Evaluating the foundation for foreign pharmaceutical R&D in Brazil

An assessment of the Brazilian national innovation system from a global pharmaceutical R&D perspective

Supervisor: Niels Mygind

Department for International Economics and Management

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Tobias Kok
M.Sc. International Business

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Mathias Nedahl
M.Sc. International Business
**Executive summary**

The BRIC markets’ importance is increasing as they provide large profit potential for multinational pharmaceutical companies (MNPCs) facing increasingly saturated domestic markets. As a consequence the MNPCs rely more on a strong performance from its subsidiaries in these markets. Theoretically, this performance is assumed to depend upon, and drive, the level of subsidiary autonomy. In this relation, a high level is synonymous with R&D mandates that enable the subsidiary to reap a higher market value. The decision of dividing R&D mandates between headquarter and subsidiary is influenced by three factors i.e. the national environment of both headquarter and subsidiary and the global corporate strategy. As the 25 largest MNPCs have allocated R&D within all the BRICs, except Brazil, it is deducted that the decision to avoid Brazil is related to the host environment and not domestic markets or corporate strategies. As a consequence, the problem statement to be investigated in this thesis is as follows:

> Why have none of the 25 examined MNPCs any R&D centers in Brazil despite a favorable market size, high pharmaceutical market value and the theoretical argument that high subsidiary autonomy in form of R&D will increase performance?

In order to answer the problem statement the following hypotheses are tested:

**Hypothesis A:**
- The Brazilian host environment is properly developed and provides necessary conditions for foreign pharmaceutical R&D.

**Hypothesis B:**
- The Brazilian host environment for foreign pharmaceutical R&D subsidiaries is premature.

Hypothesis A proposes that the Brazilian host environment is capable of providing necessary conditions for pharmaceutical R&D. In case this hypothesis is rejected, hypothesis B proposes that the market is premature.

**Applied methodology and findings**

The applied methodology relies on Arbnor and Bjerke’s exposition of systems view for creating business knowledge. It argues how the Brazilian host environment has to be understood holistically and not defined as the sum of each societal component.

To carry out the study, the conceptual framework of the broad national innovation system (NIS) has been applied and adapted in correspondence with the systems view. It consists of an analysis of the societal system level combined with R&D focused micro behavior. The analysis of the system level has
been conducted by a PIE-analysis i.e. politics, institutions and economy. The micro behavior has been analyzed by its innovative inputs from the government, educational system and private enterprises and the corresponding scientific and technological (S&T) output to measure R&D efficiency. To obtain a more nuanced and relative picture, a benchmark approach with a peer group i.e. remaining BRICs and the United States is incorporated. Through the methodology and broad NIS analysis we have been able to identify key issues creating a barrier for foreign pharmaceutical R&D in Brazil:

- **Unfavorable regulatory environment**
- **Political instability and corruption**
- **Low and ineffective private R&D spending and processes**
- **Market access difficulties**
- **Shortage in human capital**
- **Inequality in income and healthcare access**

These findings enabled us to reject hypothesis A and accept hypothesis B. By doing so, we concluded that Brazil is premature for global pharmaceutical R&D centers as response to the problem statement.

**Limitations and suggestions for further research**

Due to applied delimitations and lack of certain updated data, further research is advisable. Firstly, we find it interesting to study one of the other parts of the influencing factors when deciding to offshore R&D e.g. individual corporate strategies. Applying Arbnor and Bjerke's actors view i.e. conducting interviews with individual MNPCs may reveal findings that cannot be found in the emerging markets’ characteristics. In this relation it is interesting to obtain, if any, internal company considerations on Brazil as R&D destination, but also the remaining BRICs to identify the important differences.
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1 Introduction

International business literature within the area of global integration and local responsiveness ascribe increasing influence of subsidiaries on multinational corporations’ (MNC) overall performance (Gammelgaard et al., 2012). Consequently management of subsidiaries and their assigned roles and mandates have become a high strategic concern for MNCs. The considerations are under which circumstances subsidiaries perform optimally, how to manage them and how much autonomy should be granted the individual subsidiary? Autonomy is according to Gammelgaard et al. (2012) synonymous with the granting of more advanced roles and mandates, and is often linked to performance. Accordingly subsidiaries conducting more advanced roles have a tendency to contribute relatively more to overall company performance. The corporate decision on how much autonomy to be granted is strongly associated with the global strategy and the host and domestic business environments (Jong & Vo, 2010).

These considerations are highly relevant for MNCs operating in the pharmaceutical industry, as home and mature markets in many areas of the developed world will become saturated (Oriordan et al., 2013). Therefore the largest pharmaceutical companies acknowledge that growth and sustained competitive advantages may be increasingly dependent on effective planning and execution of emerging markets strategies, including subsidiary management and performance in these markets.

The increasing importance of these markets is a significant reason for why Novo Nordisk, the leading pharmaceutical company within diabetes, decided to be first-mover and establish R&D in China (Kristensen & Pogrebnyakov, 2011). Since companies mimic the behavior of competitors in choice of market and type of R&D subsidiaries (Bikhchandani et al., 1992), Novo Nordisk’s decision has later been followed by most of the largest multinational pharmaceutical companies (MNPCs). Despite stronger liabilities of foreignness and liabilities of outsidership than in developed markets, the Novo Nordisk case showed that establishing R&D early in a high potential emerging market can provide competitive advantages by enabling better alignment of the company’s products and capabilities with the local market demand (Vahlne & Johanson, 2009). Additionally it gave them the first-mover priority access to various resources including the local talent pool, desirable physical locations and customer awareness (Kristensen & Pogrebnyakov, 2011).

The process in China has yet to be seen in other emerging markets i.e. Brazil. In this country none of the world’s 25 largest pharmaceutical companies have established major R&D facilities (see Appendix

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1 The liability of foreignness is the additional cost of internationalization caused by low degree of institutional market knowledge in form of rules and regulations, norms and values and cognitive structures (Vahlne & Johanson, 2009).

2 The liability of outsidership is a lack of business-market knowledge in terms of the market, its players and their mutual relationships (Vahlne & Johanson, 2009).
A for a complete list of pharmaceutical enterprises and associated R&D locations). This is interesting due to the fact that Brazil is the only country in top ten, in terms of market value, where no R&D centers are located by MNPCs (Oriordan et al., 2013).

As illustrated on the above world map, it is visible that there exists a clear lack of R&D presence in South America with Brazil as the largest and leading market. With the global pharmaceutical market development, Brazilian market size and historic growth, first-mover R&D possibilities and theoretical recommendations in mind, one might ask what is stopping the industry of performing R&D in Brazil?

1.1 Three theoretical incentives for offshoring R&D activities

There exist vast subjects associated with the intersection between pharmaceutical R&D in Brazil and subsidiary management. This section aims at illuminating some of the potential areas of research. The divisions of mandates between headquarter and operational units primarily responds to the
environmental contexts of both headquarter and the subsidiary and global corporate strategy (Jong & Vo, 2010).

The overall global strategy of a MNC indicates whether a multinational firm imposes a centralized global strategy or a negotiated decentralized strategy on its subsidiaries. The reason for MNPCs not to carry out R&D facilities in Brazil may be a result of correlations between individual global strategies. However, since the examined MNPCs in Appendix A are offshoring R&D to other foreign regions, global strategies are not assumed to be a reason for this pattern.

Threats or lack of home country market opportunities may likewise influence MNPCs’ choice of offshoring R&D facilities. But since the assessed companies in Appendix A origins from a diverse range of regions, individual home country environmental factors may not be sufficient to explain the pattern. Narula (2013) argues that main reasons for offshoring R&D includes tapping into foreign sources of technology, exploitation of foreign initiatives, market proximity and exploitation of cost advantages and labor. These reasons are encapsulated by the host country environmental context, and may impose a direct influence on the degree of subsidiary autonomy. There is a clear appeal for specific research to be conducted in the area of how the host environment affects the division of R&D mandates.

1.2 Problem statement

The above discussion lays the foundation for the following problem statement:

Why have none of the 25 examined MNPCs any R&D centers in Brazil despite a favorable market size, high pharmaceutical market value and the theoretical argument that high subsidiary autonomy in form of R&D will increase performance?

In order to answer the problem statement, the thesis aims at confirming or rejecting the following hypotheses:

\textbf{Hypothesis A:}

- The Brazilian host environment is properly developed and provides necessary conditions for foreign pharmaceutical R&D.

Hypothesis A proposes that R&D mandates are the optimal approach to capture the growing market value in Brazil. In order to test this, an assessment of the environmental premises in form of R&D capabilities, institutions, politics and economics is required. The acceptance or rejection will thus
solely be based on an analysis of the business environment and not contain individual corporate strategy or the companies' home market environments as argued in section 1.1.

**Hypothesis B:**

- *The Brazilian host environment for foreign pharmaceutical R&D subsidiaries is premature.*

The purpose of hypothesis B is to evaluate whether the opposite situation to hypothesis A can be accepted. If accepted this means that despite favorable market growth and size, the host environment may still be unattractive from an R&D perspective.

To test the hypotheses, current state along with potential future changes are considered since either case may impact MNPCs’ decision-making in relation to R&D presence.

### 1.3 Assumptions

Due to the limited scope, certain assumptions are applied. It is assumed that:

- the development in the Brazilian business environment, encompassing historical as well as current state, are useful indicators for estimating future tendencies despite uncertainties. The understanding of these is fundamental in order to respond to the problem statement.

- a group of comparative nations exists. To perform a relative as well as absolute analysis, a reference group is applied comprising the remaining BRICs (Russia, India and China) and the United States. From now, this group is referred to as peer group or simply peers. These are assumed to provide the optimal standard of reference required to answer the problem statement. For a comprehensive explanation of the choice of peers please refer to section 2.4.1

### 1.4 Scope delimitations

Analyzing a market for potential R&D investments is a highly complex task that involves many different assessments ranging from softer cultural analyses to budgeting and cost-benefit analyses.

This thesis is limited to a narrow focus area, which is analyzing the Brazilian business environment on industry and macro-level. This means it will not include any company specific financial forecast such as the potential return on investment. Thus, the analysis should only be seen as complimentary in relation to assessing the potential profitability of investing in new R&D facilities for the individual pharmaceutical company.

Additionally, the following specific delimitations are applied:
• **Market and industry focus:** Despite heterogeneous pharmaceutical companies and thus product and service offerings, this thesis does not take this into consideration. Instead the purpose is to assess the overall market and industry environment for foreign pharmaceutical companies.

• **Distinguishing between pharmaceutical and healthcare industry:** The thesis does not concentrate on the overall healthcare industry, but rather its subsystem \(^3\) i.e. the pharmaceutical industry. We define the pharmaceutical market as including drugs but also devices and delivery services necessary to supply these products. The market includes branded products and generics\(^4\). Despite a pharmaceutical focus, certain aspects of the overall healthcare sphere are still included due to their close relations. This is especially the case for the political sphere where actions may directly or indirectly impact the pharmaceutical market.

• **Qualitative focus including key figures:** The thesis has a predominantly qualitative focus combined with quantitative key figures e.g. market forecasts and economic development. It is limited from not using any econometric analysis, which is mainly due to the requirement of a holistic assessment of the R&D potential.

• **Single type of R&D center:** Certain international business literature distinguishes between different types of R&D activities; implementer and innovator (Kristensen & Pogrebnyakov, 2011). This distinction is not included in the pharmaceutical companies’ definition of their R&D centers and thus this thesis does not follow this distinction.

It is of high importance that the applied delimitations are considered when interpreting the final results, since the outcome would have been different if other limitations had been applied.

## 2 Methodology

The purpose of this section is to clarify the considerations in relation to the applied methodology. This thesis’ methodical principles are largely founded on Arbnor and Bjerke’s exposition of methodology and methodical procedures in creating business knowledge. Their principles include the process from ultimate presumptions into choosing the most appropriate operative paradigm for the specific study area (Arbnor & Bjerke, 2009). This process is illustrated below:

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\(^3\)Subsystem as methodological term is elaborated in section 2.2 methodological view.

\(^4\)A drug product that is comparable to a branded drug’s dosage form, strength, quality and performance characteristics. Generics also include the subcategory of biosimilars.
The model illustrates the whole process and relationship from the initial ultimate presumptions to the applied operative paradigm in the study area.

The theory of science deals with the process from the ultimate presumptions into a more practical methodical view via certain paradigms (Arbnor & Bjerke, 2009). All humans have certain ultimate presumptions that they do not question and based on these we generate our own paradigm of the world and the way it functions (Ibid.). As humans we are all different and part of our own reality, meaning that we see the world and understand it differently. Therefore, a reflection on the authors’ ultimate presumptions becomes critical in order to choose the appropriate theory of science and methodology to understand the Brazilian environment for foreign pharmaceutical R&D. The paradigm has a bridging function between the ultimate presumptions and the methodical viewpoint (Ibid.).

The methodology of the model deals with connecting the methodological viewpoint to the study area via a specific operative paradigm. The operative paradigm consists of the methodic, which covers how the study is planned and executed and the methodical procedures, which cover the use and adaptation of theories and frameworks (Arbnor & Bjerke, 2009).

Thus the process has two functions: to transfer the ultimate presumptions into a methodological viewpoint through certain paradigms from the theory of science and secondly to provide some premises for the operative paradigm applied on the study area (Ibid.).

2.1 The authors’ ultimate presumptions

We perceive and understand the world as consisting of several systems that are components of a larger system. A system is e.g. the public sphere, the political and the social system (Arbnor & Bjerke, 2009). We believe it is impossible to individualize every component of a system and from there
aggregate them to create a holistic picture of that system. The systems reality is thus assumed to consist of components that often are mutually dependent. This causes synergistic effects and dynamics, which mean simple accumulation is insufficient. The requirement for reaching an acceptable explanation or understanding of a specific situation is therefore to consider the more holistic picture.

Theory of science relies on several paradigms, which in the model are transformed into three methodological views; analytical, systems and actors view (Arbnor & Bjerke, 2009).

![Figure 3](image)

Figure 3 “bridging paradigms connecting ultimate presumptions and methodological view” Source: (Arbnor & Bjerke, 2009)

In the following section about methodological views, only the applied view will be discussed. Therefore, there will be made liaison between our ultimate presumptions and the derived appropriate methodological view. Subsequently, the chosen operative paradigm will be accounted for by including methodical procedures and methodic.

### 2.2 The methodological view

As argued, the ultimate presumption is that a system consists of individual and interdependent components that, when added together, brings more than just the sum. That means when the Brazilian environment is to be analyzed, one change in a specific component can both influence other components and have a reinforcing effect. The characteristics for the systems view are summarized in the following table.
The table summarizes the characteristics of the systems view, which corresponds highly to the ultimate presumptions held by the authors. The table shows that knowledge developed by the systems view does not become general in the same absolute way as knowledge developed by the analytical views with a more positivistic thinking. Instead, the theoretical knowledge becomes related to one or several types of systems or to specific systems phenomena, and therefore it becomes systems-dependent knowledge (Arbnor & Bjerke, 2009).

This means that the holistic picture of the Brazilian environment cannot be defined as the sum of the different components in the society, but instead it is the relations between them that create the totality. Further, it is in our opinion that the decisions and actions in the pharmaceutical industry in Brazil cannot be understood without understanding the environment under which it operates. If for example new macroeconomic policies are implemented, the industry may be affected and respond accordingly, which then again may affect the macroeconomic environment. This exemplifies how the system-dependent knowledge applies to analyzing the environment for establishing R&D as a foreign company, and therefore a holistic understanding of the relations and synergies is required.

Applying the systems view as methodical perspective provides the opportunity to understand how the Brazilian environment functions as a system. In this relation, a distinction between different kinds of systems is needed, since one system contain several smaller systems. One system can be a subsystem or supersystem to another system. This can be illustrated by the following figure.

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<table>
<thead>
<tr>
<th>Characteristics of the systems view</th>
</tr>
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<tbody>
<tr>
<td><strong>Conception of reality:</strong></td>
</tr>
<tr>
<td><strong>Knowledge dependent on system:</strong></td>
</tr>
<tr>
<td><strong>Explanation or understanding:</strong></td>
</tr>
<tr>
<td><strong>Result:</strong></td>
</tr>
<tr>
<td><strong>Prerequisites for continuing:</strong></td>
</tr>
</tbody>
</table>

*Table 1 “characteristic of the systems view” Source: (Arbnor & Bjerke, 2009)*
The figure illustrates how different types of systems are related. E.g. system 2 is a subsystem to system 3 but a supersystem to system 1. This rationale is equally applied in the thesis where the surrounding world act as supersystem to the domestic macro environment, but simultaneously comprise the pharmaceutical industry as subsystem.

It is in our opinion that the systems view has a high explanatory value for this study area since focus is on both the relations and the individual components and not just as parallel functioning components. This enables a better understanding of the synergies and dependencies, which in the end will provide a better assessment of the Brazilian environment for foreign pharmaceutical R&D.

2.3 Operative paradigm
Subsequent to the methodical view comes the operative paradigm. The purpose of this is to create a bridge between the methodological viewpoint and the study area as illustrated by figure 3. The operative paradigm is described firstly by methodical procedures and secondly through methodics. These two methods can be described as: “adapting a technique to a methodological view is a methodical procedure, whereas applying this adaptation is methods (Arbnor & Bjerke, 2009)”. Firstly, one will see how the methodical procedure, where the theories and techniques are adapted to the thesis. This is followed by the methodics, where the theories are applied into a project design.

2.3.1 Methodical procedures
The methodical procedure refers to the way the creator of knowledge incorporates, develops, and/or modifies some previously given theories (Arbnor & Bjerke, 2009). In this section, the different models that are to be applied will be described in relation to the systems view and the study area.
2.3.1.1 The conceptual framework of innovation systems

The basic foundation and idea behind assessing the Brazilian business environment for foreign R&D is derived from the conceptual framework of innovation systems. The initial considerations and theoretical development is outlined in this section. One should note that the theory serves as conceptual framework, and is restructured and adapted to the given problem statement.

2.3.1.1.1 The innovation system approach

The traditional neoclassical scholars emphasize the market as the most efficient resource allocation mechanism. Opposite the innovation system literature recognizes that in order to create conditions for capability building, there is a need for government action (Lundvall et al., 2009). The notion of co-institutional interaction and innovation are also integrated in Porter’s cluster framework, where the focus is on interconnectedness of firms, suppliers, related industries and specialized institutions that arise in particular locations (Porter, 1990), and in the PIE-framework that elaborates the dynamics between the macroeconomic variables i.e. politics, institutions and economy (Mygind, 2007).

The innovation system approach has been gaining intellectual and practical coherence over a number of decades (Freeman, 1995; Lundvall, 1985; Nelson, 1993). Common for these contributions is that they deviated from the linear approach to technological progress and placed innovations as driving force behind growth. It went beyond the narrow confines of product and process innovation, focusing on interactive learning, and emphasized inter-dependence and non-linearity wherein institutions play the central role (Lundvall et al., 2009). As the gap between the developed and developing world becomes increasingly stark, economists and policy makers see the innovation system as having great potential, both as a source of understanding the primary causes of economic development, as well as a powerful conceptual framework for policy making (Feinson, 2002). Subsequently, policy makers at national level as well as experts in international organizations for economic co-operation have adopted the concept as a tool for policy making (Lundvall et al., 2009).

2.3.1.1.2 Innovation system spatial boundaries

Defining the spatial boundaries is crucial to conduct a meaningful analysis. Literature on innovation systems distinguishes between national (NIS), regional (RIS) and sectorial innovation system (SIS). These are difficult to determine because system boundaries often cross national borders and enterprises operate in an international context (Ibid.).
NIS is crucial for understanding the national competitiveness. It is the result of historical processes, and innovation policies are part of complex interactions that shape the system.

The boundaries of RIS are regions within countries or across national borders. Asheim and Gertler (2005) define RIS as “the institutional infrastructure supporting innovation within the productive system of a region” (Niosi, 2010).

Niosi (2010) defines SIS as “the system (group) of firms active in developing [...] sector’s products and in generating and utilizing a sector’s technologies” (Ibid.). As opposed to NIS and RIS, SIS focuses on firms and firm interaction within a specific sector, whereas NIS and RIS are equally concerned with government action and institutional setup (Ibid.). Further NIS and RIS are limited by geographical boundaries where SIS is by product scope.

From a thesis perspective, SIS would on the surface be useful since the pharmaceutical industry is in focus. However, as the main research question is related to why none of the examined MNPCs are carrying out R&D activities in Brazil, the NIS is more appropriate.

### 2.3.1.1.3 NIS perspectives
Several scholars have proposed different perspectives to the concept of NIS. Common for most definitions is that they link the system to economic and technological performance, and connects the efficiency and quality of the NIS to the attractiveness of certain FDI (Niosi, 2010). Nelson (1993) and Niosi (2002) emphasize the formal institutions that constitute the NIS – namely research universities, public laboratories, R&D-active firms, a limited set of government departments and the training system (Niosi, 2010). However, Lundvall (1992) proposes a broader approach, and argues that NIS research takes two perspectives. A narrow one embracing institutions dealing directly and explicitly with R&D, whereas the broad includes social, economic and political context. The broad system stems from the realization that technological change is inextricably linked to the overall institutional fabric of society. Besides including the narrow elements, it further considers social institutions, macroeconomic regulation, financial systems, education and communication infrastructure and market conditions as far as these have an impact on the learning and competence building process (Lundvall et al., 2009).

Lundvall et al. (2009) use the term *micro behavior* as the components taking place in the narrow perspective, while the *system level* is those components added by the broader perspective. They argue that these two levels provide a systematic perspective by linking the two dimensions in a two-way direction.

The micro behavior will be framed by an analysis of innovative input and the subsequent science and technology (S&T) output as proposed by Jun-fang (Jun-fang, 2013). Innovative inputs constitute innovation fees and human resources, and are measured by R&D expenditures and R&D researchers
The assessment of S&T output is proxied by available data on resident patents and amount of scientific articles. This will be discussed further upon application. When dealing with developing economies, Lundvall et al. (2009) argues that the narrow perspective, isolated, is of limited relevance. Due to the relative difference in the system level between developing economies, investment and progress in science does not match innovation outcomes and economic performance. By only considering the narrow perspective, the innovation system may not be fully assessed and important linkages and synergies may be left out.

### 2.3.1.1.4 Advantages of the innovation system approach

Since the purpose is to understand why MNPCs choose to disregard R&D in Brazil, the NIS serves as a solid conceptual foundation due to its linkages between macro environment and R&D. It further centralizes around the role of institutions, as they are considered to be crucial elements in all versions of the approach. These are shaped by the actions of the organizations and the relations between them (Lundvall et al., 2009).

The approach emphasizes interdependence and non-linearity (Ibid.). This means, learning is built upon interactions between organizations through complex relations with reciprocity and continuously feedback mechanisms. Innovation is thus based on interactive learning, which is contrary to the linear model of innovation, where science is the basis for innovation and an increase in the scientific inputs will cause the number of innovations, as well as technologies, to increase (OECD, 1997).

The NIS approach is furthermore in accordance with chosen methodological viewpoint, as it adopts a holistic and interdisciplinary perspective when trying to include all-important determinants of innovation. The approach also employs historical and evolutionary perspectives and renders the notion of optimality irrelevant, because no systems have been going through the same evolution and has the same historical characteristics.

The efficiency and quality of a NIS is finally directly related to a nation's ability to attract R&D FDI (Niosi, 2010). This makes the NIS concept advantageous when assessing the Brazilian business environment for R&D FDI.

### 2.3.1.1.5 Critic of the NIS

A main critic of the NIS is the embedded conceptual confusion (Edquist, 2001; Niosi, 2010; Lundvall et al., 2009). Researchers and scholars apply the concept inconsistently, which entails non-clarity. Institutions are e.g. a diffuse term as some scholars use it both as a description of organizational actors

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5 Government includes all public activities besides those taking place in the higher educational system i.e. universities.
like enterprises, universities and public agencies, and others as a description of institutional rules (e.g. sets of common habits, routines and laws). In this thesis, North’s definition of institutions is applied, which will be elaborated in the description of the PIE-model in section 2.3.1.2.

An additional confusion is related to the functional boundaries of the innovation system. It is still unclear what to include in the system and scholars have deliberately not given any indications for this (Niosi, 2010).

A final weakness outlined by Edquist (2001) is that the NIS approach is not a formal theory because the relations between the variables are not described in a rigorous manner, and the functional boundaries of the system are vaguely defined (Ibid.). The NIS approach is what Edquist calls a conceptual framework.

2.3.1.2 PIE-model

The purpose of this section is to briefly describe the PIE-model and its elements, why it is chosen as model for the NIS system level and related critiques and limitations.

The PIE-model is an analytical framework for analyzing the societal level (Mygind, 2007). It consists of the three main systems; politics, institutions and economy. The interactions between the systems are in focus, and the dynamic perspective must show how the different systems influence each other, and go into processes of dynamic change of the model. This interaction makes it clear why the term of path-dependency is important. It means the current institutions are the result of earlier developments, and at the same time they set the rules of the game for future changes (Mygind, 2007). For example some groups may have an interest in keeping status quo, which may be a barrier for change in case they are strong enough to defend their position. Opposite, other cases have shown social groups that have been strong enough to demand changes, which may cause the institutions to change. Thus, the dynamic interaction is path-dependent meaning the initial conditions are decisive when determining the next step (Ibid.).

