlands. The rail is used a lot in contradiction to Brazil. For the roadways is no competition, since there are no toll-roads in the Netherlands. There is competition in building, maintenance etc. But the government is the principal.

## **Related and supporting industries**

The construction industry in Brazil is influenced by supporting industries and clusters to guarantee a more attractive industry. Supporting industries like the universities supply the construction industry with well educated engineers, but in the Netherlands there's a lack of civil engineers. The major construction companies will probably make a statement together to get more students to the construction branch. (Nederland, 2010)

The railway system is consessioned out by the government, so that they still can influence the railway system with regulations, but the managing is for private companies. In the Netherlands there is a comparable system with Pro-Rail as private party in controlling the rail infrastructure and NS as the biggest company transporting people.

An important cluster in Brazil is the SISIND project, which goal is to disseminate a performance measurement system for the sector. The Dutch government also has initiated a policy program "Innovation in Construction" which aims to improve the level of innovation in the construction cluster by stimulating the creation of innovative clusters and consortia. (Proceedings, 1999) The cause of this initiative was a Porter analysis which revealed that the majority of firms focus mainly on cost-based price competition and much less on product differentiation and product innovation.

## **Government**

In the Netherlands, the government invests a lot of money in the construction of roads, railways and other utility and civil engineering projects (Ministerie van Financiën, 2009). This is done because of the economic crisis. The government accelerated investments in construction and infrastructure, in order to minimize the decline in building production and minimize the job losses.

## **Chance**

Opportunities for the Netherlands are upcoming important events. The HollandBelgiumBid for the 2018 or 2022 FIFA World Cup can stimulate the sector. Threats for the Netherlands are the weather conditions (e.g. the harsh winter), environmental legislations and the consequences of the construction fraud.

## **CONCLUSION**

In Brazil, most of the passenger transport takes place by plane or over the roads. Long-distance passenger rail transportation is almost inexistent in Brazil. The 28,857 km of railways in Brazil are not used for passenger transport. In Brazil, the most common way of transportation is via the road. In 2004 there was 1,751,868 km road. Most of the roads however are unpaved (1,655,515 km) so a lot of improvements can be done.

Governments are making efforts to improve them, either by chartering operations to private parties or by investing large amounts of money. Important incentives to improve the infrastructure in Brazil are the upcoming major events like the 2014 FIFA World Cup and the 2016 Olympics in Rio de Janeiro. This indicates that the demand conditions, one of the determinants of the Porters Diamond, are good.

The most important, restrictive, determinant of the Porters Diamond is the 'Factor Conditions'. Brazil has got problems with providing highly qualified labor. This lack of civil and construction engineers threatens the infrastructure projects. The average Brazilian worker has got six years of schooling which is little compared to an average of 12 years of schooling in Europe. Brazil has to pull in people from abroad but has difficulties with its language. Portuguese is not a common language, so they should aim for pulling in people who speak English.

Besides this lack of labor, the Real increased 30% in 2009 compared to the US dollar. This stimulated the import in Brazil, but made the export of Brazil less competitive in the foreign markets.

So the demand for new improved infrastructure in Brazil is high, but the development is restricted by the amount of highly qualified labor and the strong Real.

	<b>Brazil</b>	<b>Netherlands</b>
<b>Amount of railways</b>	28,857 km	2,896 km
<b>Amount of roadways</b>	1,751,868 km , paved: 96,353 km unpaved: 1,655,515 km (2004)	136,827 km (2008) (all paved)
<b>Amount of waterways</b>	50,000 km	6,215 km (2007)
<b>Railways</b>	Privatized	Privatized
<b>Highways</b>	Partly privatized	Not privatized
<b>Passenger transport</b>	Road and air	Road and rail
<b>Cargo transport</b>	Water, road, rail and air	Water, road and rail
<b>Added value</b>	63,766,115,725	44,779,745,751
<b>International market</b>	European union	Mercosur
<b>FDI world ranking</b>	#4	#5
<b>Monthly net income construction sector</b>	225 dollar	2,400 dollar
<b>Labor productivity</b>	21% of the US level	Above US level
<b>Amount of qualified labor</b>	Low	High
<b>Interest rate</b>	8.75%	1.0%
<b>Inflation rate</b>	5.17%	1.0%
<b>Investment</b>	27 billion euro	47 billion euro
<b>Investment (% of GDP)</b>	2.0%	10%
<b>Public-private partnership</b>	Slowly integrated, low usage	Fully accepted, high usage
<b>Upcoming events</b>	Fifa World Cup 2014 Olympic Games 2016	Holland-Belgium bid Fifa World Cup 2018 and 2022

**Table 5: Comparative table**

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