Despite the considerable societal coverage of the three systems, the surrounding world has an important impact on the three systems as well. The list of surrounding influential factors is extensive but important to keep in mind for the specific analysis. Additionally, the elements in the model have different importance depending on the specific analysis, and thus the elements should be weighted differently for the specific analyses. See the below figure for an overview of the three systems and their influence on each other and impact from the surrounding world.
2.3.1.2.1 Advantages of the PIE-model

The aim of applying the PIE-model is to emphasize the political, institutional and economic environment that, direct or indirectly, affects the attractiveness of conducting R&D from the MNPCs' perspective. Further, the focus is on the synergies and relations that add up to more than the sum, which is in accordance with our methodological view. Additionally the model is found useful due to its holistic nature and focus on interactions between the three categories, which is neglected in similar models. This is contrary to other theories such as the PEST or PESTEL model. These models do not include the dynamics between the elements and do not make an appropriate emphasis on the importance and role of institutions.

2.3.1.2.2 Politics

The political part of the model is based on the distribution of power, income and resources on the citizens, who can be divided into different social groups (Mygind, 2007). Political processes are defined as the process of the formulation and administration of public policy usually by interaction between social groups and political institutions. However, it is important to point out that the political institutions are not a part of the political part, but the institutional part. This is done to specify the
dynamics between the political processes and the changing institutions, and therefore the political institutions are separated from the processes to form an important part of the institutional system. This also applies for other elements e.g. economic policies that could be defined as part of institutions on a more applied level and as part of politics and in fact also as part of the economic environment. These examples show the considerable overlapping and synergies between PIE-elements (see Appendix B for a full illustration on related overlaps).

2.3.1.2.3 Institutions
The institutional part of the model departs from North’s institutional perspective (North, 1990). He believes human beings devise institutions as constraints on human behavior to shape human interaction, and that these institutions can be both formal and informal (Ibid.). Since the political and economic institutions define the rules of the games in any society, and high institutional quality is a growth driver, they are both included in the main system in the model (Mygind, 2007). The political institutions define the rules for how the political system functions. The economic institutions set the framework for the rules of the game in the economy. Additionally it is required to consider to what extent the rules are actually enforced in the society, obligating a separate section on enforcement. Finally the informal institutions lay down a set of unwritten rules of the game both for politics and the economy. Further, these often emerge when formal institutions fail. The change in the formal institutions is often done through political process and therefore the dynamics go both ways between politics and institutions (Ibid.).

2.3.1.2.4 Economy
The economy is divided into two parts: the flow variables such as GDP, investments and consumption (Mygind, 2007). The other part is the stock variables, or resources, such as human resources, size and quality of the workforce and capital equipment (Ibid.). The synergies and interdependency is seen by the economy being strongly influenced by the economic institutions and economic policies determined in the political processes. The economy also sets the base for the distribution between social groups, hence it also influence the institutions through the political system. Additionally, the economic development and the accumulated resources at a certain technological level also influence the potential and high quality and enforcement of institutions (Ibid.).

2.3.1.2.5 Critique of the model
The PIE-model suffers from the same as many other models that try to understand the extremely complex world that surrounds us. It will never be possible to make a correct model of the real world,
which means this model also simplifies aspects of the society being analyzed. These considerations are related to the specific definitions of the parts included in the model, and the problem where to place the different and overlapping sub-components. Additionally, the stressing of weighting the different components means the result will have a subjective bias due to the individually set weights.

2.3.1.3 Interplay between PIE and NIS
The two frameworks serve different purposes and perspectives as argued above. Where the NIS-framework applies an innovative approach and focus on innovation creating institutions and interactions, the PIE-framework adopts a model mainly for assessment of the general societal level. Despite dissimilarities, the two frameworks ascribe equal importance of systems, interconnectedness, dynamics and non-linearity as crucial for understanding the object in focus. This is highly in accordance with the applied methodological systems view.

Lundvall argues that, when assessing an emerging market, the NIS analysis should include the system level and micro behavior. He states that, micro behavior includes components directly affecting the innovation process i.e. R&D activities, and components in the system level assist in carrying innovation out indirectly. The components directly related to the innovation processes are easily assessable, but the system level is more diffuse as criticized by Edquist. To comply with this critique, this thesis aims at incorporating the PIE-framework as an embedded analysis in the NIS-framework at the system level creating a hybrid framework. I.e. when assessing the system level this thesis departs from the PIE-framework, which is better at including various elements compared to those stated by Lundvall. The purpose of applying the PIE-model is to emphasize the political, economic and institutional factors, dynamics and interrelations affecting the future attractiveness of the Brazilian host environment for foreign pharmaceutical R&D FDI.

2.3.2 Methodic
Methodic is the way in which the creator of knowledge relates to and incorporates the techniques into the study process, and the way the study is planned and conducted (Arbnor & Bjerke, 2009). Based on this knowledge, this section aims at illustrating the relations between the individual sections in the project and how the project process will be completed. Therefore one will find a developed project process design for this purpose below. The objective of each individual section in the design is described below the model.
The project design above illustrates the complete process flow. Because the introduction and main part of the methodology section are prior to this description, these will not be further elaborated. Instead the focus is on the pending parts of the thesis. The remaining part of the methodology includes a concise discussion of the applied data collection method along with assessing its strengths and weaknesses. This is followed by a review of the most distinctive data sources and the validity of those.
Subsequent to the data section is the literature review. The purpose is to generate the foundation for the problem statement and legitimize the area of interest. The problem statement is built upon a bipartite foundation: firstly a theoretical discussion about how higher autonomy increases subsidiary performance and secondly, empirical arguments for increasing potential in emerging markets for pharmaceutical companies. The combination of these two pillars sets the frame for the following analysis.

The literature review is followed by an overview of the Brazilian democratization process. This will include the political, institutional and economic highlights from the late period of military regime up to Dilma’s inauguration as president in 2010. The purpose is not to provide a detailed analysis of Brazil’s democratization process and development, but instead to give an overview of main events and to identify the path-dependency described in the theoretical part about the PIE-analysis. This enables a clarification of how the current environment and institutions are a result of earlier development stages. Further an understanding of previous dynamic interactions and their path-dependency are also decisive for predicting future developments, i.e. an identification of long-term trends.

Built upon the historical discussion, an analysis of Brazil’s current environment is provided through the PIE-framework. It frames the analysis on system level in relation to the NIS. This includes politics, institutional and economic elements of relevance to MNPCs’ performance and ability to carry out R&D facilities along with the dynamics and interrelations. Each PIE-element will be summarized in a sub-conclusion on risk and opportunities along with considerations about potential changes in a medium-long term i.e. 5-10 years. The time horizon is chosen due to the specific purpose, which is focused on FDI decisions rather than non-binding export contracts. Further, because investment in pharmaceutical R&D requires up to ten years research to develop successful products. Predictability is important because it will provide an answer to the future potential and not only why no MNPCs currently are conducting R&D in Brazil. However predictions on a medium-long term is attached with high uncertainty, which has to be considered at interpretation. Further, some aspects of the environment are characterized by such volatility that it is close to impossible to provide meaningful predictions. For example institutions are often more stable than macroeconomic variables resulting in shorter economic estimates.

The analysis on the system level is followed by a more narrow discussion about the R&D environment encompassing the micro behavior level of the NIS. This level is completely, or to a large extent, a result of system level activities and thus a direct outcome of those. The main components of the micro behavior include government’s, private enterprises’ and universities’ attitude towards R&D. As with
the system level analysis, this micro behavior discussion will similarly contain considerations regarding potential changes in medium-long term.

Finally the thesis will contain a conclusion followed by a discussion of the theoretical applicability and suggestions for further research.

2.4 Data collection methods

With the applied methodic in mind, the following aims at elaborating the method used for answering the problem statement. It will be argued why the applied data collection method has been chosen along with assessing its strengths and weaknesses. This will be followed by a review of the most distinctive data sources and the validity of those.

Secondary data constitute the heart of the thesis. It has been discussed to collect and apply primary data, but several contacts have been made to pharmaceutical companies without success. The aim of the contacts was to obtain information about selected enterprises’ rejection of, or potential future strategic initiatives towards, Brazil as an R&D hub. It appears to be business critical information, which is not allowed to be distributed to a limited audience. Off-the-record conversations have however been conducted but since the data source cannot be validated the relevant information has been confirmed through search for secondary sources, which instead has been applied as data source if the validity of those are satisfactory.

Applying secondary data allows the collection of multiple data sources relatively timely (Ghauri & Grønhaug, 2005). Using library corridors and search engines, a large amount of data has been obtained from multiple data sources. The accessibility of secondary data is additionally high with e.g. online databases and library reports (Ibid.). This allows for crosschecking the collected data. It enables the reduction of biasness from individual data sources, which e.g. may have been the case if a limited amount of primary data collections was applied. The accessibility further enables the generation of new insights from the large data amount (Fàbregues, 2013).

Feasibility of both longitudinal and international comparative studies is another advantage of secondary data (Ghauri & Grønhaug, 2005), which to a high degree is relevant for the problem statement. Continuous or regular surveys such as government censuses or official registers are especially good for the applied research purpose. The fact of being performed on a regular or continuous basis allows researchers to analyze the evolution of e.g. macroeconomic flows. Something similar occurs when performing comparative studies with e.g. selected peer economies. Although important differences
between countries may exist, the truth is that censuses and other government studies tend to unify criteria all over the world or, at least, within certain geographical areas or organizations e.g. EU and OECD. Another example is studies carried out by international networks that aim to collect global information following the same criteria. The Global Competitiveness Report and Doing Business Report are categorized among those, processing sources of empirical data on attitudes covering a majority of the world’s population. They are carried out by a global network of scientists that conduct national surveys. Aiming such data for comparative or longitudinal studies through primary data collection is difficult and often lacks the consistency that diverse social context comparisons require.

Among the disadvantages for reliance on secondary data is the inappropriateness of the data (Denscombe, 2010). Primary data is collected with a concrete idea in mind, usually to answer a research question or just meet certain objectives. In this sense, secondary data sources may provide one with vast amount of information, but quantity is not synonymous of appropriateness. This is simply because it has been collected to answer a different research question or objectives. The inappropriateness may, for instance, be because of the data was collected many years ago, the information refers to a entire country when one aims to study a specific region, or the opposite, one aims to study an entire country but the information is given in a region wide. Two possible ways exist to overcome this obstacle. One way is answering the research question as good as possible with the available material or the second way i.e. to find an alternative technique of data collection, such as surveys or interviews.

A second, and maybe more worrying disadvantage, is the lack of control over data quality (Saunders, 2011). Accessible data ranges from governments and other official institutions to subjective opinions from individuals. For this reason, quality issues must be verified from reliable data sources. In extension to this, a review and the validity of the most distinctive data sources will be provided in the following section.

### 2.4.1 Applied data for analysis

Several data sources will be applied to answer the problem statement. The sources range from private newspaper articles to government statistics, research papers, independent organizations, financial institutions and consultancy reports. To provide a relative and more nuanced assessment of Brazil, this thesis will, when applying quantitative data, include a peer group of economies i.e. the remaining BRICs and the United States. The remaining BRICs are chosen due to their size and growth potential. The argument for including the United States is however not only the size but also its status within R&D. It can provide a comparative aspect to illuminate the potential gaps between Brazil and the main
contributor within pharmaceutical R&D.

World Bank (World Bank, 2015) is among the most cited sources in the thesis. The World Bank is an international financial organization that provides loans to developing countries for capital programs. The main sources of data from the World Bank come from the individual member countries’ statistical systems. Developing countries, which under-invest in national statistical systems may result in poor data quality. Even though World Bank presents the data, it relies on the individual nations’ database and quality. However World Bank helps in improving the capacity, efficiency and effectiveness of these nations’ statistical systems. It is assumed that the United States data is representative and valid but shortcomings may appear when dealing with developing nations as the BRICs. However, the applied nations have developed and invested in national statistics systems that to a certain degree are presumed as reliable and valid. Among the data presented by World Bank is simple economy flow and stock variables along with more advanced and abstract measures such as political stability\(^6\), voice and accountability\(^7\) and government effectiveness\(^8\). While the former simple variables are straightforward the latter are more complex. The score ranges from -2.5 to 2.5 (2.5 equals best performance) and are calculated on quantitative data collected by member nations. Each variable is further elaborated when applied in the analysis. Further World Bank publishes its Doing Business report including 185 economies, where a ranking of 1 means that the regulatory environment is more conducive to starting and operation of a local firm.

Along with the World Bank, data from the International Monetary Fund (IMF) has been applied (IMF, 2015). IMF is an organization of 188 countries, working to foster global monetary cooperation and secure financial stability. Data from IMF embraces simple economic stock and flow variables such as commodity prices. The data collection method for IMF is similar to the one applied by the World Bank, which to a similar degree is expected to be reliable.

Other organizations that are representative for the applied data sources include United Nations (UNESCO, 2015), IMD (IMD, 2014) and OECD (OECD STI, 2014). All the sources are internationally recognized and assumed to be representative and valid. The data from these sources are primarily simple measures such as R&D spending per sector or R&D employment per sector.

\(^6\)Reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means.

\(^7\)Reflects perceptions of the extent to which a country’s citizens are able to participate in selecting their government, as well as freedom of expression, association and free media.

\(^8\)Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government’s commitment to such policies.
The last distinctive data source, which will be elaborated, is the *World Economic Forum’s Global Competitiveness Report* (Schwab, 2015). The data is collected through hundreds of partnering institutes across the assessed countries, which by World Economic Forum is expected to be representative for the population. The aim of the report is to measure national competitiveness across different national dimensions such as infrastructure, macroeconomic environment, education and innovation. The quantitative data from the report are globally ranked on a score of 1-7 (7 equals best performance). The dimensions of interest to this thesis are selectively chosen to support arguments and provide new insights. Besides ranking and scoring variables, the report further establishes a list of the most problematic factors for doing business country-wise.

Among the less international recognized and well-know indexes that has been applied is the *Freedom House* (Freedom House, 2015), *Intellectual Property Right Index* (IPRI, 2014) and the *Social Trust Index* (Medrano, 2014).

Freedom House is an independent gate organization dedicated to the expansion of freedom around the world. Among the supports of the organization is the European Instrument for Democracy and Human Rights, U.S. Department of State and U.S. Agency for International Development. The organization produces various reports aiming at highlighting the level of national freedom based on different criteria e.g. political rights and civil liberty. The findings are reached after a multilayered process of analysis and evaluation by a team of regional experts and scholars. Although some degree of subjectivity may be unavoidable, the process emphasizes intellectual rigor and aims for consistent and unbiased judgments.

The Intellectual Property Right Index aims at scoring nations on a scale from 0-10 where ten is best performing and thus indicating a country where property rights are secure. The index distinguishes between legal and political environmental, physical property rights and intellectual property right, among which the latter is applied in the thesis. The index is constituted on data from external data sources and includes World Economic Forum data on intellectual property protection and anti-counterfeiting, Ginarte-Park index⁹ and International Intellectual Property Alliance’s report submitted by U.S. Trade representatives. Among the partners to the index are U.S. Property Rights Alliance, U.K. Institute of Economic Affairs and DE Institute for Free Enterprise.

The Social Trust Index aims at discovering to what extent the population believes that most people can be trusted. An index above 100 correspond to countries where a majority of people trust others, while an index below 100 correspond to countries where the majority of people think one can never be too careful when dealing with others. The author behind the data is ASEP/JDS, which is a Spanish database.

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⁹Internationally applied index based on regressive calculations used by e.g. Institute for International Economics
bank. It further receives support from the BBVA Foundation i.e. the largest Spanish bank. Even though ASEP/JDS is cooperating with World Values Survey and proclaims quality criteria and sample quality, the data should be critically evaluated, since the sample distributions in some countries, may diverge substantially from their respective population distributions. Further the data collection time frame is set to the 1995-2009 period i.e. some data is collected in 1995 and other in 2009. The data for Brazil and the peers is from 2006-2008, which means the data can have changed considerably since. This has to be considered in the assessment.

3 Literature review

The purpose of the literature review is to provide a well-founded reasoning and legitimization for why this topic is of relevance. As mentioned earlier, the problem statement is built upon a bipartite foundation: firstly a theoretical discussion about how higher autonomy increases subsidiary performance and secondly empirical arguments for increasing potential in emerging markets for pharmaceutical companies. These theoretical aspects will be discussed separately in the following sections.

3.1 Headquarter and subsidiary relationships

The pressure from globalization and increased international competition creates incentives for multinational corporations to change their organizational structures and strategies. From the subsidiary point of view, the main question is how to effectively integrate into the local host country and simultaneously benefit from the intra-organizational network. Intra-organizational networks are positively associated with subsidiary performance, as they improve learning processes, lowers transaction costs and stimulate subsidiary’s entrepreneurial activities (Vermaik et al., 2005). Research indicates that the subsidiary network relationship with the parent company is valuable as knowledge sharing positively affects innovations (Monteiro et al., 2008). Lou (2003) suggests that parental support reduces the subsidiary’s dependencies on resources located in the host country, which in turn reduces the uncertainty associated with subsidiary operations.

In scientific literature (Gammelgaard et al., 2012; Birkinshaw & Morrison, 1995; Taggert, 1999; Brooke, 1984; O’Donnell, 2000) denote a subsidiary’s ability to integrate effectively into the host country by the degree of autonomy from parent company. Brooke (1984) argues that autonomy are present in organizations in which units and sub-units possess the ability to take decisions for

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10 Intra-organizational networks consist of the parent company and the other subsidiaries of the MNC.
themselves on issues which are reserved to a higher level in comparable organizations. O’Donnell (2000) refers to the degree to which the foreign subsidiary of the MNC has strategic and operational decision-making authority. This definition is closely related to Taggert (1999) taxonomy of autonomy claiming that highest level of autonomy is obtained when subsidiary obtains mandate for R&D.

The evidence on whether high levels of autonomy are directly related to performance is limited and mixed. Birkinshaw & Morrison (1995) finds that high and low levels of autonomy lead to increased performance. From the subsidiary evolution perspective, autonomy is often associated with performance because autonomy often correlates with the granting of more advanced roles to the subsidiary (Ibid.). Subsidiaries that have low degree of autonomy will therefore often benefit from increased autonomy, and highly autonomous subsidiaries are likely to be able to take on advanced subsidiary roles, such as R&D. This is supported by Edwards (2010), arguing that the upgrading of subsidiary mandate to R&D facilities will provide a number of market access benefits by engaging local stakeholders early in the product development, and give companies insight into how they could tailor products to local needs. Thus, theoretically, upgrading from e.g. manufacturing to R&D mandate will enable a MNC to consume a larger share of the market size.

There are counterarguments to this outcome. Autonomy can lead to the subsidiary taking a peripheral position in the intra-organizational network, leading to lower level of parent company support (Phelps & Fuller, 2000). Alternatively, autonomy can be used by subsidiaries to engage in rent-seeking behavior (Mudambi & Navarra, 2004) or the development of location-bound resources (Rugman & Verbeke, 2001). Additional, decisions solely made by autonomous subsidiaries might not be as good as decision negotiated with the parent company, which would build on a larger knowledge base (Aghion & Tirole, 1997).

The limited empirical evidence suggests that increased autonomy positively affect performance, at least in some cases. This leads Gammelgaard et al. (2012) to conclude that performance to some degree is correlated with autonomy. The hypotheses in section 1.2 are built upon the arguments that increase in autonomy to R&D mandate will benefit subsidiary performance, but the theoretical review argues in favor for further research to be conducted. In order to test the hypothesis no universal theoretical arguments are present, which argues for case specific factors of importance to be evaluated in order to accept or reject the proposed hypotheses.
3.2 Justifying the relevance of emerging markets

Emerging markets are rapidly becoming the driver of global growth. According to the International Monetary Fund, emerging economies are expected to grow two to three times faster than developed nations (Forbes, 2014). Since corporate profits tend to grow faster when economic growth is higher, emerging markets has become a target for international businesses.

From the previously described headquarter-subsidiary perspective, this growth could be exploited by increasing autonomy through R&D mandates at subsidiary level in the largest(s) emerging markets. Another benefit for investing in R&D in emerging markets is the diversification perspective. The emerging markets tend to perform differently than developed markets, and have been successful at decoupling from the greater, longer-term woes of the mature economies of the West (Levaux, 2014).

3.2.1 Characteristics of emerging markets

In the economic development literature emerging markets, or economies, are recognized as countries with lower than average per capita income and fast growing markets (Lorentz et al., 2013). Scholars often refer to this as convergence theory. Convergence of productivity among nations in the global economy has been one of the most standard predictions of neoclassical theory (Niosi, 2010). Advanced and wealthy nations would eventually experience declining growth rates as return on investment in these nations would be lower; conversely, poor countries would attract capital because of their tendency to offer higher rate of return.

Growth is determined by factors of production, such as private capital, public capital stock, labor, technology (Shah, 1992), or resource endowments (Engerman & Sokoloff, 2002), alongside geographic features, i.e. climate, health, soil quality and access to markets (Gallup et al., 1999). Further, resources and geography have shown to have an indirect effect on economic performance through the construct of institutions (North, 1990). Institutions predominantly determine the use and development of resources in a given geographical setting, and further, the competitiveness of a country (Rodrik et al., 2004).

Depending on the determinants, factor of production growth can take form as either extensive or intensive as encapsulated by the following production function:

\[
Production = \text{\textit{function}} (Q \ast L \ast T \ast K \ast R, TFP)\]  

Equation 1 "production function" Source: (Mygind, 2015)

\[L = \text{Input of labor, } Q = \text{Quality of labor, } K = \text{Input of capital, } T = \text{Quality of capital / technology, } R = \text{resource endowment, } TFP = \text{Total factor of productivity / efficient use of inputs}\]
Extensive growth is characterized as simple growth in the inputs labor (L), private and public capital (K) and resource endowment (R)\textsuperscript{12}. It comes from the expansion of ordinary inputs. Since extensive growth is input oriented, it is considered less sustainable and dependable on the use of more resource with existing technologies. Intensive growth, by contrast, involves increased effectiveness, quality and efficiency of these inputs. It is based on growth in quality of capital/technology (T), quality of labor (Q) and total factor of productivity (TFP). This is derived by a more efficient allocation of K, L and R, which results in an increase in TFP. This type of growth is considered to be more sustainable and efficient compared to extensive growth, and thus have a direct effect on emerging nations ability to catch up with more advanced nations. However some emerging nations, as a result, faces the middle-income trap. This means the easy fruits of extensive growth has been taken i.e. labor shortage equals wage increases causing emerging markets to face competitive pressure from lower wage countries. Therefore, intensive growth is required with more weight on Q, T embodied in K, L and TFP.

Besides lower per capita income and growth, emerging markets are further characterized as countries with less sophisticated institutional framework, but ongoing process of changing institutions in the direction of economic liberalization (Lorentz et al., 2013).

The most impressing growth rates are seen in four of the biggest emerging economies: Brazil, Russia, India and China, which Jim O’Neill of Goldman Sachs acronymed into the BRICs in 2001 (The Economist, 2013). O’Neill reckoned they would, over a decade, become front-rank economies, and he was right. Today they are four of the ten largest national economies in the world. Therefore they are obviously also attractive for the pharmaceutical industry. Taken this into consideration, it is interesting that Brazil is the only country among those without any foreign pharmaceutical R&D centers to help reap this increasing market value.

### 3.2.2 Generalization issues

Scholars agree that it is difficult to generalize about emerging markets (Muromcew & Renfrew, 2013). This is due to their diverse geographical positions and differences in socio-economic set-up. Further, they are highly heterogeneous in terms of history, culture, economic and institutional structures. In addition to this, the understanding of the term emerging market may mean different things in different contexts. While international business research tends to focus on social and economic development and associated consequences for businesses, the focus from other scholars may be on a particular\textsuperscript{12} including shift of labor from agriculture to industry include +T
subcategory such as financial markets. However, the general focus in more generic literature is on economic indicators such as growth, inflation or increasing trends in global resource utilization. Emerging markets are also considered to appear highly diverse within geographical regions (Ibid.). They exhibit varied ranges of growth patterns, with different combinations of growth and wealth creation. They also boast different levels of economic openness and freedom as well as disparities in their level of financial stability. Neither are emerging market economies seen to follow similar paths of development despite equal starting point. These and other differences between emerging markets in the same region are not merely due to differences in natural resource endowments, but has a clear connection with the development in values, norms and institutional settings.

The generalization issue is relevant to consider when comparing Brazil’s performance on a wide range of variables with the remaining BRICs. Additionally, the relative difference in the system level between developing economies, investment and progress in science, does not match innovation outcomes. To meet the diversity challenge, a holistic understanding is needed. This argues, as earlier discussed, for the broad NIS approach including the system level i.e. macro environment along with the R&D specific micro behavior.

4 The democratization process from latest military regime

Before analyzing the current Brazilian host environment, a review of the democratization process and growth path is beneficial. The PIE-model serves as framework to understand the main dynamics during the democratization process from latest military regime in 1964-85 to Dilma’s inauguration in 2010. The purpose is to understand the dynamics and path-dependencies between politics, institutions and economic environment. The discussion is conducted iteratively across elements. However each element is analyzed chronologically. This provides a foundation for a more comprehensive analysis of the current environment as well as enabling more qualified predictions for the coming 10 years.

4.1 Politics

The political part involves both social groups and political processes. It is relevant to identify political trends among social groups with varying income levels and demographic tendencies as these have played a significant role in shaping the historical political processes.
4.1.1 Initial movements toward democracy – a pressure from social groups

The movements toward democracy were initiated in 1974 where President Geisel announced intentions to promote a slow and gradual process of political liberalization (Mainwaring, 1986). In contrast to earlier coups where the military returned the power to the citizens relatively fast after a short interregnum, this regime aimed towards a long-term intervention.

The announcement was partly a result of diverse social groups e.g. political parties and the church pushing the regime towards new concessions, which gradually increased the opposition’s political influence. The growing unpopularity of the regime affected its ability to formulate a coherent political strategy and control the presidential succession. This enabled a transition earlier than expected illustrated by the regime’s shift from a strong presidential victory in 1982 to an ignominious defeat in 1985 (Mainwaring, 1986).

In 1985 Brazil elected its first new non-military-regime president, the 74 year-old opposition leader Tancredo Neves. Due to his death he never assumed office and was succeeded by the vice-president, José Sarney, whom took office and terminated 21 years of military rule (Ibid.).

4.1.2 Early democratic period

After the transformation Sarney’s government faced tough challenges such as recession soaring the external debt and draining the national assets, high inflation rates and a demonetized currency. These caused high instability during Sarney’s administration.

In 1989 the first election for president was held under the new Constitution where Fernando Collor from the National Reconstructing Party won. However, he resigned after only two years because he failed to block corruption accusations and trials against him (Weyland, 1993). His vice-president Itamar Franco took office where he faced challenges as hyperinflation and unemployment. As a response he granted high power to his Minister of Economy, Fernando Cardoso, who launched the Plano Real\(^\text{13}\) (Samuels, 2003). The plan eliminated the hyperinflation and due to the success Cardoso was chosen to run for presidency the following term, 1994-1998, by his party and with strong support from Itamar Franco. He eventually won the election against Lula convincingly without entering second-round run-off\(^\text{14}\) (Ibid.).

The Cardoso administration was influenced by major changes in the political and economic institutions, which will be elaborated in section 4.2 on institutional development. One of the changes

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\(^{13}\) Plano Real was a plan to stabilize the Brazilian economy in 1994. It was based on analysis of the root causes of inflation that concluded both an issue of fiscal policy and widespread inertial inflation. It was successful by replacing the old cruzeiro currency and pegging its value to the dollar temporarily.

\(^{14}\) Brazilian presidential elections are a two-round/run-off voting system i.e. a first election with several candidates are held. If none manage to achieve more than 50% of the votes the two best candidates compete in a second round.
was an amendment allowing a sitting Executive Chief to run for re-election. The amendment was passed and enabled Cardoso to run for re-election where he again defeated Lula in 1998 (Samuels, 2003).

**4.1.3 Social groups pushing for equality in the political processes**

After the 2002 election Lula finally took office. Cardoso had during his last term failed to deliver a sufficient decline in the inequality (Skidmore, 2010). Additionally, decisions such as including a vice-presidential candidate from the Liberal Party and a discourse in favor of financial markets were perceived unpopular by low-income social groups. These issues paved the way for Lula and the Worker’s Party (The Economist, 2006). The maps below illustrate the geographical vote distribution in 2002 and 2006 at the second round.

![Presidential election 2002, second round](image1)

![Presidential election 2006, second round](image2)

*Figure 7 “geographical vote distribution 2002 and 2006” Source: (Electoral Geography, 2006)*

It is clear from the illustrations that the inequality issues in 2002 was a major concern throughout the entire country and contributed to a victorious position for Lula. He won the first round with 46,4 percent and the second one with 61,3 against Serra, a center-right politician (Political Database of the Americas, 2005). The strong victory indicated a general change towards the political center-left. This was also visible at the 2006 election where Lula obtained 46,6 percent in the first round compared to Alckmin’s 41,6. Lula improved the second round results where he received 60,8 percent securing him a second term (Political Database of the Americas, 2007).
Figure 7 on the right reveals that Lula won his largest victories in the Northern and especially Northeastern states. These states are also attached with the highest inequality and poverty rates illustrated by the wealth distribution map below.

![Wealth Distribution Map](image)

*Figure 8 "geographical wealth distribution by state, 2008" Source: (Brazil Institute of Geography and Statistics, 2008)*

It can be concluded that the social groups classified by high poverty managed to keep Lula at power despite losing support in the south. This illustrates how social groups influence the political processes.

### 4.2 Institutions

The changes in the political processes caused the institutions to experience significant changes. The following highlights the historical institutional development i.e. political institutions granting higher individual freedom, liberalization of economic institutions and improvement of social constraints.

#### 4.2.1 Political institutions providing individual freedom

As mentioned, the Sarney administration took office in 1986 and fulfilled Tancredo’s promise of passing on a new Constitutional amendment. The constituent assembly began the deliberations in 1987 and concluded its work in 1988 (Alston et al., 2004). The implementation of the Constitution in 1988 completed the political process of re-establishing the democratic institutions and replacing the authoritarian legislation. The purpose of the new Constitution is to guarantee individual rights and limit the state’s possibilities to constrain freedom and regulate individual lives (Economist Intelligence Unit, 2015). It accompanied liberalization of trade, finance and capital flow, passing on efficiency gains.
Additionally, it serves as a relational framework between the federal government, states and municipalities with a decentralization of federal authority to states and municipal-levels.

Concisely the federal government exercises control over the central government. It is divided into three independent branches: executive, legislative and judicial (Alston et al., 2004). The national congress is a two-chamber legislature, consisting of the federal senate and the chamber of deputies. The states are hierarchically below the federal level and function as autonomous sub-national entities with own governments (Ibid.). Currently, Brazil is split into 27 federal entities from which 26 are states and one is federal district. The executive power within these lies with the elected governor. The judiciary is exercised by courts of first and second instance. In addition the Constitution of Brazil also contains direct democracy i.e. the concept of participatory budgeting allowing citizens to vote directly on law proposals (Spada & Gilman, 2015). The intension is to ensure connection to the lower class and to maintain grassroots’ development.

The decentralization of federal authority has resulted in sub-optimization. Highly fragmented states function as autonomous sub-national entities with own governments and varying rules and regulations (Samuels, 2003). This means all states have to comply with federal laws, however, the MNPCs also have to comply with state laws that may or may not apply across all states. The system with federative and state legislature may influence the attractiveness of investing in states differently, which will be elaborated later in the thesis.

During the process towards democracy, the Brazilian military regime was contrasting its neighbors’ from e.g. Uruguay, Argentina and Chile by maintaining significant institutions of a democracy e.g. the Brazilian Congress. Further the political party system abided to include the opposition party, Movimento Democrático Brasileiro, which was initiated by the government in 1965 (Ibid.). Despite these institutions may have served as a facade for the regime, they later proved to be important for the liberalization process since they included a certain continuity of democratic practices and leaders.

### 4.2.2 Economic institutions and liberalization of the economy

One of the major events of the economic liberalization was the replacement of a long lasting import substitution (ISI) policy since 1929 with a more open economy in the late 1980s (Akkersdijk, 2005). The main purpose of the regulatory mechanisms, such as exchange controls and tax regime, was to discourage the outflow of the foreign capital already invested in Brazil and to stimulate domestic reinvestments. The policy was adopted to develop the domestic market and encourage production of goods that usually were imported.
The large domestic market was the main factor for attracting inflows of FDI during the ISI period. Although certain sectors remained closed for FDI\(^{15}\), Brazil did implement a liberal nature of legislation towards FDI, which was maintained during the greater part of the period. The misery of the Latin American debt crisis in the early 1980s coincided with the downswing of the FDI (Ibid.). Macroeconomic instability made investments collapse from 1981-86 as illustrated below. Please note that the figures are separated, as the relative difference between FDI inflows from the period before 1990 and after vary significantly. This is seen on the vertical axes where the first graph ranges to USD 3.500 millions and the second one to USD 60.000 millions.

![Graph 1 "Brazil FDI inflow in millions until 1980s and until 2010" Source: (World Bank, 2015)](image)

After the restructuring of the economy a new and larger surge of FDI entered Brazil. These new flows were induced by the economic liberalization and stabilization, globalization, forming of Mercosur and the favorable attitude of the Brazilian government towards FDI. The exhaustion of the ISI policy took place in the same period. During the beginning of the 1990s Brazilian policy makers further adopted liberalization measures to integrate the Brazilian market into the global economy (Shikida, 2005). This significantly changed the economic institutions and thus the rules of the game. The Cardoso administration further liberalized the economic institutional settings as reactions towards crisis illustrated in the following table:

\(^{15}\) The constraints on inflow involved specific sectors assumed to be of national interest. In contrast with the service sector, which was almost entirely prohibited for foreign investments, FDI faced virtually no absolute limitations in the manufacturing sectors. In sectors the government considered strategic, FDI inflows were submitted to conditions, as associations with local companies or transfer of technology.
The table shows three major economic institutional reactions that were implemented as a result of crises. The first was a consequence of lack of reforms related to the budget in the new Constitution. Under the military regime the budget was solely under the executive branch's responsibility and Congress only had to rubber stamp it. The new Constitution restored the right of Congress to change it. A small, centralized secretive committee could relatively free from oversight of executive branch and parties add modifications. Lack of budget transparency together with hyperinflation increased and revealed the inadequacy of the budget process. The result was a reform that strengthened the role of the executive and Congress as institutions in the process.

Budget deficits, hyperinflation and subnational debt crisis also called for institutional changes. In 1995, 24 states began the process of refinancing the state debts, which was followed by a massive privatization of state owned banks and utilities in 1997-1999. Additionally, the establishment of a rather independent national bank has increased the transparency and confidence from foreign investors. This has resulted in increased confidence in economic institutions following a long-term stable environment in contrast to a political influenced central bank with more short-term interests. However, the central bank is still not legally independent because its president does not have fixed term length. This means the Brazilian president can discharge the central bank president (Binder, 2014).

A third crisis was the high deficit among states. Consequently, the Fiscal Responsibility Law was implemented in 2000 to reduce the deficits and avoid further government bailouts. It significantly increased requirements to states' fiscal governance methods. The increasing deficits were to a large extent caused by high autonomy held by the ruling state governors who often conducted short-term policies to get re-elected.

Some of the institutional reforms were facilitated by increases in tax revenues since mid-1980s on top of an already comparatively high tax burden. The tax as a percent of GDP rose 12 percentage points from 25 to 37 percent between 1993 and 2005 making Brazil an outlier among developing countries.
with regards to extracting resources from society (Lora, 2007). The tax system is further complicated by the state fragmentation, which contributes negatively to an increasing red tape issue.

### 4.2.3 Economic institutions reducing the high inequality

After Lula’s inauguration as president in 2002, Brazil underwent institutional changes to fight high inequality. As part of the government’s strategy to guarantee access to food, Lula introduced the *Fome Zero* program in 2003 (da Silva et al., 2011). Its goal is to eliminate hunger and extreme poverty via different types of support ranging from direct financial aid to creating water cisterns, distributing vitamins etc. One of the most significant initiatives as part of the Fome Zero is the *Bolsa Família* program (The Economist, 2008). The aim is to reduce short-term poverty by direct financial support, and long-term poverty by improving the human capital through conditional cash transfer, meaning that families e.g. only receive support if their children attend schools and get vaccines. Hence it also aims to provide free education to children that otherwise cannot afford it. The graph below shows the development in the GINI coefficient under Lula’s administration.

![Brazil GINI coefficient 2002-2010](image)

*Graph 2 "Brazil GINI coefficient 2002-2010" Source: (World Bank, 2015)*

The graph clearly shows a decline in the inequality from 58.6 in 2002 to 53.5 in 2010 as a consequence of political initiatives. However, the inception-coefficient is high, meaning the inequality remains high despite of the decrease. The Economist (2008) described the Bolsa Família as the “anti-poverty scheme invented in Latin America, which is winning converts on a global scale”. The program was at the core of Lula’s social policy, and his administration managed to reduce inequality with 27.7 percent during the period from 2003-06 (Aragão, 2007). Therefore, it is also believed to have played a vital role in his re-election in 2006.

Another important factor in his social policy was an increase in the real minimum wage. During 2006, after being re-elected, he signed an agreement to increase the minimum wage more than five
percentage points above inflation (Hirsch, 2006). This decision was made in agreement with the Ministry of Finance that favored cautious public spending on one side and unions that asked for a 20 percent increase on the other. Lula's focus was on keeping a tight financial policy simultaneously with the aim of reducing both the primary deficit and inequality, which this deal accomplished (Ibid.). Since the institutions set the rules of the games these changes influence the Brazilian economic development, which are discussed in the following section.

4.3 Economics

As mentioned, the political processes have a casual effect on the institutions, which have a direct influence on the economic development. The main areas to be highlighted are the annual GDP growth and the economic consequences of the primary deficit and high inflation.

4.3.1 Positive but volatile GDP growth

The Brazilian GDP growth has been developing positively, but with volatility since the military regime. The development from 1987 to Lula's termination as president in 2010 is illustrated below:

The graph shows a volatile development but with a positive tendency. The average GDP growth from 1987 to 2010 is 2.69 percent, which is quite positive for such a long period. This section will illuminate the economic development as per ruling government and their related institutional changes described above. This will be analyzed through two periods:
The period with Cardoso as Minister of Economy and later his two presidential terms were highly characterized by the liberalization of the economy. During this period (1993-2002) Brazil experienced an average of 2.85 percent GDP growth. The highest growth rate appeared during his year as Minister of Economy and first presidential term with an average growth of 3.33 percent indicating a correlation between the liberalization and economic growth. His second term from 1998-2002 had a lower average growth of 2.13 percent. Despite a decrease, the number is still rather positive. It can be discussed whether this growth was insufficient to outweigh Cardoso’s poor performance in fighting inequality. As he was re-elected in 1998 due to strong economic developments compared to those in inequality, it can be derived that the people were willing to accept a lower economic growth in case he managed to fight inequality during his second term, which did not happen. 

As theoretically argued, the economic sphere influences the social groups, which then have impact on the future political processes. Therefore, the declining popularity of Cardoso paved the way for Lula who appealed stronger within social issues. Lula’s presidential term however still showed a stronger economic growth with an average of 3.9 percent from 2002-2010. This is despite the global economic meltdown in 2009 where Brazil experienced negative growth. 

The rather volatile economic growth is obviously not only a result of the sitting government, but also economic key variables that have a significant role on the economic development. Other factors of high importance for economic growth are found in the surrounding world, where especially commodity prices are decisive. These are to be described later in the surrounding world section 4.4.

### 4.3.2 State deficit & high inflation

Since the democratization process in the late 1980s, the different Brazilian presidents have experienced similar economic issues but in different scales. These include large national and state deficits and debt, high inflation (hyperinflation during 1980s and beginning 1990s), low savings and high interest rates (Melo et al., 2010). 

The high inflation and hyperinflation inherited from the military regime naturally caused savings to decrease. As a consequence monetary policy measures i.e. increasing interest rates were implemented. Adjusting the interest rates has remained an important monetary tool for inflation control (Melo et al., 2010).
When it comes to the development of the economic resources it is important to consider the debt as a significant explanatory factor. Tight financial policies have historically posed economic constraints and reduced the space for political maneuverability and investments (Ibid.). As a consequence low public investment in economic resources such as infrastructure and human capital has materialized. Opposite Brazil has strong economic resources regarding commodities such as oil, ethanol, agriculture, food and some manufacturing capacities as well. This will be elaborated in the following section.

### 4.4 Surrounding world – benefitting from increasing commodity prices

The economic resources described above expose the Brazilian economy towards changes in global commodity prices. During the Lula administration, the economy benefitted highly from what is referred to as the 2000s commodities boom. This is illustrated in the following graph showing a commodity price index embracing all commodities with base year 2005.

![Graph 4 "all commodity Prices Index, 2005=index 100" Source: (IMF Data, 2015)](image)

Brazil’s strong capacities in diverse commodities enlarge the relevance of the all-including index. The graph illustrates the precipitous development initiating in 2002 and lasting until 2010 but with a remarkable slowdown during the financial crisis in 2007-08. The expansion is highly driven by price increases in physical commodities such as fuel, metal and food (IMF Data, 2015). The boom provided Lula with more flexibility compared to Cardoso that governed under less favorable circumstances. Despite the positive impact from increasing commodity prices, Brazil was also affected by a relatively loss of competitiveness on manufacturing goods, which especially has been fueled by Asian economies with China as the biggest competitor (Sirkin et al., 2014).
Oil is one commodity where fluctuations have had a significant impact on the Brazilian economy. The prices are, as all other commodities, set by supply and demand on the global market place. The oil crises during the military regime placed Brazil in a vulnerable situation. In 1974 approx. 80 percent of Brazil’s total oil consumption was imported, and increases in oil prices imposed a substantial burden on the balance of payments (Potter, 2008). Consequently, reducing dependence on imported energy, particularly oil, became the main objective of a new energy policy. The secession was to be achieved by large investments in petroleum substitutes, notably electric energy and ethanol, and by a substantial expansion in the exploration and domestic production of petroleum. Since, Brazil has made large strides in its journey to decrease reliance on oil imports through increases in the alternative energy source of ethanol and domestic oil supply (Potter, 2008). The reliance on ethanol has made Brazil less sensitive to global oil shocks. The large expansion of domestic energy sources has further resulted in a reversed view of the import-export distribution. The compound annual growth rate (CAGR) of fuel import as a percentage of total import decreased 3,15 percent from 1980 to 2010 (World Bank, 2015). Conversely the export of fuel as a percentage of total export equals a CAGR of 5,97 percent in comparing period. Despite development and increasing independence on foreign oil, the Brazilian economy experienced a setback in the late 1980s and early 1990s. Due to dramatic decreases in oil prices during the oil glut, the government were incapable of sufficiently subsidize ethanol and make it competitive with gasoline. The development towards a relatively stronger oil exporting country caused setbacks on the ethanol industry in the 1980s and 1990s.

4.5 Summary PIE graphic

As initially mentioned, the objective of the historical discussion is to identify path-dependency and interactions between politics, institutions and economy through main events during the democratization process to Dilma’s inauguration in 2010. Additionally the purpose is to establish a foundation for improved insights of the current environment as well as future predictions. The findings from the historical analysis are summarized into the following PIE-framework, illustrating causality and path-dependency between the elements.
The circle illustrates how the overall path-dependency applies to Brazil, where the circular development continuously shapes the political, institutional and economical settings. The democratization process initiated with conflicts between those in power, the military regime, and social groups represented by the opposition and the public. The pressure from social groups led the development in the political processes i.e. democratic election and removal of the regime in 1985. This development established the premise for institutional changes such as the constitutional amendment and liberalization of the economy and financial entities. Additionally, the new constitutional amendment provided more authority to states and regions causing governors to conduct rent-seeking behavior, which increased subnational debt. Due to the institutional changes the economic environment also changed e.g. with the privatization of banks. These had a direct influence on the ability of setting monetary policies to fight the high inflation without being influenced by politicians. Despite institutional improvements, the economy and economic resources such as national debt, high inflation and weak human capital continued to constrain development. This again affects the social groups and thus restarting the circular path.
The illustrated path-dependency is a slow and gradual process constantly shaping the development of the Brazilian society. This can be additionally exemplified with the change from the Cardoso administration to the Lula administration. This was a consequence of increasing dissatisfaction with the development of social issues such as inequality and education during Cardoso’s term despite managing to deliver positive GDP growth. As a result many social groups changed political attitude towards the center-left during the period leading up to the 2002 election. The political processes with the Lula administration then affected institutional changes with programs such as Fome Zero and Bolsa Família. Lula’s institutional changes also influenced the economy by improving human capital and increasing GDP growth benefitting social groups. The social and economic progress during Lula’s period was further influenced by the increasing commodity prices as these affected the financial maneuverability positively.

The above shows how the current Brazilian environment and institutions are a result of earlier developments. The PIE-elements are part of a system where they directly and/or indirectly influence each other depending on the path-dependent process corresponding to the applied methodology. Further, the super- and subsystem thinking becomes visible as an important way of understanding. This is exemplified by the overall Brazilian macro-environment as a supersystem influencing the subsystems in form of politics, institutions and economy. Further the Brazilian environment is a subsystem to the global environment where e.g. commodity prices are determined.

5 System level of NIS (PIE-analysis)

The aim of the system level analysis of NIS is to apply the PIE-framework to illuminate the current political, institutional and macroeconomic environment i.e. from 2010 and onwards that influences MNPCs’ ability to carry out R&D operations. As the PIE-framework has a holistic nature with focus on path-dependency and dynamics, the following current analysis takes the findings from the historical discussion into account to improve the analysis. This is highly in accordance with the applied methodological systems viewpoint. To transfer the analysis from a general perspective to become more case-specific, industry level is included on each PIE-element. Each element will further contain a sub-conclusion summarizing the risk and opportunities for MNPCs considering R&D activities in Brazil.
5.1 Politics

The political analysis departs by looking at relevant social groups. This is based on earlier findings illustrating how social groups are a strong determining factor for potential changes in the political processes. Subsequent, an analysis of the current political situation is conducted. The section concludes with a separate element dealing with the healthcare and pharmaceutical market from a political perspective.

5.1.1 Poor social groups retain Worker’s Party at power

The inequality issues were an important political issue at the 2010 election despite a reduction throughout Lula’s period. With publicly announced support from Lula towards Dilma for President, his success with Fome Zero and Bolsa Família became highly valuable for her. The support gave Dilma an important legitimacy among the lower social groups. This enabled a convincing victory with 55.5 percent of the votes against Serra (H.J., 2010).

The change from nationwide center-left attitude in 2002, to a split between the Northeast as center-left and the South as center-right in 2006 and 2010 has continued to divide the country in the 2014 election. This is highly caused by geographical equality gaps, described in the historical discussion, which continuously persists. In the latest World Bank report, the GINI coefficient was measured at 54.7, which emphasizes a high inequality. In comparison with the improving figures under Lula, it means an increase in the inequality in recent years. By adding GINI data from 2010 and onwards to the graph from the historical discussion, the development is illustrated below.

![Brazil GINI coefficient](graph5.png)

*Graph 5 “Brazil GINI coefficient” Source: (World Bank, 2015)*

The graph displays that Dilma has managed to continue reducing the inequality in her first two years as President, however it also illustrates how the trend is reversing from 2012-13. It could indicate that Lula may have reaped the lowest hanging fruits regarding inequality reduction, meaning his initiatives
may have helped those with lowest barriers from leaving poverty, whereas those left face stronger obstacles. Otherwise, it can simply be interpreted that Dilma has failed to deliver sustainable social policies. To obtain a more relative picture of Brazil’s inequality it is compared to the peers. By comparing with the remaining BRICs and the United States, it becomes even more visible that Brazil faces significant challenges. Latest published coefficients show Russia scoring 40.1, India 33.9, China 42.1 and United States 40.8 cf. United Nations (UNDP, 2014).

The Brazilian middle class, who enjoys decent purchasing power, accounts for 120 million and is expected to increase considerable, which may leverage MNPCs’ distribution abilities (Agarwal et al., 2012). What is important to notice, is that the increase in wealth is mainly attributed the urban areas in the Southeast regions such as São Paulo and Rio de Janeiro. Opposite, these metropolises also have a high inequality, which is observed with millions of people living with limited access to electricity and healthcare in the favelas16. In the rural areas of Brazil more than 80 percent of the population are poverty-ridden, which again emphasizes the significant inequality of wealth- and income distribution and access to healthcare (Euromonitor, 2015).

The increasing inequality from 2012 to 2013 has been a persistent issue for Dilma. Looking at the 2014 election, it is obvious that she continuously benefits from political attitudes on sociality, by winning the election with 51.6 percent against Neves (J.P., 2014). This was the fourth consecutive victory for the Worker’s Party (WP), however, with the smallest margin in Brazil’s history. It can be concluded that Dilma’s weak performance regarding inequality has had an impingement, but not enough to lose the voters’ confidence at the time. Later it will be argued that this confidence has decreased considerably since. The 2014 election results additional showed Dilma and the WP’s dependency on the low-income social groups. This is illustrated on the figures below where the left-handed illustrates which states Dilma won in 2014. The second one illustrates the degree to which states benefit from social welfare i.e. Bolsa Família, which is a core political symbol for the WP.

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16 A favela is a slum in Brazil.
The two maps clearly show a correlation between the percent of receiving welfare and the election outcome. These maps also correspond to the wealth distribution map from 2008 cf. historical discussion in section 4.1.3. In conclusion this proves how the largest and strongest social groups manage to keep those representing their political ideology at power. The development also indicates, that disappointing these strong social groups are undesirable and almost resulted in Dilma losing the latest election in 2014. Due to the demographic evolution in Brazil, inequality issues may consolidate further into the country's social groups and affect future political processes in the medium-long term.

### 5.1.2 Demographic evolution increases elderly social groups

The age distribution is changing significantly, and the average life expectancy of the Brazilian population is improving at a much faster pace than other developing countries (Instituto Brasileiro de Geografia e Estatística, 2014). This is a result of political initiatives, lifting inhabitants out of extreme poverty and provide basic healthcare to a larger proportion of the population. Within the next 20 years, the population over 60 is expected to triple. In the same timeframe, the average life expectancy will rise from the present 75 years to 81 as shown in the figure below.
Figure 11 illustrates the projected development in the Brazilian life expectancy. Since social welfare improvements are a large contributor to this development, it can be deduced that those with a significant improved lifetime belong to the lower income class and may depend on similar programs. This implicates a larger proportion of elderly people will come from a generation affected by low-income and high inequality. Additionally they may not have sufficient time to educate and work their way out of poverty before retirement. This may result in a large social group of elderly people affected by poverty and inequality. For the WP this is "positive" as these social groups constitute their main advocates. From a macroeconomic point of view, the demographers have voiced the concern because the increased amount of elderly people pressures the pension system, as the working population are supposed to support a larger fraction of the society.

In summary the reversing development in inequality and the demographic evolution, causing a higher proportion depending on social welfare and a relative smaller working force, comprise a challenging condition for politicians. For Dilma it is important to find sustainable solutions and to get back on
track on reducing inequality. These challenges and future developments among social groups set the scene for the current political processes.

### 5.1.3 Current political process & ideologies

As mentioned Dilma won against Neves in the country's closest election, ending up splitting the nation between rich and poor (Leahy & Pearson, 2014). This gave the WP a fourth consecutive term meaning Dilma could continue in office from primo 2015. However, the WP is not ruling the country individually. As the Brazilian political system is a multi-party system, the government will often constitute of more than one party. This is also the case for the 2015 government, where the ruling coalition constitutes several parties. This amount of political parties may cause difficulties in reaching agreements and thus checks and balances between parties are anticipated to entail a slow decision-making process.

With the establishment of the new government, Dilma can start focusing on how to break the negative inequality development. At her inauguration she announced to deepen the social welfare network Fome Zero and Bolsa Família that was initiated by her predecessor (BBC, 2014). Despite the socialistic ideology, she is ambiguous on issues that involve privatization and neoliberalism. This is exemplified by awarding favorable grant to private enterprises including the construction of new power plants and roads, as long as it implies a more economical solution than using public workers (Phillips, 2014). Further she permitted the privatization of building airports to improve the infrastructure in preparation for the World Cup 2014 and the Olympics in 2016 (Ibid.).

Personally, Dilma is known for a rough and short temper giving her the nickname as the “Brazilian Iron Lady” (BBC, 2014). A reason is her many sackings of ministers that have been connected to corruption allegations. She has thus prided herself and her administration as investigating and taking corruption very seriously. However, currently she has become a target for corruption allegations. The mass political protests against her and the government have been almost carnival-like. Some of the protestors even announced their homage to the previous military regime. A protestor explained: “I had a great education during the military period. I could live in peace; I could sleep with my windows open. I can’t do that anymore” (Leahy & Pearson, 2014). He is referring to the rise of political corruption scandals and street crime, which according to Schwab (2015) is one of the most problematic factors for doing business in Brazil. This is not an opinion solely from a far-right protester, it is also supported by the wider population. An increasing number, now approx. three in four Brazilians, supports an

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17 Dilma’s PT (WP), Partido do Movimento Democrático Brasileiro (PMDB), Partido Social Democrático (PSD), Partido Progressista (PP), Partido Democrático Trabalhista (PDT), Partido da República (PR), Partido Comunista do Brasil (PC do B), Partido Socialismo e Liberdade (PSOL) and Partido Verde (PV).
impeachment of Dilma (Ibid.). Thus the president’s popularity is suffering in the middle of a flagging economy and a corruption scandal at Petrobas. Taken her history of priding herself and the WP’s attitude towards corruption into account, the scandal may damage her integrity even harder. Despite the scandal, it is very unlikely that she will face any impeachments momentarily. The law states that one have to commit a crime during the current term in office (Knowledge Wharton, 2015). Since the allegations are not based on events in the current presidential term, she has to actively engage in covering up, before the opposition can impeach her for corruption. Despite Dilma cannot be legally impeached at the moment, the scandals and protests create political uncertainty.

The scandals and protests indicate a high political instability in Brazil, which can be quantified via the World Bank indicator for political stability and absence of violence. This indicator reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism (World Bank, 2015). The indicator development is visualized in the below graph.

![Graph 6: Political stability and absence of violence/terrorism](Source: (World Bank, 2015))

The graph illustrates how the Brazilian political stability has been fluctuating between -0,25 and 0,25 from 2008-2013. This makes it the best performing BRIC country but relatively far from the United States. Despite being the best performing BRIC, the Brazilian score indicates political instability. This was the case of Confederations Cup, World Cup and the latest’s Petrobras scandal. Aggregated, it can be anticipated that these events will decrease the indicator even further for year 2014 and 2015. The rather poor political stability is supported by the Global Competitiveness Report stating that political instability is one of the most problematic factors for doing business in Brazil (Schwab, 2015).
**5.1.4 Opposition seeks to exploit political instability and dissatisfaction with Dilma**

The opposition is currently seeking opportunities to gain more public support due to the political instability (Leahy & Pearson, 2014). While the Petrobras scandal has fuelled the discussion about impeaching Dilma, she also faces other challenges from the opposition. In the beginning of the current term she entered into an open conflict with her main coalition partner from the centrist PMDB, demanding more power after trumping her WP in last year’s elections to become the dominant part in the lower house (Leahy & Pearson, 2014). The speakers of the lower house and the senate, both from PMDB, kicked the year off by rejecting legislation on fiscal tightening proposed by Dilma (Ibid.). Despite this, she recently provided her coalition partners the responsibility for political coordination between the presidential palace and congress to Michel Temer, her PMDB vice-president (Leahy & Pearson, 2014). The opposition is claiming that the new finance minister, Joaquim Levy, is pushing Dilma into outsourcing important government functions. An analyst from Eurasia Group explains this situation as a weakening of Dilma’s power. Other analysts explain that the market is seeing Levy as autonomous and as the best hope of restoring the budget balance (Ibid.). This means Dilma has a low negotiation power in relation to dictating policies against Levy because of fear for him resigning, which could cause a significant investor exit and potential market collapse. In summary, the perceived outsourcing is reducing Dilma's power and room for political maneuvering only three months into her new presidential term.

**5.1.5 Politics and the pharmaceutical industry**

Following the current national political situation, it is necessary to extend the analysis towards healthcare politics. As argued in section 1.4, the pharmaceutical industry has a historically intimate relationship with healthcare politics and reforms. It has played a vital role in the advancement of medical care, and continues to drive medical innovation and improvements in patient satisfaction. There exist a continuing debate amongst industry representatives and healthcare professionals (HCPs) i.e. doctors, nurses etc. about the state of interaction between the HCPs and the pharmaceutical industry (Kliner, 2012). Critics believe physicians are putting their professionalism on the line by becoming too confident with the pharmaceutical industry. They believe this is a result from loss of patient trust, and suboptimal patient care (Ibid.). Irrespective of attitude towards this debate, it is obvious that HCPs hold a significant stake in the pharmaceutical industry, and hence potential R&D subsidiaries. Therefore the overall political situation is complemented by the development in healthcare politics and reforms of relevance for the pharmaceutical industry.

This section is concluded by positioning the national and industry specific politics into perspective for foreign MNPCs and the attractiveness of performing R&D in Brazil.
5.1.5.1 Challenging political processes within healthcare reforms

According to the new Constitution, healthcare must be a universal right with equal access to products and services through decentralization, single direction in each sphere of government and integral care. As a consequence the Brazilian Healthcare Reform Project was initiated, which is based on the principles of universal healthcare and state responsibility (Silva, 2014).

Since the introduction of the Brazilian Healthcare Reform there has been different variations and political perceptions of the project. Some consider the Healthcare Reform from a highly socialistic perspective e.g. high state involvement. Others defend the liberalization of the healthcare system under the limits of capitalism but still within a social orientation. Despite different ideological perceptions, the Healthcare Reform attempts to respond to the intense protests and demonstrations regarding social and healthcare issues. This started mainly in the second term of the Lula government and has continued through the Dilma administration as required by social groups supporting the WP.

Despite representing the working class, Dilma’s government has been struggling with strong protests since the beginning of the Confederations Cup in 2013. These protests were initially organized to protest against increases in public transportation costs, but it quickly escalated to include protest over police violence, education and healthcare (Sewell, 2014). In this relation the healthcare protests are of high interest due to their influence on the pharmaceutical industry. The outcomes of the protests were positive as Dilma seems to have met the demands by initiating healthcare reforms (Ibid.).

A major concern was the distribution of petroleum royalties (Boadle, 2013). Dilma’s government has agreed to meet some of the demands where 75 percent of the royalties will be channeled into education and 25 percent to the healthcare system (Sewell, 2014). Considering the size of the Brazilian petroleum reserves, this political decision will have a significant influence on healthcare and education. Further, the government has announced to introduce the new program “More Doctors” to meet the shortage of healthcare physicians, especially trained medical doctors (Ministry of Foreign Affairs of Denmark, 2014). The purpose is to invite doctors from other Latin American countries to work in the Amazon and Northeastern states where the shortage is most evident. The reforms also aims at changing the medical university curriculum i.e. students are required to spend two years in the public sector (Sewell, 2014). Therefore, Dilma’s government attempts to secure the sustainability of the Brazilian healthcare system as well as increasing the cross-national access to doctors. Another outcome has been increasing public spending on free and heavily subsidized drugs through initiatives such as the Programa Farmácia Popular (PFP). These political changes and processes in the healthcare system are among the largest since the current Constitution introducing universal healthcare.
The increased public spending and healthcare reforms are both positive and negative for the international pharmaceutical industry. The intention to solve the shortage of practicing doctors across the country means that the MNPCs’ distribution network expands through doctors as the final distributor to patients. Further, more students together with the import of qualified doctors from surrounding countries potentially increase the pool of future researchers with the suitable medical background for R&D activities.

From the opposite perspective, Dilma’s government is also heavily involved in regulating drug development, pricing and distribution (Vettori, 2015). The government aims at strengthening the Brazilian generics industry, which is the largest in South America. This is done by supporting policies aimed at extending the availability of medicines to low-income consumers permitting them to choose unbranded products in a larger scale (Ibid.). Combined with patent protection loss of more than 20 best-selling branded products in 2012-13, the generics market grew by more than USD 400 millions in that period. The governmental support for generics seems to continue and as a consequence the volume market share for generics is expected to exceed 33 percent by 2018 (The Economist Intelligence Unit, 2014). The result of creating more unfavorable business environment for branded products increases the entry barrier for establishing R&D centers in Brazil intending to develop branded medicine.

The unfavorable development is not the only challenge for MNPCs. The political instability further has a negative effect as it complicates the navigation and reliability of the business environment. A high risk factor may be the consequence of a potential impeachment of Dilma. This would supposedly have a negative effect on the political stability for the newly started term and the following four years. The political instability may harm the foreign MNPCs in two ways. First the political attitude can become hostile in relation to protecting their IPR, which is a fundamental requirement for doing R&D. Secondly in case the political attitude favors domestic pharmaceutical companies, it may become unattractive to upgrade from production to R&D.

5.1.5.2 Social groups creating pharmaceutical business opportunities

The demographic evolution described earlier provides a large business potential for MNPCs. Due to the ageing population, and the fact that there are a proportionately low number of hospital beds per capita, the homecare segment is expected to grow at a two digit pace during the next decade and beyond (Ministry of Foreign Affairs of Denmark, 2014). The homecare segment was established roughly four decades ago, however the private sector did not enter the segment until 15 years ago,

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18 Home healthcare is a wide range of healthcare services that can be given in your home for an illness or injury.
which implies a relatively new market. It is estimated that homecare reduces the cost of treatments by 30 percent, but insurance companies are concerned about the extended treatment period (Ibid.). The homecare segment trend in Brazil is towards home services 24 hours per day. The market demands high-level technology and laboratory devices at home, management software for companies, and sophisticated databases for companies to monitor and control patient treatment. This argues for increased potential for pharmaceutical devices and technologies. The segment mainly focuses on treating the 56 million Brazilians (about 28 percent of the population) who suffer from chronic illnesses such as diabetes, Alzheimer and heart surgeries. Despite the homecare activities mainly are focused towards the elderly population, there is a potential for the specialization of the service e.g. baby- and kids care associated with post pregnancy period and the prevention of illnesses (Ministry of Foreign Affairs of Denmark, 2014).

In addition to the opportunities in homecare, the historical increase in minimum wages and reductions in inequality are expanding the middle-income class. This enlarges the business potential for branded products. However, while the generics primarily target the poorest citizens it also focus on higher income groups. Despite this, an increasing middle class still provides a solid business potential, as these will be more likely to have the financial resources and preferences to turn to the out-of-pocket market, either for newly developed products or when the public system is insufficient. The extend to which the public system is insufficient will be elaborated further in section 5.2 about institutions.

5.1.6 Political risks and opportunities
To provide the reader with a valuable overview of the medium-long term political trends, the main findings are summarized in the following “politics box” from the PIE-framework. It will be discussed whether they are classified as risks or opportunities from an R&D perspective. This will later be combined with the rest of the institutional and economic analysis to identify path-dependencies and synergies. Despite floating boundaries, the words with black font are related to the national sphere whereas the grey words are pharmaceutical specific.
In accordance with the systems view and the PIE-analysis approach, the relation and synergies are of high importance. One topic may isolated be an opportunity, but at the same time provide certain risks. This is exemplified by the political focus on improving the healthcare system, which is clearly positive. Combined with Dilma’s attitude towards private enterprises, opportunities may appear for MNPCs to grasp. The increase of funding from petroleum royalties into healthcare combined with the “More Doctors” program is opportunities MNPCs can benefit from on a long-term perspective. Due to the time lag on educational related initiatives, Brazil will not start to experience improvements before six years, where the first new round of doctors is educated. Thus the effect will consolidate on a long-term. However, the political healthcare agenda is not solely positive for MNPCs. The focus on improving the generics market is a high-risk factor for any MNPC that considers R&D activities in Brazil. The political focus on reimbursement and promotion of replicating drugs comprise a profitability risk. However, replicating drugs is a highly complex task and requires high capabilities in order to research molecular compounds and formulas. This argues in favor for certain pharmaceutical research capabilities in the country.

The high degree of inequality does not only create social groups divided by income but also applies to healthcare, where a large pool of poor citizens lack healthcare access compared to high-income groups. Due to a political focus towards changing this, more from the low-income group is moving into the middle class. Despite setbacks in the GINI coefficient the last couple of years, the long-term trend has been towards decreasing inequality. This is an opportunity for MNPCs because more people will have access to medicine and may be able to demand branded products. Finally, the group of elderly citizens is increasing, which both represent opportunities and risks. The risk is mainly attributed to a
macroeconomic burden of supporting these. Further challenges lies in reduced mobility combined with access barriers to drugs. However, this provides a long-term opportunity in form of the homecare segment that is expected to show two-digit growth.

Despite the political focus on improving the healthcare system, one has to remember the current situation. Firstly the high political instability creates uncertainty around the political processes. Combined with protests towards inequality and poor education, these factors have frustrated the social groups supporting Dilma in 2014. This type of situation is seen several times before, and can be argued to be in heritage from the political history. Long-term trends with political instability, corruption scandals and military coups have contributed to a country with high volatility in the political processes complicating future predictions on improvements.

In summary, the path-dependency identified in the historical development indicates that the frustrations, inequality issues and corruption scandals may have severe consequences for Dilma and the WP in the future. Based on these issues, the long-term trend with a WP president may come to an end at the next election. This is dependent upon whether voters’ trust previously has been attached to the political party or Dilma. If they still trust the WP, a new candidate may be eligible despite the current low government confidence. However, one should note that the next election is in 2018, which gives Dilma time to improve her position and trust base.

5.2 Institutions

Due to the path-dependency illustrated in the historical analysis, it is necessary to include the findings from the political section into the institutional analysis. The institutional analysis will include the political and economic institutions along with enforcement and rule of law. Each will be elaborated individually but also their interrelations. This is followed by a separate part dealing with the institutions’ impact on the pharmaceutical market.

5.2.1 Political institutions

The formal rules of the political game are given in the Constitution, discussed in the historical analysis. As mentioned, the purpose of the Constitution is to provide democracy and individual freedom of the Brazilian citizens. The degree to which the Constitution functions successfully is analyzed by looking at the individual freedom and ability to affect political processes. This is done because the Constitution defines the rules for the political processes including the formal power division between government,
parliament and judiciary with checks and balances to avoid abuse of power. Subsequently, the political effectiveness is analyzed by quantitative measures.

When assessing the performance of the political institution i.e. the Constitution, specific indicators from the World Bank, Global Competitiveness Report and Freedom House are applied. The voice and accountability indicator, provided by the World Bank, reflects the perceptions of the extent to which a country’s citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association and a free media (World Bank, 2015). This indicator is important for MNPCs because it indicates the degree of governmental transparency. The below graph illustrates Brazil’s position compared to the remaining BRICs and the United States.

The graph illustrates that Brazil and India are the best performing BRICs. In 2013 Brazil scored 0,37 just below India’s 0,41. When this is compared to Russia’s -1,01 and China’s -1,58 it seems rather positive. However, on a scale that ranges from -2,5 to 2,5, a score of 0,37 is unimpressive. Despite remaining quite constant, it is actually the lowest score in the last five years indicating a negative trend. For the pharmaceutical industry this means relative long-term stability in the freedom of the society e.g. free media, which is important in relation to transparency.

This indicator can be compared to Freedom House’s assessment of politic rights, civil liberties and freedom, which are reported in the below table.
This table provides a picture that corresponds to Graph 7. Brazil’s score is 2 in both political rights and civil liberties, on a scale from 1-7 with 1 as the best, closely followed by India. This means that when it comes to political rights, civil liberties and general freedom both Brazil and India performs better than China and Russia. The performance of Brazil is highly related to the political processes that removed the previous military regime and implemented a new Constitution. Therefore, the Constitution can be interpreted as relatively successful in improving the political institutions regarding democracy and individual freedom. Further it illustrates the causal effect from political processes that change the institutions.

Brazil’s relative positive score is beneficial for the country and its businesses. However, does the Constitution as political institution also improve the effectiveness of the Brazilian government and its organizations? To assess this, the World Bank’s indicator for government effectiveness is applied. It reflects the perceptions of the quality of public and civil services, the degree of its independence from political pressures, the quality of policy formulation and implementation and the credibility of the government’s commitment to such policies (World Bank, 2015). This indicator is important for MNPCs because it explains something about the reliability and quality of the political institution. When foreign MNPCs interact with the government, a high score means they may rely more on their commitments. The score for Brazil and the peers’ government effectiveness is illustrated in the below graph.

<table>
<thead>
<tr>
<th>Assessment of freedom</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political rights</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Civil liberties</td>
<td>2</td>
<td>Not free</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Freedom</td>
<td>Free</td>
<td>Not free</td>
<td>Free</td>
<td>Not free</td>
<td>Free</td>
</tr>
</tbody>
</table>

Table 3 "political rights, civil liberties and freedom score" Source: (Freedom House, 2015)
The graph shows a relatively close score between all the BRICs, however with China as the best performing country throughout the period. Despite quite constant scores, Brazil has from 2008-2012 performed worse than India, but has managed to improve from 2011-2013 whereas India has experienced a decrease in its performance from 2011-2013. This means, Brazil in the latest reported data from 2013 is above India. When comparing to the United States, Brazil cannot be said to perform well. A reason for Brazil’s poor performance may be found in the multiparty-system that slows decision-making time compared to e.g. China with only one party. This may decrease further after the recent election where Dilma won the narrowest victory in Brazil’s history.

The rather negative Brazilian score is supported by the World Economic Forum’s Global Competitiveness Report stating that inefficient government bureaucracy is the fifth most problematic factor for doing business in Brazil (Schwab, 2015). This is negative for MNPCs due to the complexity and bureaucracy that comes with researching and developing new products that require patent protection. The indicator for the burden of government regulations further supports this problem. It explains how burdensome it is for businesses to comply with governmental administrative requirements e.g. permits, regulations and reporting, which is of high relevance for R&D investments and processes. In this category Brazil is the second worst country worldwide (Schwab, 2015).

In summary the political institutions provide a relatively positive premise for individual freedom and democracy. Opposite the government effectiveness is relatively poor for Brazil, however still within close range of the remaining BRICs. Due to the close relationship and floating boundaries between the political and economic institutions the following elaborates the economic institutions’ performance.
and how political institutions affect these. However, this causality cannot be generalized since other countries, e.g. from Asia, experienced economic institutional changes before the political institutions changed (IMF, 2005).

**5.2.2 Economic institutions**

The aspects covering the economic institutions encompass the rules governing the economy. This includes the rules for distribution of rights between the state and individual entities. Further, the rules for property rights\(^{19}\) - laws created by government in regard to how individuals can control, benefit and transfer property - will be assessed due to its relevance for R&D.

**5.2.2.1 State v. liberalization**

Despite removal of ISI, Brazil still suffers from bureaucracy and regulations as argued in relation to government effectiveness. Generally state v. liberalization refers to the degree to which an economy is characterized by the ‘invisible hand’ or state-owned and controlled. None of these extremes are usually found, but economies tend to lie in-between these two extreme cases (Peng & Meyer, 2011). One of the most cited theoretical mechanisms on how excessive business regulation affects economic performance, and development, is that it makes it too costly for firms to engage in the formal economy, causing them not to invest or to move to the informal economy (WBDB, 2014). Opposite, sound business regulations are important for a thriving private sector. As the pharmaceutical industry has a direct affect on a nation’s well-being and healthcare, the industry is subject to several regulations. These affect, or may affect, MNPCs’ ability to carry out R&D processes in Brazil. This part does not aim at listing all regulations the pharmaceutical industry is governed by, but instead focus on the general level for doing business including critical issues as labor laws and tax regime.

In the 2014 World Bank Doing Business report, Brazil ranked 120th out of 189 countries in terms of overall ease of doing business. The table below summarizes the measures for Brazil and the peers.

<table>
<thead>
<tr>
<th>Ease of doing business 2014, 2013 *</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy rank 1-189</td>
<td>120, 123*</td>
<td>62, 64*</td>
<td>140, 142*</td>
<td>93, 90*</td>
<td>7, 7*</td>
</tr>
</tbody>
</table>

*Table 4 “ease of doing business ranking 2014, 2013” Source: (World Bank, 2015)*

\(^{19}\) From the perspective of MNPCs dealing with foreign R&D, the main subtype of property right interest is intellectual property right. Consequently, this analysis will focus on intellectual property rights.
Besides a clear distance between the BRICs and the United States, the group ranges widely with Russia as the best performing and India as the worst. However, the Russian score may have changed significantly due to the instability related to the annexation of Krim and the following trade sanctions. The ranking is based on different variables including cost of starting a business, dealing with licenses, employing workers, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing down a business. In an absolute and as well as relative scale, Brazil is ranked poorly where especially the tax system is pulling the measure in the negative direction. PwC has in corporation with the World Bank and the International Finance Corporation (IFC), produced a comparison of tax systems in 189 economies, ranking each in terms of overall complexity, time required to comply with tax codes, number of payments and total tax rate (PwC, 2014). It is concluded that Brazil is ranked as the most time-consuming tax regime in the world. The nation has developed so quickly that there is a dizzying array of tax codes from one region to the next, some of which contradict one another. This, combined with aggressive tax enforcement aided by the development of a new Public System of Digital Bookkeeping (SPED), which uses super computers to track every transaction in the country, has made tax compliance in the region a big issue for multinationals. This complicated the navigation for foreign enterprises and may to some degree neutralize the benefit of the large market.

Besides ineffective tax regime, the cost of starting up businesses and dealing with construction permits are additionally among the variables pulling Brazil in the negative direction. This is especially due to bureaucratic and ineffective government handling, which correspond to the discussion on political institutions.

Besides complex tax regime, the labor market regulations have in recent years increased the cost of doing business in Brazil (Baker & McKenzie, 2013). Costs associated with health insurance, food, transportation, contribution to the social security department and other taxes paid to the government significantly impact businesses. These benefits, along with a guaranteed annually adjusted maximum wages, have emerged from an increasing amount of labor unions and government attitude towards employee protection. This has resulted in higher labor regulations and increased labor cost, which to some extend has reduced the nation’s attractiveness of manpower production.

In summary it can be concluded that Brazil is rather liberalized but has a highly regulated labor market and tax regime. Especially, the complex tax system in combination with the earlier described fragmented states, pose constraints for private enterprises and may reduce or remove the benefit of the large market size. Subsequent to this section it is natural to illuminate Brazil’s attitude regarding IPR, which is one of the most critical factors related to R&D.
5.2.2.2 Intellectual property rights

Although the term of property traditionally refers to tangible pieces, intellectual property specifically refers to intangible property that results from intellectual activity (Peng & Meyer, 2011). Intellectual property pertains to any original creation of the human intellect such as technical and scientific creation. Intellectual property rights (IPR) refer to the legal rights given to the instigator to protect his invention or creation for a delimited period of time (Bhattacharya & Saha, 2011). In modern economy, it is settled that IP plays a critical role and especially in industries depending on knowledge and innovations.

The International Property Rights Index publishes an annually economic index that continuously has proven to be the most inclusive, and far reaching, study on the correlation between economic success and property rights (IPRI, 2014).

The report reveals non-varying figures for the assessed countries, with general tendency to improve earlier years’ performance. Compared to the remaining BRICs, Brazil are leading with a minor margin, which imply more quality of the IPR system, resulting in improved conditions for MNPCs operating within R&D. Compared to the United States, the worlds most advanced economy and leading pharmaceutical market, improvements are needed in the BRICs in order to compete with the IPR system for attracting R&D investments. The above figures are in section 5.2.5.5 decomposed into specific IPR categories, which will show a more nuanced and case-oriented perspective.
5.2.3 Enforcement and rule of law

The quality of enforcement is an important part of the institutional quality because well-defined laws are worthless if not enforced appropriately. The state administration and the judiciary are not only implementing formal political institutions but especially economic institutions. Thus, the quality of these organizations, the state’s administrative capacity and the court system’s ability impartially enforce the law, determine the actual implementation of the formal institutions.

The first applied indicator deals with regulatory quality, which is directly related to the level of state regulation discussed in economic institutions. It reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development towards open market economy. In the below graph, one can see the development of the BRIC’s and the United States’ regulatory quality from 2008-2013.

The graph illustrates that Brazil is performing relatively better than the rest of the BRICs. However, the performance lies between 0 and 0,2, which is not impressive on a scale to 2,5. Despite best performance in the BRIC group, Brazil has some room for improvement in its regulatory quality. Since the pharmaceutical industry is a highly regulated industry, it is dependent on a high regulatory quality that ensures promotion of the industry's development. Thus potential inabilities in the government to formulate and implement sound policies may make it unattractive for MNPCs to establish R&D in Brazil.
The second applied indicator is rule of law. It reflects the perceptions of the extent to which agents have confidence in, and abide by, the rules of society and in particular the quality of contract enforcement, property rights, the police, the courts as well as the likelihood of crime and violence (World Bank, 2015). Especially the quality of contract enforcements and property rights become extremely important for assessing the attractiveness of R&D investments. On the graph below one can see the five-year development in the BRIC’s and the United States’ rule of law.

From the graph, it is evident that Brazil has experienced a positive development from 2008 to 2010 where they improved from approx. -0.4 to 0. However, since 2010 this development has stagnated and remained rather constant. The performance is almost the same as India’s in 2013 but better than China and Russia. The overall low performance is negative for the attractiveness of R&D since the protection and enforcement of discoveries against generics is crucial for the individual MNPC.

The third applied indicator used to evaluate the enforcement is the control of corruption. This reflects the perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (World Bank, 2015). This indicator is of high importance since large MNPCs must be able to rely on regulations and contracts are in compliance, and if not, then appropriate enforcements are taken. The below graph illustrates the control of corruption score by the BRICs and the United States.
As the previous enforcement graphs, Brazil is performing better than the remaining BRICs. However, this is again relative since the performance is remaining around 0, which is unimpressive. The low performance in controlling corruption is supported by the World Competitiveness Report that places corruption as the sixth largest problematic factor for doing business (Schwab, 2015). An example from the report is related to irregular payments and bribes where Brazil is ranked 89 out of 144.

These indicators can only be expected to move further in a negative direction after the Petrobras scandal, where President Dilma’s administration has become embroiled in thickening corruption scandal. It threatens to turn off domestic and foreign investors and undermine the country’s economy. The poor control of corruption is also an explanatory factor for Brazil’s low public trust in the politicians. The World Competitiveness Report gives them a score of 1,7 meaning they are ranked 140 out of 144 (Schwab, 2015). Thus Brazil is among the absolute worst countries when it comes to public trust in its politicians.

In the middle of the Petrobras scandal are allegations that politicians, including some from Dilma’s WP, received hundreds of millions of dollars in kickbacks from contracts by Petrobas (Wharton Knowledge, 2015). Dilma’s position as chair of Petrobas between 2003-10 has further fuelled the suspicions. The investigations have currently covered 20 companies for allegedly, forming a cartel to inflate contract values and nearly 50 politicians, including the Senate Chief. Subsequently, the crisis has escalated as the government has announced investigations into its health ministry and state-owned bank, Caixa (Ibid.).

There is also a potential to turn this crisis into something positive for Brazil. According to William Burke-White (Wharton, 2015), deputy dean and professor at University of Pennsylvania Law School: “Brazil has built a strong democracy with good institutions, good court systems, good investigative
Further, Brazil appears to be a culturally diverse country, which hampers the ability to construct a culturally appropriate MNPC in Brazil. Hofstede’s cultural dimensions will be discharged. Despite much debate and critics about the general validity of the theory, it may be applicable as guidance to a cultural analysis.

5.2.4 Informal institutions

Informal institutions emerge as unwritten rules and are embedded in national culture (Mygind, 2007). They are less transparent for foreign MNPCs that suffers from liabilities of foreigness, i.e. lacking access to the relevant networks and knowledge about local traditions. The rules can be categorized in different levels from deep beliefs about fundamental life questions to norms and preferences covering daily life (Ibid.). The values on the most superficial level can change fast following often short-lived fashion trends, but deep beliefs usually change rather slowly.

When formal institutions are effective, informal institutions complement them. However, when formal institutions are insufficient, inadequate and not securing effective functioning of the economy, then informal institutions may substitute or set up competing systems (Peng & Meyer, 2011). An example is corruption that is embedded in informal behavior in public and political decision-making by replacing certain formal institutions cf. section 5.2.3 on enforcement and rule of law.

Despite being intangible, informal institutions still have an impact on businesses. A research conducted by Jones & Teegen (2001), based on an examination of the R&D investments abroad by foreign enterprises, indicates that culture plays a role in explaining the location of foreign R&D – i.e. culture should be considered in the investment decision.

Several informal institutions frame and affect business transactions, but the intention of this thesis is solely to explore those institutions that affect MNPCs’ ability to conduct R&D in Brazil. Mygind (2007) proposes, with some caution, Hofstede’s cultural dimension theory as guidance to a cultural analysis. Despite much debate and critics about the general validity of the theory, it may be applicable as guidance about behavior and pitfalls. However, as this thesis aims at understanding why none of the examined MNPCs have R&D facilities in Brazil, Hofstede’s cultural dimensions will be discharged. Further, Brazil appears to be a culturally diverse country, which hampers the ability to construct a
homogeneous group for analysis (Ardichvili et al., 2013). Instead, the focus is upon the most conspicuous informal institutional rule that may affect MNPCs’ ability to carry out R&D activities.

Trust is culture-based and has emerged as a central theme in international strategy research (Madhok, 1995). This is also stated by Mygind (2007), arguing that high level of social trust results in lower transaction costs and improved conditions for business transactions, while low social trust means an increased need for detailed and complex contracts and insurance systems. Wike & Holzwart (2008) finds a negative correlation between degree of corruption and level of social trust – i.e. when corruption are high, the level of social trust is low and vice versa. As discussed earlier, Brazil suffers from corruptive behavior, which theoretically should lead to low degree of social trust. Medrano (2014) has constructed an index\(^2\) based on data from most recent surveys on national social trust illustrated in the following graph.

![Social Trust Index](image)

*Graph 13 "social trust index" Source: (Medrano, 2014)*

High degree of social trust is in graph 13 proven by larger values, and is illustrated by the bar size. Brazil is placed in the bottom compared to the peers, but it is not only in this cluster that Brazil performs poorly. On the researcher’s index, comparing 120 nations, Brazil is placed as no. 111, meaning that the degree of social trust is very low. This may provide barriers for negotiations and inflict additional transaction costs for MNPCs as argued above.

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\(^2\) Social trust is in the research paper referred to as ‘interpersonal trust’ and based upon the question: “Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?”. The index is constructed through the formula: Trust index = 100 + (% Most people can be trusted) - (% Can’t be too careful). In this way, indexes over 100 correspond to countries where a majority of people trust others, while an index under 100 corresponds to countries where a majority of people think one can never be too careful when dealing with others.
This is especially an issue for R&D subsidiaries because they will handle deeply business critical information and hence trust to suppliers, business partners and affiliates are required for success. The data from graph 13 should however be interpreted with some caution as argued in section 2.4.1, which criticizes the time of data collection as well as diverging periods. What appears most striking is the high index in China. Steinhardt (2012) agrees about the high level, and concludes in a statistical analysis on trust in China, that the tremendous level of social trust is strongly affected by the spillover effect from institutional confidence, where the Chinese political system is perceived in very positive terms by its citizenry. Additionally, he interprets the results with some caution and argues that on a negative note, a specifically narrow interpretation of the ‘most people’ part of the standard item, which is induced by the Chinese cultural heritage, needs to be seriously considered. It has been argued that such an interpretation effect should vary with the strength of a traditional pattern of social association and should therefore be most pronounced in rural Mainland China. This argument is supported by Bjørnskov (2005), cautioning that the authoritarian political system and the cultural conditions in Mainland China\textsuperscript{21} may inflate survey results.

As Brazilians tend to attach value to interpersonal relationships but generally have low social trust, Gouveia (2013) argues that personal relations are important and may determine the success or failure of business relations. Therefore, if launching R&D, MNPCs need to be able to establish strong interpersonal relationships with customers, suppliers, state and other business partners. By doing that, MNPCs would be able to incorporate the surrounding environment in R&D processes, which may provide long-term benefits.

All of the above discussed formal and informal institutions have consequences for the pharmaceutical market and the attractiveness of investing in R&D as a foreign company. This will be elaborated in the following section.

\textbf{5.2.5 Pharmaceutical market and institutions}

This section on institutions and the pharmaceutical market will be divided into three main areas. Firstly follows the institutional set-up including important organizations and the macroeconomic money-flow split between public and private and subnational levels. Secondly, the institutions dealing directly with R&D i.e. drug approval processes and the following market access institutions will be discussed. Finally, the IPR discussed earlier will be decomposed into a more industry specific discussion.

\textsuperscript{21} This may additionally be present in a nation such as India.
5.2.5.1 Political institutions framing the pharmaceutical industry

As mentioned the Brazilian Constitution guarantees universal healthcare and charges the federal government with the ultimate responsibility of ensuring the health of the nation (Livro Branco, 2015). The entities taking care of this responsibility are illustrated in the below organogram.

![Organogram](image)

Figure 13 “political organization centred around MOH” Source: (Livro Branco, 2015)

The regulatory bodies that represent the entire country and govern the healthcare system and the pharmaceutical market include the Ministry of Health (MOH), National Health Council and other organizations that serve as gatekeeper for e.g. compliance and sanitary surveillance. The MOH only detains 50 percent of the decision-making power when it comes to policy making in the healthcare sector. The remaining 50 percent relies with the National Health Council (civil society), which is guaranteed by the Constitution. This half split model is replicated at both the state and municipal level. The states are represented by the State Secretaries of Health and the municipals by the Municipal Secretaries of Health that deals with general practice and primary care service on city and municipal level.

For the MNPCs considering establishing R&D these organizations are of high relevance. First of all, they are the policy- and decision-makers regarding work and education management, which is important because R&D subsidiaries require advanced qualifications compared to e.g. sales and production. Additionally, they set the discourse regarding strategic sciences, technologies and inputs. This is of high importance, because political focus on development within a specific disease area may increase the attractiveness for certain MNPCs if the focus lies within their business area.

The organizations in the above illustration are also significant decision-making authorities related to the macroeconomic money flow in the healthcare sector. This will be elaborated in the following section.
5.2.5.2 Money flow in the healthcare sector

Public entities and regulations have a direct influence on MNPCs’ ability to distribute products through pricing policies and reimbursement practices. This section will focus on main characteristics of the money flow division between the public and private sector (a full graphical overview is provided in Appendix C). The system is divided into three stages, representing the financiers, resource distributors and the providers of healthcare services and products. The financiers constitute the public or private sphere. In total the healthcare expenditure from these amounts to 9 percent of GDP and is financed by 47 percent public and 53 percent private funding.

The public funding is based on taxes. The public resource distributors are spread on three levels with their own budgets i.e. federation, states and municipalities. Each of these entities is allocating the financing on their respective budgets, which are redistributed to respective funds i.e. national, state and municipal funds. The final budgets are then devoted on various healthcare providers such as pharmacies, public hospitals and social health organizations.

The private financier constituting the 53 percent of the total budget is split into two resource distributors i.e. health insurances 43,1 percent and private expenditures 56,9 percent. The private expenditure as resource distributor provides co-payment to the following providers: pharmacies, payment for activities to private philanthropic hospitals and payment for services at private professionals. The health insurances however do not include the co-payment aspect towards pharmacies.

This brief overview does not only illustrate the complexity that surrounds the healthcare system, but also the dependences and influence of public funding, policies and regulations. A study conducted by Deloitte in 2012 found that 75 percent of the population relies on the public system and the remaining 25 percent mainly uses the private system (Deloitte, 2012). As more than half of the healthcare spending occurs in the private sector but 75 percent relies on public system, there is an unequal access to healthcare resources. This corresponds with the political analysis about unequal distribution of resources between different social groups. The very same study further reveals that the performance in the Brazilian healthcare system is questionable. The Deloitte Center for Health Solution’s longitudinal research surveyed adults in 12 countries (of which five is presented in table 5) to gauge opinions and expectations about their healthcare system. The sample was nationally representative with respect to age and gender, but not adjusted for income and geography, which may bias the result presented below as e.g. Brazil and China are considerable demographically diverse.
The results are roughly unanimous; there is room for improvements in the Brazilian healthcare industry, despite the national healthcare reform. Only 8 percent of the surveyed population believes that the performance in the healthcare system is excellent or very good, and only 7 percent are satisfied with the performance of the healthcare system in Brazil. These ratings are the single worst of all the 12 examined countries in the survey. This may be a consequence of what Paim (2008) refers to as the assertion of political focus. It is argued that the political orientation towards healthcare has changed from the healthcare reform as a project for continuity to the implementation of decision-making grants to individual states regarding healthcare. The performance of the healthcare system hampers the potential for the pharmaceutical industry, but simultaneously it illustrates the future potential in the country.

The above described importance of the public sector and the organizations such as ANVISA, is not only important when looking at the healthcare sector from a macroeconomic point of view, but also when considering it from the individual company’s perspective. Thus the public organizations’ approval process directly influences the time from developing a new drug to when it is found on the market. If a product is approved, they also influence directly via market access policies e.g. reimbursement. These factors will now be elaborated.

### 5.2.5.3 Low efficiency in the registration process of drugs and medical devices

ANVISA, The Health Surveillance Agency, is the Brazilian food and drug agency, responsible for the approval of drugs and medical devices. It is the Brazilian version of the American FDA and European EMA, which are considered as the most powerful organizations in the international pharmaceutical industry.

ANVISA uses a class categorization for medical equipment, which is similar to the one used by EMA. This includes class 1, 2, 3 and 4 products (Ministry of Foreign Affairs of Denmark, 2014). The registration process for class 3 and 4 products is lengthier and more costly than class 1 and 2. This is due to ensure compliance with Brazilian Good Manufacturing Practices. During recent years, a lack of staff has led to significant backlog on ANVISA’s handling of applications, which poses a substantial

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22 Grades “A” and “B” are given if the performance of the healthcare system is excellent or good.
entry barrier for companies that want to launch new products. This means that MNPCs that want to enter the market with new products need to obtain a clear view of the registration process to evaluate the time-to-market, and subsequently plan a realistic entry strategy.

Also for new drugs, the requirements for market authorization are highly regulated. Required for authorization is: I) safety and efficacy, which is evaluated by the office of drug registration and II), price approval given by the Executive Secretariat of the Pharmaceutical Price Chamber. The required time for obtaining drug authorization is highly depending on which country you are applying for illustrated in the following table.

<table>
<thead>
<tr>
<th>Country</th>
<th>Average time (in days) required for drug approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>45-60</td>
</tr>
<tr>
<td>Europe</td>
<td>60-75</td>
</tr>
<tr>
<td>India</td>
<td>70-110</td>
</tr>
<tr>
<td>China</td>
<td>270</td>
</tr>
<tr>
<td>Brazil</td>
<td>365</td>
</tr>
</tbody>
</table>

*Table 6 "average time in days required for drug approval" Source: (Ministry of Foreign Affairs of Denmark, 2014)*

The table illuminates the fact that Brazil is lagging significantly behind other countries. Of high interest is the significant difference to other major markets such as India, China and the United States. The procedures for approval of clinical trials are also significantly long. It takes up to 12-18 months, on average, to obtain the approval of conducting clinical trials.

If a company manages to develop and achieve approval of a product, it further faces market access challenges, which will be elaborated below.

### 5.2.5.4 Institutions shaping market access for MNPCs

The Pharmaceutical Market Regulation Chamber governs the *pricing policies* of pharmaceuticals, and the Office of Economic Regulation executes the daily operations (Ministry of Foreign Affairs of Denmark, 2014). When introducing a new drug, it is compared to the best treatment option existing in the market. If the new one is considered to be better than the comparator, a premium price is allowed, but this price cannot exceed the international ceiling price, which is the lowest price among reference countries. If there is no benefit over the comparator, then the cost of treatment cannot exceed the cost of treatment with the comparator. For premium cost drugs that are purchased by the government, a mandatory discount is applied over the factory price set by ANVISA (Ibid.). This discount is based on
the difference between the Human Development Index of Brazil and the reference countries. These policies constrain MNPCs on individual corporate pricing strategies, which may have a negative effect on the profit generated by new inventions.

Brazil has a basic reimbursement system restricted to the public sector where charging patients for medicine is prohibited (Bertoldi et al., 2012). The National Committee for the Incorporation of Technologies (CONITEC) is responsible for guiding the Minister of Health about which health technologies and pharmaceuticals should be provided by the Brazilian Public Health System. CONITEC’s guidance is based on reports and budget-impact analyses, and is subsequently sent to the Minister of Health, who is the ultimate decision-maker. Some of the drugs are purchased directly by the federal government while others are purchased by the states and municipals, which receive funds from the federal government cf. 5.2.5.2. Examples of important reimbursement programs include Exceptional Drugs (high cost drugs for chronic diseases), Strategic Drugs (ex: tuberculosis, AIDS) and Farmacia Popular do Brasil (co-payment program in private pharmacies) (Ibid.).

Despite a complex reimbursement system, the public sector availability of pharmaceuticals is insufficient in supplying essential pharmaceuticals to the population as required in the Constitution (Bertoldi et al., 2012). Consequently, patients resort more often to purchasing medicines through private channels, where the availability is higher, but prices are high and patients have to pay fully out-of-pocket. A study referred to by Bertoldi (2012) reveals that, on average, 40 percent of medicines prescribed in public healthcare were not available. This argues for an ‘unhealthy’ healthcare system where the reimbursement system fails. A good and healthy reimbursement system would benefit MNPCs since it would be easier to market products. However, as the Brazilian government favors generics, the products that would be subsidies through reimbursement practices are restricted to generics.

After discussing the drug approval and market access process, the next step is to discuss IPR from an industry perspective. Therefore, the final part includes an analysis on how the earlier discussed IPR system influences MNPCs’ ability to protect new products if they managed to develop and obtain both approval and market access.

5.2.5.5 IPR – institutional key to R&D success
The pharmaceutical industry is driven by scientific knowledge rather than manufacturing know-how and therefore relies on a strong IPR system (Angell, 2000). Thus a company’s success will be largely
dependent upon its R&D efforts. One of the key issues in this industry is the management of innovative risks. There is high cost attached to the risk of failure in pharmaceutical R&D with the development of potential medicines that are unable to meet the stringent safety standards, being terminated, sometimes after many years of investment. The cost of introducing a new drug into the market may vary between USD 300 millions and USD 1.000 millions (Bhattacharya & Saha, 2011). Consequently, investments in R&D are very high as a percentage of total sales. Based on the examined MNPCs in Appendix A, the average R&D expenditure as percentage of revenue equals 17 percent, ranging from 7,3 percent (Teva) to 28,6 percent (Bristol-Myers Squibb) which is a remarkable proportion. Along with all the associated risks at the development stage, no company will like to risk its IP becoming a public property without adequate returns. Accordingly, the need to protect the knowledge from unlawful use has become expedient. This is at least for a period that would ensure recovery of the R&D and other associated costs and adequate profits for continuous investments in R&D.

It is clear that the local regulatory quality, specific for IPR, is of interest to MNPCs considering R&D subsidiaries in Brazil. Overall Brazil scored best among the BRICs on the previously described Intellectual Property Right Index i.e. Graph 9. However, this index can be decomposed into intellectual property right areas e.g. protection of individual property rights, patents and copyrights. The following table shows the ranking on these sub-indexes:

<table>
<thead>
<tr>
<th>Intellectual Property Rights split (2014)</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td>5,6</td>
<td>5,1</td>
<td>5,5</td>
<td>5,4</td>
<td>8,4</td>
</tr>
<tr>
<td>Protect. of Individual Property Rights</td>
<td>5,1</td>
<td>4,1</td>
<td>5,3</td>
<td>5,6</td>
<td>7,4</td>
</tr>
<tr>
<td>Patent Protect.</td>
<td>6,9</td>
<td>7,4</td>
<td>7,5</td>
<td>8,4</td>
<td>9,8</td>
</tr>
<tr>
<td>Copyright Protect.</td>
<td>4,7</td>
<td>3,7</td>
<td>3,7</td>
<td>2,3</td>
<td>8,1</td>
</tr>
</tbody>
</table>

Table 7 "intellectual property right index split" Source: (IPRI, 2014)

From this data, it is arguable that Brazil fails relatively to the peers within protection of patents. As this is an element of high importance in the pharmaceutical industry, this has a negative influence on conducting R&D in Brazil. Additionally, as mentioned earlier, the political focus in Brazil is more towards promoting the generics market. Therefore, policies encouraging generics were included in the Brazilian legislation on the sanitary guidelines to which medicine is subject i.e. the Patent Act and law regarding the Generic Medicine Act (Angell, 2000). Since 2000, the market for generics has expanded

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23 It takes between 8-10 years for developing a drug medical (Bhattacharya & Saha, 2011).

24 The year when generic drugs were launched in Brazil.
with rates above 10 percent per year and, consequently, increased its share of the overall Brazilian pharmaceutical market (Calicchio & Francis, 2011). Producers of innovative medicine, or branded products, report lack of protection of patent rights claiming that the TRIPs Agreements\(^\text{25}\) have been violated. They criticize that information is passed on to local producers of generics. This may impose challenges for MNPCs granting R&D mandate to local subsidiaries. Firstly due to the policies encouraging generic pharmaceuticals, and secondly due to the lack of patent protection of branded products.

In summary the institutions set a complex and difficult frame for the pharmaceutical industry to navigate within. The Constitution promises universal public healthcare upon which the majority of the citizens rely on, however it is insufficient in supplying the necessary products. Therefore, many rely on the expensive private out-of-pocket market. This provides a market potential for supplying new drugs but the ineffective drug registration process creates a barrier for developing new products. For the MNPCs this means the time for market increases and thus the direct costs together with loss from potential sales increases. In relation to the market potential associated with the governmental insufficiencies in supplying the necessary products, it should be noted that the government counteract the increasing out-of-pocket payments, and in the future it may be expected that the insufficiencies will be reduced. Thus, the market access is unfavorable due to a political favor of the generics market together with high reimbursement requirements for premium branded products. Finally, the patent protection is relatively low despite a rather positive overall IPR compared to peers.

### 5.2.6 Institutional risks and opportunities

As with the political analysis, the institutional analysis will be summarized by applying a medium-long term perspective into the "institution box". This box will be connected with the politics and economy later in the assignment for a full overview together with an analysis of the dynamics. Again, the words with black font are related to the national sphere whereas the grey words are industry specific.

\(^{25}\) The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) is an international agreement administered by the World Trade Organization (WTO) that sets down minimum standards for many forms of intellectual property (IP) regulation as applied to nationals of other WTO Members (WTO, 2015).
The first institutional boundary to be highlighted is the political. In summary, Brazil has a high and constant degree of political rights, civil liberties and a free democracy compared to especially China and Russia from the BRICs. This allows for continuing transparency in the medium-long term making it easier to assess societal risks and opportunities. However, the government effectiveness has a history with a very high burden of governmental regulations and bureaucracy. This also applies to the pharmaceutical industry that is subject to ANVISA, which is significantly lagging behind regarding the average time for drug approvals. Despite earlier discussions of implementing a fast track approval process for life saving drugs, the regulatory environment is not expected to improve significantly in the medium-long term for other products (Oriordan et al., 2013). This is a clear risk factor because a slow approval process means a longer time-to-market causing a loss of potential sales.

Within the economic institutions lie both opportunities and risks as well. The complex healthcare system comprises unfavorable reimbursement and restricted pricing policies, which increases the entry barriers for newly developed branded products. Further, there exist a division between the public and private market, where 75 percent relies on an insufficient public system. The ambition on improving the public system as providing universal healthcare offers a medium-long term opportunity due to an increased market potential – however mainly restricted to generics. Opposite, the private market characterized by out-of-pocket payments is an existing practice for wealthy people, which may be a market segment for branded products.

Figure 14 "institutional risk and opportunities"
Regarding the *enforcement*, Brazil is performing slightly better than the remaining BRICs. Isolated the performance is not impressive, which is seen when comparing to the United States that performs significantly better. For Brazil, the rule of law indicator represents a risk of inabilities in the government to formulate and implement sound policies. However, the biggest risk comes from corruption. The recent Petrobas scandal seems to include the healthcare system as well threatening the Brazilian economy. Because of its history and the current corruption scandals, Brazil is now suffering from one of the world’s lowest public trust in politicians. Therefore, the citizens have less confidence in politicians despite showing a better control of corruption than the remaining BRICs. The corruption and low trust in politician may fuel the political instability and risks further in a long-term perspective.

The *informal institutions* with high relevance for R&D activities relates to social trust and relationship. Social trust is deeply embedded in national culture, and cannot be expected to change significantly in a medium perspective. This is strengthened by the negative correlation between low social trust and the presence of corruption in Brazil. This is a high risk factor when it comes to handling sensitive business information and will require MNPCs to operate under detailed and complex contracts and regulations increasing the operating costs.

### 5.3 Economics

The historical analysis showed that the economy is highly impacted by the rules of the game set by the institutions. The path-dependency confirms how the institutions influence both the flows of production and income, and the stocks of accumulated resources. This is also the reason why the economic analysis automatically will embrace economic policies because these impact the economy. The analysis will not highlight the Brazilian debt, which has been discussed, but it will instead investigate the macroeconomic flows and policies, and how these are applied in the context of an excessive national debt. This is followed by the national resources, or stocks, and concluded with an industry specific analysis.

#### 5.3.1 Macroeconomic flows

To understand the current situation, different variables of interest are included in the analysis. Initially, the economic situation is studied by the GDP growth. Subsequently, the underlying 2014 macroeconomic stabilization and policy indicators of interest are elaborated. This is followed by the expectations for 2015 and the most recent political incentives concerning fiscal and monetary policies. These are included to stress a potential impact on the future pharmaceutical market.
5.3.1.1 Macroeconomic slowdown up to 2014
The Brazilian GDP amount to USD 2.245 trillion according to World Bank’s most recent comparable data set, making the economy the world’s seventh wealthiest (World Bank, 2014). Despite earlier designations as a fast growing emerging market, Brazil has in recent years suffered from economic turbulence. The most recent data on economic development shows a GDP growth at 0.1 percent. This is the lowest figure since 2009, where the country presented a negative GDP growth at 0.3 percent as a result of global economic crisis (Ibid.). Relative to the peers, this trend is not unique where Russia’s GDP growth has followed a similar path (table 8).

<table>
<thead>
<tr>
<th>% GDP growth</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>-0.3</td>
<td>7.6</td>
<td>3.9</td>
<td>1.8</td>
<td>2.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Russia</td>
<td>-7.8</td>
<td>4.5</td>
<td>4.3</td>
<td>3.4</td>
<td>1.3</td>
<td>0.6</td>
</tr>
<tr>
<td>India</td>
<td>8.5</td>
<td>10.3</td>
<td>6.6</td>
<td>5.1</td>
<td>6.9</td>
<td>7.2</td>
</tr>
<tr>
<td>China</td>
<td>9.2</td>
<td>10.4</td>
<td>9.3</td>
<td>7.8</td>
<td>7.7</td>
<td>7.4</td>
</tr>
<tr>
<td>United States</td>
<td>-2.8</td>
<td>2.5</td>
<td>1.6</td>
<td>2.3</td>
<td>2.2</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*Table 8 "percent GDP growth overview" Source: (IMF, 2015)*

Generally Russia, Brazil and China show decreasing figures while India shows volatility but remain at high rates, and the United States stays at approx. constant rate. The weakness of the Brazilian economy in 2014 is particularly caused by exogenous factors, such as the deterioration in the terms of trade and the slowdown in activity in the economies of major trading partners (China and Argentina), and also domestic aspects (BBVA, 2015). Regarding the latter, factors such as the uncertainty attached to economic policy, the dramatic fall in economic confidence and the upward course of interest rates prevent improving growth figures.

5.3.1.2 Non improving figures projected for 2015
The environment for economic activity is by BBVA (2015), Lewis & Jelmayer (2015) and PwC (2015) not expected to improve significantly during 2015. The main factors behind the stagnation in 2014, which has already been outlined, are generally expected to continue. Additionally, idiosyncratic factors are expected to contribute to the stagnation. The expectations for 2015 is generally grounded in the negative impact of a the following variables: I) further deterioration of the terms of trade (see Appendix D for a graphical illustration); II) another year of weak demand from major trading partners.

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26 Brazil GDP in PPP accounted in 2014 for 3 percent of the global GDP (PwC, 2015).
27 Terms of trade (TOT) refers to the relative price of exports in terms of imports and is defined as the ratio of export prices to import prices.
(see Appendix D for a graphical illustration); III) the correction of economic policy underway; IV) the corruption scandal involving Petrobras and several of the country's biggest construction companies, and V) the water shortage and the energy crisis.

With respect to Petrobras, the problems arise from the suspected payment of bribes by major construction companies to the oil production company. This creates a highly unpromising situation for the company, especially considering the recent withdrawal of its investment grade status by Moody’s (Moody’s, 2015). The predicted economic situation for 2015 is partly grounded on the impact of the Petrobras crisis on Brazil’s investments and oil production. Concerning the fixed capital investments, it should be noted that Petrobras is one of the country’s major investment players and that the construction companies being accused of bribery are the ones executing a substantial proportion of its infrastructure investments. Therefore, the potential spillover effects from a better infrastructure that could benefit pharmaceutical market access can be expected to decline. In addition, the declining investment activity is a grounded projection for future economic activity. Thus, the current situation is expected to harm the economy in the medium-long run.

Among the factors which are expected to support economic activities positively in 2015 is the gradual dispelling of uncertainty concerning the economy, as the adjustment of economic policy consolidates and the impact of the recent exchange rate depreciation on net exports (BBVA, 2015). Private consumption, which accounts for approx. two-thirds of GDP (World Bank, 2014), will be boosted by the 2.5 percent minimum wage increase, which could improve this component of GDP. Despite a decreasing tendency in unemployment during 2014, the rate has increased to above 6 percent since primo 2015, which must be expected to influence the figures for 2015 negatively (Bloomberg, 2015).

### 5.3.1.3 Political restructuring shaping the future of Brazil

In the aftermath of the 2014 election, president Dilma embarked on a radical change of the economic policies. The escalation of the distortions by the previous economic policies, evident loss of credibility in recent years and dismal macroeconomic performance, have motivated and forced a shift in economic policy-making (BBVA, 2015). The adjustment will focus on fiscal policy, though it will feature changes to monetary policy management. The switch to a more pragmatic economic policy is fundamental to trouble-shoot the deterioration in external accounts, the decline in the fiscal situation and rising inflation. It is expected that if the adjustments is well implemented the country could return to growth in line with its potential rate of around 2.5 percent in 2016.
5.3.1.4 Large national debt still affecting fiscal policies

The public sector sowed a primary deficit of 0.6 percent of GDP in 2014, which was inferior to comparable figures for previous years (World Bank, 2014). The decline in 2014 came from lower government revenues and a rise in spending in real terms (World Bank, 2015). In an environment marked by a decrease in tax receipts, the attempt to boost economic activity in an election year through greater spending and tax incentives has played havoc with the public finances.

The public sector accounts reveal that fiscal policy was more expensive than supposed during 2014 (BBVA, 2015). This implies that a bigger correction will be required for the country to meet the primary surplus targets, which were announced in December 2014. Specifically, a fiscal effort of 1.8 percent of GDP is needed to achieve the primary surplus target of 1.2 percent this year.

In the beginning of 2015 the government revealed accurate figures and incentives to reach the primary surplus objective through increased taxation and spending cuts. Tax-wise the CIDE30 on fuels was reintroduced, the rate of fiscal tax was lifted for loans to families, and the IPI31 tax on manufactures was standardized (Rapoza, 2015). In terms of cuts, the government has announced its intention to cut spending in connection with certain welfare benefits, such as unemployment cover and widows’ pensions. Lastly, it has scaled down subsidies to the electricity sector and on loans from public banks. It is expected that additional tax rises and reduced public spending in the coming future to reach the figure of 1.8 percent (BBVA, 2015). These initiatives may contribute to the increasing unpopularity of Dilma as they contradict the needs from middle- and low-income social groups, which constitute her main supporting base.

Whatever incentives proposed by the government, there is a risk of the fiscal target not being met due to lack of political stability, difficulties with facing cross party negotiations and the waning of popular support of Dilma as argued in the political analysis.

5.3.1.5 Inflation targeting monetary policy

Only a few days after Dilma’s victory in 2014, the central bank increased interest rates after holding them at 11 percent for six months. The Selic rate thus closed 2014 at 11.75 percent and it now stands at 14.25 percent (Banco Central do Brasil, 2015). According to the Banco Central do Brasil (2015), the decision to lift the interest rate to above 14 percent, is grounded in a wish to make inflation converge

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28 The available data for general government give a 4 percent decrease in revenue and a 6 percent increase in government spending in real terms.
29 Rising the primary balance from -0.6 percent in 2014 to 1.2 percent in 2015.
30 CIDE is a Brazilian fuel tax and paid royalties
31 IPI is a basic sales tax applied to industrial products in Brazil
towards 4.5 percent in 2016. This is the target that has been pinpointed in recent statements, however it has not been achieved since 2009.

The upturn in inflation in the short-term supports the likelihood of further monetary tightening. In spite of the persistent focus on the domestic demand, inflation remains at a high level. It closed 2014 at 6.4 percent and in January broke through the ceiling of the target range of 6.5 percent, reaching 7.1 percent (Banco Central do Brasil, 2015). The increase in regulated price inflation is a consequence of the lack of fiscal scope to hold them at artificially low levels. This situation has become even more obvious in recent months as the new finance minister, Joaquim Levy, has begun to reverse the expansive accent on fiscal policy and support the model of less intervention by the government in terms of setting prices for regulated goods (BBVA, 2015).

The adjustment in electricity rates of approximately 30 percent this year is a case in point, as it shows that the ballooning costs marked by a water shortage crisis will be passed on to end consumers rather than the government (Ibid.). Further, the inflation may also be fueled in 2015 by the impact of tax hikes on prices.

Considering all of these variables, it is forecasted that inflation for regulated prices will stroke at 10 percent in 2015, which is far above the 5.5 percent in 2014, as well as the 1.5 percent in 2013. Opposite it is expected that inflation of free market prices continue to subside gradually this year.

Reaching success and growth with the macroeconomic policies and initiatives is of high importance due to the close interdependency between macroeconomic growth and the economic resources. For example when Brazil makes high investment in its resources, it increases the potential for future growth. The results are dependent on the quality of Brazil’s institutions, which illustrates the importance of system thinking. The following section analyzes the Brazilian economic resources.

5.3.2 Economic resources

The economic resources to be analyzed include human capital, geography and the infrastructure. To avoid repetition, the fixed capital in form R&D expenditures and related indicators are analyzed in the micro behavior of the NIS analysis in section 6. Following the economic resources, specific pharmaceutical economic flows and resources will be analyzed.

5.3.2.1 Human capital

The human capital is in many countries a main resource, however with signification variations of size, composition and quality.
The quality of, and investments in, the labor force is an important factor for estimating the future income potential. It can be measured via the participation rates on primary, secondary and tertiary education. Despite the actual quality within different schools are assumed to vary, the participation rates provide a rough estimate of the quality of the labor force. The level of education together with the health and life expectancy is directly related to the quality of the educational and health systems (Mygind, 2007). A potential way to measure their outputs may be through the educational level of the population and health indicators e.g. life expectancy. Further other indicators such as the number of medical doctors per capita are applied in this section.

Before digging into the quality of the human capital, it is necessary to look at the quantitative aspect. Brazil is in South America both demographically, with approx. 200 million inhabitants, and geographically the largest country (Economist Intelligence Unit, 2015). As described in the section about social groups, the demographic development with regards to life expectancy is significantly increasing. The increasing amount of elderly people leaving the labor force creates a requirement for improving productivity, and hence higher quality in the future labor force. Returning to the production function in equation 1, this means a decrease in L needs to be outweighed by an improvement in Q or TFP to maintain or increase the productivity. In this relation the level of the primary and higher education becomes important to illuminate.

The primary education is analyzed by looking at the primary education enrollment rate and quality relatively to the remaining BRICs and the United States. The table below provides a quantitative overview of the countries’ performance.

<table>
<thead>
<tr>
<th>Primary education</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary education enrollment rate in percent</strong> (Net primary education enrollment rate</td>
<td>98,5</td>
<td>96,2</td>
<td>93,3</td>
<td>99,9</td>
<td>91,8</td>
</tr>
<tr>
<td>2012 or most recent year available)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Quality of primary education</strong> (on a score from 1-7, where 1= extremely poor and among the worst in the world, 7= excellent and among the best in the world)</td>
<td>2,6</td>
<td>4,2</td>
<td>3,6</td>
<td>4,2</td>
<td>4,7</td>
</tr>
</tbody>
</table>

*Table 9 “primary education score” Source: (Schwab, 2015)*

Brazil’s primary education enrollment rate at 98,5 percent is rather positive when comparing to the BRICs and the United States. It is only China that performs better than Brazil with 99,9 percent, though this number seems unrealistically high considering the number of inhabitants. One reason may be the children living without official social security numbers e.g. due to the one-child restriction law.
Therefore, they are not reflected in this number, but if they were, it is assumed that many of these do not attend school, as they are not part of the system. In addition, both the Brazilian and Indian enrollment rates are suspiciously high, which may indicate a lack of registration quality and inadequate social administration processes, especially in the Brazilian favelas. As a consequence, this data should be interpreted with a cautionary note.

Based on the available data, it is interesting that the most developed country, the United States, is the worst performing country when it comes to primary education enrollment. The reason may be found in its attitude toward the state’s role concerning education and the degree of user charges for education.

Brazil’s performance in enrollment is positive for MNPCs because it creates a foundation for a broader future talent pool of employees. However, this performance has to be followed up by a high quality to consolidate the enrollment effect. For example, if the quality is very low, the high number of students may be relatively worse off, than for example a country with a lower enrollment rate but higher quality. This seems to be the case for Brazil that has a very low score of 2,6 on a scale from 1 to 7 and is among the worst in the world. Comparing this to the United States, it has a quality score of 4,7 which isolated is a rather high score. Thus, the United States has a slightly lower enrollment rate, but a much higher quality. Seen from a MNPC’s point of view in relation to R&D this is negative, because R&D activities are more dependent on fewer specialists than many low-skilled generalists. However, if the low educational quality only occurs in primary school and not in the higher educations, it may have a low influence on the final talent pool of employees and thus the attractiveness on investing in R&D in Brazil.

The following table illustrates numerical key figures for the higher education and training.

<table>
<thead>
<tr>
<th>Higher education and training</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary education enrollment rate* (Net secondary education enrollment rate</td>
<td>99,4</td>
<td>95,3</td>
<td>68,5</td>
<td>89</td>
<td>93,7</td>
</tr>
<tr>
<td>Tertiary education enrollment rate* (Net tertiary education enrollment rate</td>
<td>N/A</td>
<td>76,1</td>
<td>24,8</td>
<td>26,7</td>
<td>94,3</td>
</tr>
<tr>
<td>Quality of the education system</td>
<td>2,7</td>
<td>3,5</td>
<td>4,2</td>
<td>4</td>
<td>4,6</td>
</tr>
<tr>
<td>Quality of math and science education</td>
<td>2,6</td>
<td>4,3</td>
<td>4,2</td>
<td>4,3</td>
<td>4,4</td>
</tr>
<tr>
<td>Quality of management schools</td>
<td>4,5</td>
<td>3,7</td>
<td>4,4</td>
<td>3,9</td>
<td>5,6</td>
</tr>
<tr>
<td>Availability of specialized research and training</td>
<td>4,5</td>
<td>4,3</td>
<td>4,2</td>
<td>4,4</td>
<td>5,6</td>
</tr>
</tbody>
</table>

*Table 10 “higher education and training” Source: (Schwab, 2015)

*Values are on a 1-7 scale unless otherwise annotated with (*)
When looking at the higher education and training system, the situation is close to status quo. For secondary education enrollment Brazil is now the best performing country with 99.4 percent. Russia, China and the United States are fairly close to Brazil, but India is lacking significantly behind on this parameter. When it comes to tertiary education enrollment rate there is no available data for Brazil. This could be interpreted, as tertiary education enrollment in Brazil is low due to the lack of published data as the only country of the analyzed group. Further, the educational structure between the peers may differ and consequently hamper the interpretation of the results.

Similar to the analysis of the primary education system, the quality of the higher education also has to be considered. The quality of Brazil’s higher educational level is similarly to the primary system characterized by a poor quality with a score of 2.6. Russia is the closest, but still significantly better performing with a score of 3.5. The rest of the group has a quality performance higher than 4.0. The quality of the educational system can be further elaborated by looking at the quality for math and science education together with quality of management e.g. business schools. However, these numbers do not make it more attractive from a foreign MNPC’s point of view. Brazil only scores 2.6 on math and science compared to the rest of the group that all score above 4. Despite this, Brazil scores 4.5 on management quality, which is second highest only beaten by the United States, which scores 5.6. For the MNPCs, these numbers are a significant disadvantage. A high level in math and science education is mandatory in order to provide skilled and capable researchers. Opposite the management quality is less important due to different reasons. Firstly, strong management skills are not mandatory capabilities in order to conduct research. Secondly, the MNPCs may have the resources to improve these skills after hiring the individual employee. Thirdly, they may use expatriate managers with strong leadership skills to make sure the corporate strategy is followed and to train the local new hires until they have obtained the necessary management skills.

5.3.2.2 Geography and infrastructure

Just as developed institutions are the regulatory condition for low transaction costs, the infrastructure is the condition for low transport and information costs (Mygind, 2007). Developed transport and communication structures mean that people, goods, services and information can flow within the country and to the outside world. Therefore the infrastructure becomes a significant part of the economic resources, because it influences not only costs but also the development of competition within a country.

Given its nature geography is closely related to infrastructure, i.e. a complex geography with mountains, rivers and diverse climate make it more expensive to establish e.g. road systems. The
possibility of overcoming geographical barriers depends on technological opportunities e.g. telecommunication and IT have opened for access to remote areas.

The Brazilian geography can be described as both large and complex. Brazil is the fifth largest country worldwide, both in terms of area and population, and occupies close to half of the entire South America continent (Spinetto & Bristow, 2013). The country consists of several highly different environments such as the amazon rainforest, the Brazilian highlands and vast stretches of coastline. Therefore the local climate is depending on the areas’ elevation and proximity to the ocean. One can define most of the climate as tropical and sub-tropical, but Brazil still possesses five marked ecosystems\(^{33}\). This serves as the foundation for Brazil’s rich natural resources that among others include gold, iron, petroleum, platinum and timber (Ibid.). Without a deeper analysis of the geography and natural resources, it can be assumed that due to the size of the country and the complexity in both geographical environment and demand for handling natural resources, there is a significant demand for a strong infrastructure system.

To assess the Brazilian infrastructure, data from the World Competitiveness Report is compiled in the below table. Further it contains data for the remaining BRICs and the United States to obtain a relative picture of the performance.

<table>
<thead>
<tr>
<th>Infrastructure(^{34})</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of overall infrastructure</td>
<td>3.1</td>
<td>4.1</td>
<td>3.7</td>
<td>4.4</td>
<td>5.8</td>
</tr>
<tr>
<td>Quality of roads</td>
<td>2.8</td>
<td>2.7</td>
<td>3.8</td>
<td>4.6</td>
<td>5.7</td>
</tr>
<tr>
<td>Quality of railroad infrastructure</td>
<td>1.7</td>
<td>4.3</td>
<td>4.2</td>
<td>4.8</td>
<td>4.9</td>
</tr>
<tr>
<td>Quality of port infrastructure</td>
<td>2.7</td>
<td>3.9</td>
<td>4</td>
<td>4.6</td>
<td>5.7</td>
</tr>
<tr>
<td>Quality of air transport infrastructure</td>
<td>3.4</td>
<td>4.1</td>
<td>4.3</td>
<td>4.7</td>
<td>6.1</td>
</tr>
<tr>
<td>Available airline seat km/week, millions*</td>
<td>3,827.3</td>
<td>3,685</td>
<td>3,498</td>
<td>14,163</td>
<td>34,115.8</td>
</tr>
<tr>
<td>Quality of electricity supply</td>
<td>4.1</td>
<td>4.8</td>
<td>3.4</td>
<td>5.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Mobile telephone subscriptions/100 pop.*</td>
<td>135.3</td>
<td>152.8</td>
<td>70.8</td>
<td>88.7</td>
<td>95.5</td>
</tr>
</tbody>
</table>

Table 11 “infrastructure score” Source: (Schwab, 2015)

The overall infrastructure of Brazil is rather poor with a score of 3,1 on a scale from 1-7. Comparing to the BRICs, Brazil is not that far from India, but lacking significantly behind Russia and China. The distance is more significant when comparing to the United States, which on all parameters perform better than the BRICs. The inadequate supply of overall infrastructure is also considered one of the largest challenges for doing business in the country. When considering the different infrastructure

\(^{33}\)Tropical rainforest, the pantanal (tropical wetland), the cerrado (tropical savannah), mata atlantica (“Atlantic forest”) and the pampas (fertile plains).

\(^{34}\)Values are on a 1-7 scale unless otherwise annotated with an (*).
aspects such as roads, railroads, port, air transport and electricity supply Brazil’s performance varies considerably. The quality of roads, railroads and ports all score less than 3, which are factors contributing negatively to the average performance. Especially the railroad infrastructure with a performance of 1,7 points out as terrible and the comparative aspect does not improve the picture where the peers perform higher than 4.

The overall performance is positively influenced by the performance in the air transport infrastructure and electricity supply. For the air transport Brazil’s score is 3,4, which still is unimpressive, but not on a level too far from the BRICs. Despite the quality of the Brazilian air transport system has to improve, the country performs well when it comes to available airline seat km per week. The performance on this area is the 9th best worldwide, indicating that the volume capacity is quite high, but it still suffers from quality issues.

When it comes to the electricity supply Brazil scores 4,1, which isolated is a decent score. Despite it is still below Russia, China and the United States, Brazil performs better than India on this point. Related to the electricity supply, Brazil has a positive performance for mobile subscriptions. A subscription rate of 135,3 per 100 population ranks them as the 37th best country in this category. However, it can be concluded that a very complex geographical environment both creates barriers as well as demands for a wide-ranging infrastructure system that yet has major improvements to be implemented.

The above discussed macroeconomic flows and resources set the national context for economic development and growth opportunities. Due to the scope of the thesis it is beneficial to explore economic figures and developments specific for the pharmaceutical industry. This is to be elaborated in the following section.

5.3.3 The pharmaceutical market from economic perspective

The economic analysis of the pharmaceutical market will include an overview of economic flows as well as stocks. The flows include insights into the market development and spending on healthcare among the BRICs. The stocks will contain a discussion on relevant human resources and infrastructure issues.

5.3.3.1 Booming Brazilian pharmaceutical market

The Brazilian pharmaceutical market trend is unlike the overall macroeconomic development. The below table illustrates the development from 2005-2016 (expected) for the top 10 total pharmaceutical markets worldwide.
The increase in the national economy and aging population in 2018 with a CAGR of 12 percent (Euromoney Institutional Investor Company, which forecast generic market will reach more than 33 percent by 2018). They also find the demographic developments e.g. an increasing middle class and aging population as main drivers behind the growth. Despite a slowdown in the national economy, the pharmaceutical growth rates seem to be continuing at a rather high rate. The pharmaceutical revenue can be further explained by looking into the national spending on

<table>
<thead>
<tr>
<th>Year</th>
<th>Rank</th>
<th>Country</th>
<th>Size</th>
<th>Rank</th>
<th>Country</th>
<th>Size</th>
<th>Rank</th>
<th>Country</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>1</td>
<td>USA</td>
<td>249.2</td>
<td>2010</td>
<td>1</td>
<td>USA</td>
<td>350.380</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Japan</td>
<td>84.9</td>
<td></td>
<td>Japan</td>
<td>111.2</td>
<td>2</td>
<td>China</td>
<td>155.165</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>France</td>
<td>33.3</td>
<td></td>
<td>China</td>
<td>66.7</td>
<td>3</td>
<td>Japan</td>
<td>105.135</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Germany</td>
<td>33.1</td>
<td></td>
<td>Germany</td>
<td>45.0</td>
<td>4</td>
<td>Brazil</td>
<td>42.52</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Italy</td>
<td>21.3</td>
<td></td>
<td>France</td>
<td>41.3</td>
<td>5</td>
<td>Germany</td>
<td>39.49</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>UK</td>
<td>16.4</td>
<td></td>
<td>Brazil</td>
<td>29.9</td>
<td>6</td>
<td>France</td>
<td>32.42</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Spain</td>
<td>16.1</td>
<td></td>
<td>Italy</td>
<td>28.6</td>
<td>7</td>
<td>Italy</td>
<td>23.33</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Canada</td>
<td>15.9</td>
<td></td>
<td>Spain</td>
<td>22.7</td>
<td>8</td>
<td>India</td>
<td>24.34</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>China</td>
<td>14.1</td>
<td></td>
<td>Canada</td>
<td>22.4</td>
<td>9</td>
<td>Russia</td>
<td>23.33</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Brazil</td>
<td>11.8</td>
<td></td>
<td>UK</td>
<td>21.6</td>
<td>10</td>
<td>Canada</td>
<td>19.29</td>
</tr>
</tbody>
</table>

Table 12 "pharmaceutical market development in the world" Source: (Oriordan et al., 2013)
healthcare on monthly average by household income (PPP, USD) versus income level. The graph below illustrates the relatively picture among the BRICs in 2013.

The graph illustrates how the healthcare spending in Brazil is significantly higher than the remaining BRICs. The shortage of demanded product and doctor supply in the public healthcare system and presence of a strong out-of-pocket market is the driver behind this graph. Another explanation could be that Brazilians are unhealthier than the remaining BRICs, however it seems unlikely that this can be the sole reason behind the significant gap. However, this cannot be confirmed empirically.

The public shortage of necessary medicine means that the households with higher income will turn to the more efficient and expensive private market illustrated by the increasingly large gap from approx. USD 3.500 to USD 7.500. The shortage problem is so significant that a gap to the rest of the BRICs is already established for households with less than USD 1.000. Considering the high inequality described in social groups, this creates a market access challenge for MNPCs because healthcare spending is already on a significant high level for low-income families. Consequently, it may be difficult to sell additional branded products with an attached premium price.

Despite the positive growth estimates, the industry still faces strong challenges related to the earlier discussed human capital and infrastructure.
5.3.3.2 Human resources in the healthcare sector

Traditionally, Brazil’s physicians were tenured as statutory public servants, meaning they worked in institutions subject to public administration (Ministry of Foreign Affairs of Denmark, 2014). This accompanied special working conditions, such as stability and social security benefits. Today, to reduce expenditures, private and public entities as well as insurance companies only seldom employ doctors as private individuals. Instead they are engaged as separate legal entities either as a group or individual (Ibid.). To be authorized by the private sector, doctors are required to be accredited by the insurance companies (Ibid.). The majority of doctors accredited by insurance companies work by volume, meaning their earnings depend on the number of patients attended. Doctors can also attend patients with health insurance plans other than the ones accredited. In this case, the doctor is paid not by the insurance company but by the employing hospital resulting in lower fee per medical appointment, as there is a margin for the hospital. Working as a legal entity with pay per service is cost efficient for the hospitals and clinics. However it makes the work for the physicians more precarious, which has entailed a negative effect on the availability of physicians.

As mentioned, Brazil suffers from a shortage of HCPs incl. trained physicians. The average number of physicians is according to the World Bank’s most recent data 1.9 per 1,000 inhabitants against 2.5 in United States and 4.3 in Russia (World Bank, 2015). The large gap may be due to the earlier discussed low educational quality, especially in the science sector. The inadequately workforce is also considered one of the most significant challenges for doing business in Brazil (Schwab, 2015). Further the regional differences are significant, resulting in lower ratios in the more remote areas of Brazil (Livro Branco, 2015).

Graph 15 "registered doctors per 1,000 inhabitants across region" Source: (Livro Branco, 2015)
The spread ratios between central and remote areas become clear when looking at the above graph. It highlights a significant difference between registered doctors per 1,000 inhabitants across the country. The gap between the North and South best exemplifies this as the South has 2.5 times more doctors than the North. Moreover, there is a significant difference between the public and the private sector, with far more positions available per 1,000 inhabitants in the private sector (Ministry of Foreign Affairs of Denmark, 2014). The graph above also correlates with the Brazilian wealth distribution. As discussed earlier, the Northern and Northeastern part of Brazil is the poorest regions and these are also suffering most from doctor shortages. Therefore the social groups in these areas do not only suffer from economic inequality but also within healthcare access.

As outlined in the political processes, the pressure for more doctors in the public system led Dilma’s government to introduce the new “More Doctors” program in 2014, which both increases import of doctors from neighboring countries and enrollments at medical schools. The program is expected to add up to 36,000 doctors to the public health service by 2021 (Ministry of Foreign Affairs of Denmark, 2014), which will boost the potential talent pool for the pharmaceutical industry in the medium-long term.

Despite positive intentions, both initiatives within the program have been criticized by the Doctors’ Organizations. It claims that the lack of doctors in remote areas is primarily due to lack of infrastructure and supply, preventing a better distribution of doctors (Ministry of Foreign Affairs of Denmark, 2014). The infrastructure’s influence on the pharmaceutical industry is to be further elaborated in the following section.

5.3.3.3 Poor infrastructure creates market access barrier
For the pharmaceutical industry the infrastructure imposes market access challenges and is directly related to many of the issues the market faces. Firstly, the lack of doctors in remote areas is, as mentioned, claimed by the Doctors’ organization to be due to lack of infrastructure and supply that prevents a more equal distribution of doctors. As the doctors are the distributor of prescriptions and advise on drugs, the above problem also influences MNPCs’ access to patients in remote areas. Secondly, the lack of infrastructure is both a source of demand as well as a barrier for the previously described booming homecare market. The lack of infrastructure disable citizens in remote areas from accessing doctors and further a pharmacy, super market or other kind of drug store as the final point of sale. Opposite, the lack of infrastructure also complicates the homecare providers’ delivery possibilities and forces them to innovate. Thus it can be concluded that the infrastructure represents challenges that reduces the market access for both patients and healthcare providers.
5.3.4 Economical risks and opportunities

Similarly to the political and institutional analyses, the economic analysis will be summarized in the following "economy box", where words in black font are related to the national sphere and the grey font is industry specific. However, as argued in the methodological part, predicting macroeconomic flows on a medium-long term scale are attached with high uncertainty due to greater volatility compared to especially institutions. Therefore certain macroeconomic forecast is only on short-term i.e. 2016 as further periods are too unpredictable. However other estimates, mainly related to economic stocks and the pharmaceutical market, are applied on a more medium-long term scale.

In accordance with the PIE-analysis and methodological systems view, the economy part is first analyzed individually with focus on internal relations. Subsequently the economy is analyzed together with politics and institutions in section 5.5 about PIE-dynamics to emphasize societal relations and synergies in the NIS system level.

| Economy (flows): |
| 7th largest economy worldwide, economic stagnation, more pragmatic and less interventionist economic policies, large national debt, tight financial policies i.e. tax increases and spending cuts, high inflation, high interest rates to reach inflation target |
| Brazilian pharmaceutical market is booming and expecting to be 4th biggest worldwide in 2016 |
| High spending on healthcare versus income level and large out-of-pocket market |

| Resources (stocks): |
| High educational enrollment rates, low educational quality especially in math and science |
| Complex geographical environment, poor infrastructure quality, high amount of mobile subscriptions |
| Lack of doctors, implementation of “more doctors” program, regional inequality on healthcare accessibility |

In summary the Brazilian economy is the 7th wealthiest measured in GDP. The country has previously experienced growth rates corresponding to emerging markets as described in the literature review. However, Brazil has recently experienced what can be classified as growth stagnation in 2014, which is expected to continue throughout 2015 due to the implementation process of monetary and fiscal policies. The economic slowdown is caused by exogenous as well as domestic forces. This illustrates
the complexity of the economic sphere and how the systems view, as a method of understanding, adds explanatory value because a holistic perspective is required for a full assessment.

Despite uncertainties related to macroeconomic flows, Brazil’s economic future on a medium-long term will continue to be influenced by a high national debt level. The current policies are carried out within debt constraints focusing on tight fiscal policy and a monetary policy aiming at controlling inflation. Within this context short-term estimates are included about the macroeconomic environment. It is expected that the macroeconomic environment will start to improve in 2016. The international landscape should be kinder, given that, after four years of significant decreases, the terms of trade ought to hold relatively stable in 2016. The economic growth, both worldwide and for certain major trading partners, is expected to surpass levels seen in 2015 and the recent past. The effects from the Petrobras crisis are also likely to have an impact in 2015, although the significance is unpredictable. In addition the consequences of monetary and fiscal policies is expected to start work through in 2016. These policies have created the basis for predicting a positive development in the GDP growth of 1.8 percent in 2016. However, this is still short of its potential rate around 2,5 percent but still an improvement of the 2014-15 levels.

The above macroeconomic flows are not the only domestic factors challenging the Brazilian environment. As a consequence of the development since the military regime, it is also affected by structural issues that are problematic from a more medium-long term perspective. Following the theoretical discussion on intensive and extensive growth cf. section 3.2, it can be argued, that growth in Brazil has resulted in a middle-income trap. Such an economy is characterized by accomplishment in evolving from low per capita income levels, but fail to progress to higher income levels of advanced economies. Since the debt crisis of the 1980s, Brazil has been unsuccessful in delivering structural transformation and per capita income growth that had characterized the previous three decades (Teles & Cardoso, 2009). Brazil’s failure to achieve high-income status originates from the transformation of unskilled workers from labor-intensive occupations to more modern manufacturing or service industries. As these new occupations did not require significant upgrading of skills, they deployed advanced levels of embedded technology imported from more advanced economies and adapted those to local conditions (Canuto, 2014). This boosted TFP, leading to GDP growth beyond what could be explained by the expansion of extensive inputs of labor, capital, and resources, lifting the economy to the middle-income bracket. Accordingly economic progress depends on an economy’s ability to continue raising TFP by moving up the manufacturing, service, or agriculture value chain toward higher-value-added activities that require sophisticated technologies and higher-quality human capital along with intangible assets like organizational capabilities.
Middle-income economies seeking to climb the ladder are restricted from import or imitate existing technologies or capabilities (Canuto, 2014). By contrast, they are required to perform and build these endogenously. This requires a vigorous institutional framework – including, a strong education system and advanced infrastructure – that encourages innovation and incentives for continued upgrading of incentives, technology and human capital – to reach the frontline-countries and to be part of leading the technological frontier. Following this logic, Brazil’s inability to continue its ascent up the income ladder is rooted in its failure to modify its institutional environment.

Despite the recent economic slowdown, focus on increasing taxes and cutting costs and structural challenges, the pharmaceutical market is expected continue its strong growth. The market is thus estimated to be the 4th largest worldwide in 2016. It is prospected to achieve a CAGR at 12 percent to 2018 indicating a strong pharmaceutical market growth on the medium term.

Despite industry growth, the economic attractiveness of investing in pharmaceutical R&D is ambiguous. Capturing as much value as possible of the growing pharmaceutical market is obviously an objective for investing in the country, however hiring talented employees is also both a significant objective as well as requirement when it comes to R&D. It turns out questionable whether Brazil can provide the human capabilities required for R&D activities. Further, the infrastructure is constraining market access and reducing the benefits of the large and growing market size.

### 5.4 Surrounding world

The influence from the surrounding world, illustrated in the historical analysis, is of high importance for the current and future environment as well. Among external factors having the greatest stake in Brazil’s macroeconomic situation are the negative development in commodity prices, partner state policies and a reverse trend in FDI inflow. Additionally, Brazil’s membership of WHO influences domestic health policies and hence the environment for MNPCs.

It has been argued that, increasing commodity prices, including fuel, have historically been a propulsive force in the economic development. By 2011 this trend reversed, and the prices have generally been declining since as exhibited in Graph 16. By chance, the adjustment in global commodity prices in 2014-15 has correlated with the inauguration of Dilma, which can be expected to impose future difficulties and constrained maneuverability compared to her predecessors.
Despite Brazil’s export, unlike export-driven countries as China, is equivalent to only approx. 12 percent of GDP, it is still a significant driver of the national economy in terms external revenue sources (World Bank, 2013). Commodities constitute approx. 60 percent of total exports, led by iron ore, crude petroleum and soybeans. The destinations are diverse but among main recipients count China at 17 percent, United States at 11 percent and Argentina at 7 percent (Ibid.).

Two main external factors have contributed negatively to Brazil’s economy. This is the combination of decreasing global commodity prices since 2011 together with a slowdown in the increase of exports to China. From 2011 to 2013, China’s imports rose by only USD 1,5 billion or 3,8 percent overall, which is significantly below previous years’ export value. The importance of commodity prices and of China as importing country is illustrated by the fact that nearly 83 percent of China’s import from Brazil was in commodities in 2013. In 2014, the overall trade value between Brazil and China was down by 6 percent compared to previous year (World Bank, 2015).

Further Brazil’s main trading partner in South America, Argentina, has been gradually reducing its imports from Brazil as a result of imposed restrictions due to domestic economic difficulties. Consequently, Brazil’s exports to Argentina declined by 27,2 percent in 2014, and overall trade with Argentina dropped by 21,2 percent (Ibid.).

As a result of difficulties from the surrounding world, Dilma has appointed Armando Monteiro to head the Ministry of Development, Industry and Foreign Trade. Armando wants trade expansion beyond the Mercosur states35 to access new markets. Among key priorities are increasing trade with the United

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35 Argentina, Uruguay, Paraguay and Venezuela
States, implementation of a trade agreement between Mercosur and the European Union and increasing trade with Mexico and other Pacific Alliance members\textsuperscript{36}.

Various factors work in Brazil's favor of these markets (MIT, 2015). Firstly, the Brazilian currency, real, is weakening and secondly, the government plans to offer financing insurance on exports to reduce Brazilian companies' political risks related to entering new markets. Thirdly, Brazil is in a beneficial diplomatic position as the country hosts the Mercosur's rotating presidency in 2015. Finally, Dilma plans to visit the United States in September this year, concerning expansion of trade agreements.

In spite of these circumstances, Brazil will have trouble expanding into new markets. Negotiations between Mercosur and the European Union have faced obstacles because of Argentina's unwillingness to negotiate on protectionist policies (Ibid). Consequently Brazil has pushed for a multi-track EU free trade agreement, allowing for separately negotiated agreements.

Concerning the Pacific Alliance members, Brazil's main constraint has been Mercosur's common external tariff, preventing Brazil from signing free trade agreements or lower trade tariffs in bilateral deals\textsuperscript{37} (MIT, 2015). The current plan is to eliminate over 90 percent of trade tariffs by 2019 between Brazil and the Pacific Alliance, although Brazil prefers to fast track this initiative.

The main limitations for expanding trade with the United States are American demands of opening the Brazilian market additionally and allow American companies to participate more in Brazilian government tenders of infrastructure and energy assets (Stratfor, 2015). At the moment, Brazil has a law that limits the participation of foreign suppliers in state-owned companies and government contracts, making foreign participation difficult. Opposite Brazil has called for the United States to open its market more to Brazil's agricultural exports. Currently the two countries have had trade disputes related to cotton and ethanol, a product that Brazil historically has reared as an alternative source of energy.

Another aspect illustrating how the surrounding world influences Brazil is the inflow of FDI. The general economic slowdown in Brazil is mutually affected by a decrease in FDI, which creates a negative spiral. After a slowdown in 2009, inward FDI increased considerable, and then slowed down slightly in 2011 (Santander, 2015). Having reached USD 64 billion in 2013, inward FDI declined to USD 62 billion in 2014. This decline is a general trend in South America as corporate investors chasing

\textsuperscript{36} Chile, Columbia, Mexico and Peru

\textsuperscript{37} Except in the case of Mexico, which is exempt by Mercosur legislation
superior growth markets as e.g. the Brazilian market recently has seen a near-zero growth rate (Fingar, 2015). The future however looks brighter according to the World Bank (2015) prediction increased GDP growth, assuming that China’s growth slowdown is not worse than expected and commodity prices do not plunge substantially lower. However, recent escalations of the Chinese stock market indicate a stronger slowdown than anticipated.

The above described conditions such as a weaker currency and greater government support is likely to benefit Brazil’s new export plan in the future. However, predicting future developments in economic flow variables are as argued earlier attached with great uncertainty. For example commodity prices are, at least in the short run, moving as a random walk and affected by speculative actions. These are externally determined and are in the medium term by World Bank and IMF expected to improve. As commodity prices historically have shown to be highly determining for the economic success in Brazil, the potential improvement will be beneficial for the economic maneuverability.

As a WHO member, Brazil is subject to practices, regulations and recommendations proposed by the organization. This underlines the dependency and WHO’s ability to influence institutions. WHO’s main strategic priorities include reducing exclusion and social disparities in health, and organize health services around people’s needs and expectations (WHO, 2013). In latest Country Corporation Report published by WHO (2013), there is a clear correlation between the priorities of WHO and the Brazilian government. Potential synergies can be achieved due to WHO’s pressure of improving health inequality combined with a domestic pressure from social groups. Consequently, cooperation between the Brazilian government and WHO can result in changing institutions to improve the situation. Currently, the cooperation has resulted in increased national support in the three government levels, recognition of WHO’s managerial and technical expertise and ongoing mobilization of extrabudgetary financial resources. WHO recognizes that Brazil has made progress in its supply of universal healthcare, but argues that further initiatives are required where especially managerial expertise is in short supply. Therefore it can be expected that WHO in the future will act as an influencing partner to solve health issues, and try to directly influence national health decisions.

For the individual MNPC it can be an advantage to closely monitor tendencies and innovations proposed by the WHO to be abreast of national policy implementations. This will enable them to exploit new political initiatives faster than competitors, and thereby incorporate this knowledge in its strategic decisions and R&D.
5.5 Dynamics within the PIE analysis

The dynamic section is built upon the findings from the NIS system-level analysis conducted via the PIE-framework. The purpose is not to provide a repetition of the findings, but rather to emphasize the dynamics and potential synergies comprising future risks or opportunities of interest for the international pharmaceutical industry. The findings and path-dependency is presented in the following illustration.

**Politics:**
High political instability – in heritage from history.
Center-left dominating political processes
Political process of improving the healthcare system with more funding and more doctors.
Political support of generics market.

**Social groups:**
High inequality
Increasing elderly population
Increasing middle class
Unequal access to healthcare
Groups in need of home healthcare
Lack of doctors

**Economy (flows):**
7th largest economy worldwide, economic stagnation, more pragmatic and less interventionist economic policies, large national debt, tight financial policies i.e. tax increases and spending cuts, high inflation, high interest rates to reach inflation target
Brazilian pharmaceutical market is booming and expecting to be 4th biggest worldwide in 2016
High spending on healthcare versus income level and large out-of-pocket market

**Resources (stocks):**
High educational enrollment rates, low educational quality especially in math and science
Complex geographical environment, poor infrastructure quality, high amount of mobile subscriptions
Lack of doctors, implementation of “more doctors” program, regional inequality on healthcare accessibility

**Formal institutions:**
**Political:** Constitution guarantees universal healthcare
High political rights, civil liberties and free media. Low government effectiveness, high burden of bureaucracy (red-tape)
**Economical:** Liberalized economic institutions, complex and fragmented tax system, relative high labor regulations, strong overall IPR but rather low patent protection
Unfavorable reimburse and restricted pricing policies, high out of pocket market, long drug approval process, complex healthcare system
**Enforcement:** Relatively low enforcement of patent protection, high corruption

**Informal institutions:**
Low social trust correlated with high corruption
Personal relationships of high importance

**Surrounding world:**
Decreasing and volatile commodity prices, decreasing trade value with important countries, negative FDI inflow development
Pressure to meet WHO compliance

Figure 16 “dynamics within the PIE-framework”
Where the discussion of the development from military regime to democracy showed a clear causal relationship illustrated with the clockwise circle, the current analysis provides a more complex picture. It shows that institutions are not only affected by politics and then influencing the economy, but they are also directly influencing politics and social groups. This is exemplified by higher independence among banks that can respond quicker and without political influence, along with unbeneﬁcial economic environment constraining institutional maneuverability.

The social groups are continuously characterized by high inequality despite an increasing middle class. Together with an increasing elderly population, these movements will have a significant impact on future political processes. The developments are further consolidated into the pharmaceutical industry that is exposed to unequal healthcare access, shortage in skilled human resource but also the potential to meet these challenges with home healthcare solutions. Social groups’ dissatisfaction with the government’s handling on economic resources e.g. education and healthcare has fueled the political instability in heritage from the political history. It has forced the political process in a direction towards improving the human capital within the healthcare sector through institutions such as "More Doctors" but also promoting the generic industry to serve the low-income group. The pressure for implementing future initiatives like these is further encouraged by WHO as its main priorities include reducing exclusion and inequality in healthcare. As inequality in healthcare is a shared issue for social groups and WHO, synergies are observed within this field. The outcome for the attractiveness of investing in R&D in Brazil based on these initiatives is two-folded. Increasing the healthcare sector’s capacity and access is a preferable vision, which is aligned with MNPCs’ interest. However, doing so by politically promoting the generics market is unfortunate from a branded R&D perspective.

Pushing for initiatives such as "More Doctors" is possible due to institutional boundaries providing political rights, civil liberties and a free media. This means institutions do not only affect social groups and political process via the economy, but also directly by the Constitution providing transparency and individual rights. Despite the Constitutional amendment guarantees universal healthcare, it is not successfully implemented in the society. This can be connected to poor institutional performance in other areas such as the low government effectiveness, presence of red tape and high fragmentations between regions and states due to different legislations. The fragmentation of states is further affected by poor economic resources in form of the infrastructure creating a negative synergy that reduces the benefit of a large market. One can interpret the Brazilian institutions as positive by providing transparency and possibility for influencing the political processes, however, despite political implementation of concrete initiatives, the actual execution and performances are insufficient.
The societal issues described above have resulted in industry specific institutional insufficiencies. The most significant ones include the complex and fragmented system causing failures in delivering universal healthcare resulting in an expensive out-of-pocket system. Further the red-tape issues are incorporated into ANVISA’s drug approval process, which is lagging significantly behind other countries. Combining this with political initiatives favoring the generic markets and a relatively poor patent protection, one sees a societal development making it less attractive to develop premium branded products.

Finally, the high degree of corruption is a key institutional aspect to consider. The corruption has placed the political situation on the edge, causing a collapse of already low social trust and political stability if corruption appears to have infected the heart of the government and political organization. As corruption historically has been an embedded part of the national history, it is not an unlikely scenario. In case the presence of corruption at highest political level is proved, it may have an enforced effect on the surrounding world, especially the inflow of FDI, which will have a further negative consequence on the foreign investment level and hence the economic development in Brazil.

The economy is directly influenced by institutional forces along with the surrounding world that has a continuing effect on political processes and social groups. The current slowdown in economic flows i.e. growth is to a large extent contributable to the decrease in commodity prices along with domestic forces. The effect of the former is related to Brazil’s large stocks of natural resources among which the majority are classified as commodities. The decreasing commodity prices will further have a direct influence on healthcare and education as it is politically decided that these areas consume respectively 25 percent and 75 percent of petroleum royalties. The domestic forces are especially referred to by the large national debt burden. Recent fiscal and monetary policies are however implemented to bring Brazil back on track, and it is estimated that these incentives will start working through in 2016. This intervention will however not improve the 2015 situation, which is constrained by tight fiscal frames. The results of these are however partly dependent upon the development in global commodity prices where potential higher prices will increase export value, and thus impact fiscal and monetary policies as domestic enterprises increases its tax base.

Despite disappointing growth measures, the pharmaceutical market has shown, and is expected to show, excessive growth rates. This is determined by domestic institutional forces prioritizing reductions in social disparities in healthcare along with WHO initiatives. The Brazilian pharma market is estimated to be the 4th largest in 2016 and is predicted to achieve a CAGR at 12 percent until 2018. Regarding the attractiveness of investing in pharmaceutical R&D in Brazil the situation is ambiguous. Capturing an increasing share of the market growth is obviously an attractive factor, which could be
captured by increasing local responsiveness through resident R&D. However it is questionable if human capabilities required to customize products or processes are present. Further, the economic resources from the infrastructure is constraining the market access and reducing the benefits of a large market size.

6 Micro behavior of NIS
As argued in methodical procedures, NIS theory distinguishes between a narrow and broad perspective. It is argued, that in this specific situation it is preferable to apply a broad perspective containing an analysis of the system level and the micro behavior. In the former section, the PIE-analysis was applied as tool for assessing the system level i.e. the macro environmental context. This section aims at assessing the micro behavior and the dynamics and interrelation within and across the system level.

The micro behavior embraces organizations and institutions dealing directly and explicitly with R&D. To capture these aspects, the micro behavior will be assessed through an analysis of its innovative input and the subsequent science and technology (S&T) output as proposed by Jun-fang (Jun-fang, 2013). It is suggested that innovation input indicators include innovation fees and human resource inputs, and are measured by e.g. R&D expenditures and R&D researchers (full-time equivalent) across different innovation entities (enterprises, universities, government38). The assessment of S&T output is proxied by available data on resident patents and number of scientific articles. Despite criticism on the use of patent data as proxy for innovation output, this variable is the single most frequently used indicator of innovation output (Kravtsova & Radosvonic, 2011). Several scientific papers have examined the relationship between firms’ R&D expenditure and patents and found a positive correlation. The number of scientific articles is also a direct outcome of R&D activities, which produce new S&T knowledge and require inputs of human and financial resources (Jun-fang, 2013). The different innovative inputs and outputs are summarized in the table below.

38 Government includes all public activities besides those taking place in the higher educational system i.e. universities.
Variable | Variable Name
--- | ---
Providers of Innovative inputs | Government
| University
| Enterprise
| Patents applications
| Patent grants
| Patents in force
| Scientific articles

Table 13 “applied variables as proxies for providers of inputs and S&T outputs”

The extent to which these inputs provide S&T outputs are relevant for assessing the Brazilian environment for innovation i.e. R&D, and the attractiveness of establishing R&D subsidiaries.

Initially a brief overview of the development of S&T in Brazil will be assessed at a glance. This is followed by a closer look at the innovative inputs and outputs as in table 13 above. Due to data limitations, most recent data published by reliable data sources on specific R&D expenditure and personnel contains information from 2011. As data from 2011 is applied for analysis, it cannot be expected to represent the current level and therefore it includes considerations on potential changes since 2011. Since the S&T output is a product of the innovative inputs, the output data included is from the following year i.e. 2012. Further, the time lag between innovative inputs and S&T outputs are relevant to consider, because many R&D activities require several years of work before they amount to specific products. This is especially the case for the pharmaceutical industry where e.g. a successful drug development on average takes 8-10 years (PhRMA, 2013). Therefore, when considering the output data on 2012, it is not only explanatory factor for the inputs in 2011, but also the degree and effectiveness of previous inputs. In order to evaluate the effectiveness of how well Brazil transforms its innovative inputs into outputs, simple efficiency calculations are applied i.e. output variables divided by input variables, in the concluding section of this analysis.

6.1 S&T expansion in Brazil at a glance

Initial movements toward S&T in Brazil were affected by fear of independence during the colonial period. The Portuguese colonial power feared that the appearance of educated Brazilian classes would boost nationalism and aspirations towards political independence, as it had happened in the United States (Stanton, 2014). Therefore, S&T was mainly carried out and performed in Portugal at highly

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39 No industry specific data for S&T output has been obtainable and thus aggregated patents and scientific articles are used.

40 Specific content refers to data on national R&D expenditure on sectorial level. I.e. expenditures by enterprises, government and higher educational organizations (Universities).
developed universities, which reduced the Brazilian development. Further, S&T policies have been hindered by political instability in form of periods with military regime as described in the political part of the PIE-analysis. Shortly after Brazil returned to civilian ruling, the Ministry of Science and Technology (MCT) was formed in 1985 (Ho & Luban, 2004). The main role of the ministry was to take explicit control of the expansion of infrastructure in S&T principally related to human resource development. Also, attempts were made at identifying important strategic sectors and provide funding to ensure growth. Previous allocations were ineffective since they were awarded on academic criteria rather than application to commercial opportunities (Ibid). It is interesting to note, that MCT mainly was concerned with infrastructure building rather than technological goals, hindering the long-term development.

The periods of political instability may have influenced Brazil’s current R&D figures due to changing political interests. However, due to governmental regulations and incentives, R&D has been growing since the 1990s (Grueber, 2012). The following graph represents the R&D figures from 2005-2011 in the peer group.

![Graph 17 “R&D expenditure as a percentage of GDP” Source: (World Bank, 2015)](image)

In 2011 Brazil allocated 1,21 percent of GDP to R&D. This is an improvement from earlier years, and compared to the peers, Brazil is placed in the upper half of the BRICs surpassing Russia and India, but far distanced from the United States. Brazil increased its R&D expenditure as percentage of GDP by 4,13 percent from 2010 to 2011, which is the highest of the assessed economies only surpassed by China (4,55 percent).

The increasing governmental focus and public policies in favor of innovation, has led the President of Anpei (National Association for Research and Development of Innovative Companies), Carlos Eduardo
Calmanovici, to argue that the Brazilian business environment increasingly is attracting global centers of R&D (Calmanovici, 2014). This is especially within areas related to extracting natural resources e.g. deep-water oil extraction (OECD STI, 2014). Despite domestic enthusiasm about the Brazilian ability to innovate and attract R&D, current rankings from the Global Competitiveness Report reveals that current figures has been aligning. One figure is innovation founded on a weighted average from different measures. These measures include to what extent companies have capacity to innovate, quality of scientific research institutions, company spending on R&D, university-industry collaboration in R&D, degree of which government purchases foster innovation, availability of scientists and number of patent applications. The innovation figures are based on measures from 2013, 2014 and 2015, and are presented in table 14 below.

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>3.3 (3,4)* (3,5)**</td>
<td>3.3 (3,1)* (3,1)**</td>
<td>3.5 (3,6)* (3,6)**</td>
<td>3.9 (3,9)* (3,9)**</td>
<td>5.5 (5,4)* (5,6)**</td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 14 “innovation score 2013, 2014 and 2015” Source: (Schwab, 2013; Schwab, 2014; Schwab 2015)

The difference between the figures of the BRICs is quite small, which may be difficult to observe from an enterprise perspective. Despite a rather small gap between the BRICs, the development of Brazil’s innovation is trending downwards. This is an interesting development considering the government’s goal of increasing R&D spending up to 1.8 percent in 2014 from 1.21 percent in 2011 to improve the country’s innovation capacities (OECD STI, 2014).

It is notable that the relative ranking on innovation scores from 2014 deviates from the ranking on R&D expenditure as a percentage of GDP in 2011. Despite the United States ranks as number one followed by China both in terms of expenditure and innovation, the rest of the rankings have changed. For example whereas Brazil has much higher expenditure than India in 2011, India still ranks better on innovation capacities in 2014. Even though the two tables provide different measures, it is possible to conclude that either India and Russia have increased their R&D budgets to a level above Brazil since 2011, Brazil has decreased their budgets relatively or the relative efficiency of Brazil’s R&D spending is lower than India and Russia. The decreasing Brazilian performance further correspond with the economic analysis previously performed, concluding that the GDP growth rate and economic performance has decreased considerable since 2011, indicating a degree of correlation as argued by EU Innovation Research (2011). The development in R&D expenditure may be a result of tighter

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41 Values are on a 1-7 scale with 7 as the best score.
financial budgets caused by the large national debt along with e.g. decreasing export revenues as a result of decreasing commodity prices.

The following parts aim at exploring the nuances of the R&D figures for Brazil starting with the government.

6.2 Innovative input: Government

During the latest decade the Brazilian government has implemented various initiatives to encourage competitiveness through structured efforts in R&D and innovation. An example is the project *Inova Empresa*, a program built to stimulate long-term breakthrough innovation projects with an estimated investment of more than USD 14 billion over a couple of years (Calmanovici, 2014). The purpose is to support innovation projects in areas such as healthcare, agribusiness and energy, oil and gas (O Banco Nacional do desenvolvimento, 2014). Additionally, the government directly supports R&D infrastructure programs, such as the *Sirius Project*, which aims at providing the necessary technical environment to allow the development of next generation technologies (LNLS, 2014). Further it act as an important element for the country to develop skills and competences, and to encourage the creation of technology based companies and sectors that will further stimulate R&D activities.

Along with a strong governmental focus on innovation creating projects, different R&D incentives are launched. Ernst & Young annually publish an R&D incentive reference guide comparing incentives to promote R&D (EY, 2014-2015). This report reveals that companies conducting R&D in Brazil are exposed to beneficial conditions for effective R&D. This includes accelerated depreciation on R&D assets, financial support and tax deductions. From an enterprise perspective this seems attractive, but comparing with the peer group it is visible that other incentives are available on the global market, which may be more promising42. Among these include cash grants and loans in India and reduced tax rate in China. As R&D budgets tighten, R&D incentives become increasingly important. Pharmaceutical companies have long been big recipients of these incentives, and many rely on them to help fund their long-term and expensive R&D programs.

The most obvious way of quantitatively determining the government attitude toward R&D is to measure personnel in and expenditure on R&D. As argued earlier, present data on specific sector expenditure and personnel is unobtainable. Concurrent, comprehensive historical data on a proportion of the assessed economies are equally unavailable. As 2011 data are the only available year

42 It is out of scope of this thesis to evaluate each incentive individually and create a fully comparison of the countries.
across the peers, these figures are presented in the following table. Where additional data are available, this will be included textually in the analysis.

<table>
<thead>
<tr>
<th></th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0,66</td>
<td>0,43</td>
<td>0,48</td>
<td>0,33</td>
<td>0,8</td>
</tr>
<tr>
<td>Public R&amp;D expenditure in % of GDP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government R&amp;D personnel per 1.000 inhabitants (full time)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0,04</td>
<td>0,99</td>
<td>0,07</td>
<td>0,18</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

Table 15 "public and Government R&D figures" Source: (IMD, 2014; UNESCO, 2015)

From the table it is visible that among the peers, Brazil is the country spending the largest proportion of the GDP on R&D in the public sector, only surpassed by the United States. As with many developing countries, research in Brazil is, and has for decades, predominantly been a public-sector activity counting for around 55 percent of total R&D expenditure in 2011. According to British Council (2015) this figure is expected to approx. persist in 2014. From valid available data, it is not possible to obtain figures for the amount of public expenditures performed in government but non-statistical sources claim that the universities consume a majority of public R&D budgets.

Figures for R&D personnel in the government are available as presented in table 15. Government R&D personnel has been close to constant since 2006 and is calculated as number of full time researchers per 1.000 inhabitants (see Appendix E). For Brazil this figure is considerable lower than any of the peers, which may indicate shortcomings within the area. The explanation of the low number of government R&D personnel is found in a correspondingly high amount of university personnel, which match the distribution of R&D expenditure as argued above. This is to be elaborated in section 6.3. Brazil has gradually increased its government R&D personnel from 0,03 per 1.000 inhabitants in 2007. In the corresponding period both China and Russia\(^3\) has shown fluctuating figures, but only Russia has managed to increase its government employment. Russia's 2011 figure is the most conspicuous of those presented in the table. One explanation could be Russia's high focus on military activities along with a history of prominent space-activity recognition.

It is important to note, that different public structures may provide an explanation for this statistics in table 15. As argued, the majority of public R&D expenditure in Brazil is distributed to the universities, which imply that the majority of R&D personnel are employed here. This will be elaborated in the following.

\(^{33}\) Data from United States and India are unavailable from corresponding source.
6.3 Innovative input: Universities and higher education

Universities play an important part of a nation’s ability to conduct quality innovation and R&D. In Brazil, the federal universities are placed in leading national positions with R&D (British Council, 2015). In the PIE-analysis it was argued that the quality of the Brazilian educational system was low compared to the peers. The data from the PIE-analysis is complemented with more innovation specific variables of interest in the following table. Compared to the PIE, this will provide a more research/innovation oriented analytical approach towards higher education measures.

<table>
<thead>
<tr>
<th>Higher education measures 2014 (2013*) (2012**)</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of scientists and engineers</td>
<td>3.3 (3,4*)</td>
<td>4.1 (3,8*)</td>
<td>4.4 (5,0*)</td>
<td>4.4 (4,5*)</td>
<td>5.3 (5,3*)</td>
</tr>
<tr>
<td></td>
<td>(3,5**)</td>
<td>(3,8**)</td>
<td>(5,0**)</td>
<td>(4,4**)</td>
<td>(5,4**)</td>
</tr>
<tr>
<td>Quality of math and science education</td>
<td>2.6 (2,6*)</td>
<td>4.3 (4,3*)</td>
<td>4.2 (4,7*)</td>
<td>4.3 (4,4*)</td>
<td>4.4 (4,4*)</td>
</tr>
<tr>
<td></td>
<td>(2,6**)</td>
<td>(4,3**)</td>
<td>(4,7**)</td>
<td>(4,4*)</td>
<td>(4,3**)</td>
</tr>
<tr>
<td>Quality of scientific research institutions</td>
<td>4.0 (4,3*)</td>
<td>4.0 (3,7*)</td>
<td>4.0 (4,5*)</td>
<td>4.3 (4,3*)</td>
<td>6.1 (6,0*)</td>
</tr>
<tr>
<td></td>
<td>(4,1**)</td>
<td>(3,6**)</td>
<td>(4,4**)</td>
<td>(4,2**)</td>
<td>(5,8**)</td>
</tr>
</tbody>
</table>

*Table 16 “Higher education figures” Source: (Schwab, 2015; Schwab, 2014; Schwab, 2013)

Academically, relatively few graduates possess the required qualifications to enter accredited postgraduate programs within science and technology. The result is shortcomings in scientists and engineers, where Brazil is ranked below the peers. In addition, the data argues for a decreasing trend in Brazil compared to e.g. Russia exposing improvements. Since research in the pharmaceutical industry requires scientists, the lack of personnel availability reduces the potential talent pool and may appear as a barrier to conduct R&D in Brazil. One reason for low availability of scientists and engineers may emerge from lack of educational capabilities.

The R&D within a nation is additionally conditional upon the quality of math and science education. From the table above and the discussion on economic resources, it is clear that Brazil suffers from shortcomings within this field. Not only are the figures in the bottom of the 2015 ranking, but additionally they are non-improving at a constant rate. This may serve as an explanation for the low availability of scientists and engineers as discussed above. For Brazil to be able to compete with the peer group on attraction of R&D FDI, it may be necessary to improve the availability of high skilled workers significantly either by attracting foreign or increase supply of domestic competences.

Despite low availability of scientists and low quality of scientific education, Brazil manage to compete with the remaining BRICs on the quality of scientific research institutions. On the surface, this looks promising, but comparing to earlier years this is a disfigure. A rise in the number of private research
organisations is blamed for slipping research standard (Bowater, 2014). This can be seen by figures from previous year where Brazil’s score was 4,3. According to Rita Barata, consultant at the Brazilian Federal Agency for Support and Evaluation of Graduate Education, private institutions do not have the required research and good research mainly is performed by public universities. She argues that: "There are good research institutions [...] but there’s a lot of very fragile private institutions with a lot of problems with the quality of the personnel". Two percent of programmes in Brazil lost their credentials last year for failing to meet standards. The majority of those that lost credentials were private research organisations let down by their research quality (Ibid.).

Despite decreasing quality of university research, the number of university R&D personnel in Brazil is high compared to the peer group illustrated in the following graph.

![Graph 18 * university R&D personnel per 1,000 inhabitants (full time)*](source: Appendix E)

Brazil is only surpassed by Russia, but has been reducing the gap since 2007. It can also be assumed that the United States has higher personnel despite lack of available data. It can be concluded that the majority of R&D personnel in Brazil is employed at the universities. This is opposite to India and Russia where the main part is employed by other governmental entities. This may be one reason why Brazil’s number is significantly higher than e.g. India.

The high amount of university R&D personnel in 2011 contrasts to the 2015 data in table 16 on low availability of researchers and scientists in Brazil compared to the peers. This may indicate shortcomings in other sectors i.e. private, which is negative for MNPCs. However, there may be opportunities to enter university-industry collaboration and benefit from these due to the large amount of university personnel.

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N/A for the United States.
This leads to the last component i.e. the private enterprises. This will be done by looking at this sector’s input i.e. R&D expenditure and full time researchers along with university collaboration, which will be discussed in the following section.

6.4 Innovative input: Private enterprises

Research-wise, there is a tendency from advanced and innovation dependent nations to perform a large part of research in the private sector. In Brazil this figure is contradictory, where universities and other public organizations carries the largest R&D budgets (UNESCO, 2015). The business sector in Brazil is very heterogeneous with low propensity to conduct R&D. The distribution is highly skewed by size with an overwhelming amount of firms not engaging in innovation except necessary replacements. Opposite a small number of large companies benefit from their international network that provides them with opportunities for new technologies. This has resulted in low figures for Brazil concerning R&D spending in the private sector.

<table>
<thead>
<tr>
<th>2011</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise R&amp;D expenditure in percent of GDP</td>
<td>0.55</td>
<td>0.66</td>
<td>0.33</td>
<td>1.51</td>
<td>1.95</td>
</tr>
</tbody>
</table>

*Table 17 "enterprise R&D figures" Source: (IMD, 2014; UNESCO, 2015)*

The private investments in R&D in Brazil correspond to 0.55 percent of the Brazilian GDP in 2011, an index lower than countries such as China, USA and Russia. Applied research, technology and engineering are largely performed at universities and research centers system, contrary to more developed countries e.g. United States, where the private sector is attributable to a larger proportion of national R&D. Reasons for such innovation pattern may firstly be that few Brazilian private enterprises are competitive or rich enough to have their own R&D (Deutches Wissenschafts- und Innovationshaus, 2014). They usually develop products by outsourcing from other foreign companies. Secondly, the high-tech private sector in Brazil is dominated by large MNCs, which usually have their R&D centers abroad. Thirdly it may be explained by the arguments revealed in the institutional analysis about red tape issues and low patent protection. Lastly a reason may be found in the low level of the Brazilian human capital discussed in the economic resources in the PIE-analysis. The relatively worse educational level may create a barrier for Brazilian researchers to join MNCs because the MNCs have a higher incentive to use better-educated employees from other countries.
The result is fewer researchers in the private sector, which are forced to look at jobs at universities or government entities instead. This is visualized in the following graph where only India performs worse per 1,000 inhabitants than Brazil.

Since there is a relatively high amount of R&D at the universities compared to the government, the collaboration between universities and enterprises are of high importance. The following table shows the score on university-enterprise collaboration among the peers in 2015.

The table shows a relatively negative Brazilian score of 3.8 on a scale from 1 to 7. This is very close to Russia and India but still distanced by China and the United States. The score indicates that the relationship between the universities and private industries are working, but with room for improvements. Considering the relatively low interest in conducting R&D among enterprises, it is arguable that the university is mainly responsible for the relatively neutral score on university-industry collaboration. However, if incentives are successfully implemented to improve the enterprise propensity to conduct R&D, this should increase not only the private sector’s performance but also the universities’ according to the funding reinforcing loop (Uriona-Maldonado et al., 2010). This means that funding from private enterprises go towards universities and enable them to create information and knowledge. This goes back to the enterprises and is then used to generate profit, which then can be used for further funding.
A current significant trend is reversing the picture of low enterprise interest in R&D (Deutches Wissenschafter- und Innovationshaus, 2014). Companies such as IBM, General Electric, Samsung and Motorola have established large R&D centers in Brazil. One of the incentive factors for this, besides the market potential and increasing skills of Brazilian technical manpower, has been favorable tax system incentives by the government for R&D performers (Ibid.). Further six Brazilian companies appear in the study Global Innovation 100 among those that invest the most in R&D world-wide: Vale, Petrobras, Gerdau, Totvs, CPFL Energy and Embraer. The majorities of these domestic companies operate within energy and production and thus exploit the rich natural resources in Brazil. This is a positive trend which indicates that an increasingly amount of international and domestic companies starts to consider the Brazilian environment as an option for R&D. Despite this, the environment has still not been attracting major international pharmaceutical R&D investments.

The above-discussed inputs from government, universities and private enterprises together create the foundation for the S&T outputs. The S&T output will be discussed in the following section.

6.5 S&T output

The number of patents and scientific articles will serve as proxies for S&T output. Patents are important for a nation because it stimulate R&D, and are a strategic necessity for modern businesses. The scientific articles are used because they create knowledge and potential spillover effects.

<table>
<thead>
<tr>
<th>2012 S&amp;T Output per 100.000</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patent applications</td>
<td>3.4</td>
<td>24.33</td>
<td>1.46</td>
<td>41.41</td>
<td>146.51</td>
</tr>
<tr>
<td>Patent grants45</td>
<td>0.47</td>
<td>16.40</td>
<td>0.26</td>
<td>8.76</td>
<td>66.01</td>
</tr>
<tr>
<td>Number of patents in force</td>
<td>2.1</td>
<td>92.4</td>
<td>1.6</td>
<td>36.9</td>
<td>535.8</td>
</tr>
<tr>
<td>Scientific articles 46</td>
<td>6.64</td>
<td>9.89</td>
<td>1.82</td>
<td>6.65</td>
<td>67.62</td>
</tr>
</tbody>
</table>

Table 19 "S&T Output per 100.000 inhabitants" Source: (IMD, 2014)

Patent applications per 100.000 inhabitants reached 3.4 in 2012 cf. IMD (2014). Compared to the peers this figure is only above India, arguing for lower prosperity to apply for patents in Brazil. A reason may be found in a very complex and costly application process where the national authorities...

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45 Reported in absolute numbers in IMD (2014). Re-calculated to per 100.000 by authors with World Bank data on population size.
46 Reported in absolute numbers in IMD (2014). Re-calculated to per 100.000 by authors with World Bank data on population size.
do not offer any support regarding the required preparation of the required documents. As a result, it is recommended to hire an attorney or properly registered agent specialized in industrial property, which may increase the cost significantly (Novais, 2013). This corresponds to the presence of red tape challenges found in the PIE analysis.

The patent application can be combined with the patent grants to obtain a grants/applications ratio. This reveals to what extent public and private entities are able to convert applications into grants. The figure for patent grants indicates a potential positive correlation between grants and applications, but with very different ratios: Brazil (14 percent), Russia (67 percent), India (18 percent), China (21 percent) and United States (45 percent). The ratios show that in e.g. Russia 67 percent of applications are converted into grants. This is much lower in Brazil where only 14 percent of applications succeed, meaning that it is statistically more attractive to apply for patents among the peers. However, the actual reason for this may be highly complex. One major reason for Brazil’s performance may be the red tape issues revealed in the PIE analysis i.e. an overburdening of bureaucracy. This may have a negative influence on MNPCs since lack of patents reduces the willingness to innovate because of higher risks of not getting the final patent needed for the research to be profitable. Thus it is blocking the ability to sustain growth and productivity. Another reason may be that enterprises simply tend to apply for unqualified patents compared to the peers due to e.g. lack of competences and knowledge.

The number of scientific articles is further a direct outcome of R&D activities, which produce new knowledge and require inputs of human and financial resources, and reflect the quality of the NIS (Jun-fang, 2013). They are important because they address issues that are of concern for the population, businesses or institutions and thereby articulate tacit into explicit knowledge. Judging S&T output on number of resident scientific articles improves Brazil’s position relatively to the peers. Even though Brazil is the second worst performing in the group, the figures on scientific articles are equal to China, and only a bit behind Russia. Generally there exist a clear distance from the BRICs to the United States, which will not be further elaborated. Cf. IMD research on scientific articles published by origin, Brazil is in absolute figures placed as the lowest performing among the peers. What is interesting to note, is that Brazil performs better than India and almost as well as China when the measures are transformed into a per 100,000 inhabitants version. This means that, Brazil on a relative scale is almost as efficient as China in producing scientific articles. Compared to Russia, Brazil is still lacking ability to produce scientific research, which relatively reduces the nation’s productivity and growth. The reason for the relatively better performance in scientific article output compared to grant/application ratio is to be

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47 Grants/applications ratio of patents shows the percent of applications turning into actual patent grants.
found in the inputs. Considering the universities rationale is to provide new knowledge rather than profit specific inventions, they will in higher degree provide scientific articles than specific patents applications. Combining this with the high support from the government and higher university personnel than in the private enterprises the result will be a stronger position in scientific articles output than patent applications and grants. However, it is important to notice that these articles are an important part for future development in Brazil. They may not immediately contribute to patents but can useful for private enterprises to develop new technologies in the future.

6.6 Measured efficiency and concluding remarks

It has been argued that Brazil performs the majority of its R&D activities in the public sector, where the universities are responsible for the largest proportion. This distribution is valid both in terms of R&D personnel and R&D expenditure. In the private sector, enterprises are lacking prosperity to conduct R&D, which has a negative effect on the figures for expenditure and personnel. Concerning S&T output, the figures reveal that Brazil lacks either incentives or ability to apply for patents. Conversely on a relative scale, Brazil is perceptible better at producing scientific articles than patents besides ranking as second worst (see Appendix F for a full overview of aggregated data on innovative inputs measured as R&D personnel and expenditure, and S&T output). Based on these figures, six ratios are calculated to show the relatively efficiency of turning inputs into outputs among the peer group. These will include:

- Patent grants / R&D expenditures
- Patent grants / R&D personnel
- Patent applications / R&D expenditures
- Patent applications / R&D personnel
- Scientific articles / R&D expenditures
- Scientific articles / R&D personnel

Both patent grants and applications are chosen as outputs because they illustrate to what degree the host environment promotes R&D and applying for patents. Opposite patents in force is an aggregated number based on grants from several years. The ratios are illustrated in the following graphs.

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48 Alternatives include patent in force
The figures above illustrate to what extent the assessed countries are able to efficiently convert their innovative inputs into S&T outputs. Graph 20c proves that Brazil are relative inefficient in turning its R&D expenditures into patent applications. This is proportionately to Graph 20d, where R&D expenditure is substituted by amount of R&D personnel. An explanation for the low application ratios may be the corresponding low grants ratios shown on graph 20a and 20b. The even lower grants ratios may therefore reduce incentives for future applications, as the statistical probability for
obtaining the final patent grants is low combined with an expensive and inefficient application process.

Public R&D expenditure and personnel (including universities) are in 2011 high in Brazil, but the aggregate level is reduced to some degree by the low prosperity in the private sector. Combined with considerable low patent application figures, the ratios for Brazil does not look promising in terms of efficiency. Patent applications are largely filed by enterprises, which have been argued to possess relatively little prosperity to apply for patents compared to the peers. The low engagement in patent application may be a direct link of Brazil’s low ability to protect patents as argued in the PIE-analysis. Thus increasing patent protection may have a positive influence on enterprises incentives to apply for patents, since they would be better protected against competitors. If patents are not sufficient protected, enterprises are not encouraged to spend time on application in a bureaucracy-bounded environment nor willing to allocate capital. As argued, the current trend of non-R&D related activities in Brazil may reverse the picture of low enterprise interest in R&D, where companies such as IBM, General Electric, Samsung and Motorola have established large R&D centers in Brazil. This may, besides encouraging more enterprises to establish R&D facilities, have a positive influence on the number of patents applications in Brazil for more recent periods, on which data is unobtainable.

Graph 20e proves that Brazil’s efficiency increases when patents are substituted with scientific articles – another measure for S&T output. This is also valid in terms of R&D personnel presented in graph 20f. One explanation might be that patent applications, in general, are a private sector activity, where the production of scientific articles predominantly is linked to universities and other public organizations and institutions. As argued the R&D performance in the private sector is considerable lower than the public, which may have a significant impact on the figures. The high amount of public interest in R&D is expected to have a positive impact on the number of scientific articles, which correspond to the figures above.

It should be noted, that the ratios above is calculated on the basis of 2011 figures, which according the economic analysis may have changed since. It can thus not be expected to remain at equivalent figures. However, besides economic turbulence in recent years and reduced growth rates, the focus on R&D has remained (APEX-Brasil, 2015). At a CeBIT (Centrum der Büro- und Informationstechniko) conference in Germany in March, CeBIT announced Brazil as a “must-be place” for development and research. Despite, this mainly was directed towards software development and ICT-related research, it may create spillover effects on other industries e.g. pharmaceutical. Nevertheless, general R&D in mind, Brazil is increasingly focused towards bringing the country to the top of the list in terms of R&D building in the country.
In summary, the poor Brazilian performance in the NIS micro behavior is highly influenced by the surrounding system level where especially fragmentation of states, red tape issues, low patent protection and weak human capital sets the foundation for a weak R&D environment. The weak R&D environment is further a problematic factor as a strong R&D and innovation sphere is needed for Brazil to escape the middle-income trap. This means that the negative influence from the system level towards the R&D micro behavior is reversed back to the system level as the R&D environment is insufficient in aiding Brazil in leaving the middle-income trap. Additionally, the low level in national R&D constrains economic and institutional development and hence affects national competitiveness and attractiveness.

7 Summary and concluding remarks

This thesis departs from an interest within the area of global integration and local responsiveness. The assumption is that subsidiaries conducting more advanced roles i.e. R&D tends to contribute relatively more to overall company performance. Combined with the increasing importance of emerging markets this led to wonder why Brazil is the only BRIC country without any R&D centers among the 25 largest global pharmaceutical companies.

As a consequence the scope for this thesis has been limited to investigating the host environment of Brazil for MNPCs from an R&D perspective. To do so, the following problem statement has been investigated:

*Why have none of the 25 examined MNPCs any R&D centers in Brazil despite a favorable market size, high pharmaceutical market value and the theoretical argument that high subsidiary autonomy in form of R&D will increase performance?*

To answer this, the two following hypotheses were established and tested through qualitative analysis of the Brazilian host environment.

**Hypothesis A:**

- *The Brazilian host environment is properly developed and provides necessary conditions for foreign pharmaceutical R&D.*

**Hypothesis B:**

- *The Brazilian host environment for foreign pharmaceutical R&D subsidiaries is premature.*
To answer the problem statement and herein the hypotheses, Arbnor and Bjerke’s exposition of methodology and methodical procedures in creating business knowledge has been applied. They suggest three different methodological views of which the systems view has been applied. The systems view argue how the Brazilian host environment has to be understood holistically and not defined as the sum of each different component in the society. It is rather the relations and synergies that create the totality. Further, it explains how one component can be super- and subsystems to each other and have spillover effects. This methodology has provided a high explanatory value for understanding the environment holistically and not parallel functioning components by focusing on the interrelations and synergies.

To carry out the study, the conceptual framework of broad NIS (National Innovation System) has been applied in correspondence with the systems view. The broad NIS has been restructured and adapted towards answering the problem statement optimally. The analysis of the societal system level of the NIS has been conducted by a PIE-analysis i.e. political, institutional and economic analysis. The micro behavior of the NIS has been conducted by analyzing innovative inputs from the government, educational system and private enterprises and the corresponding scientific and technological (S&T) output to measure the R&D efficiency. To obtain a more nuanced and relative picture the numerical indicators have been compared with a peer group i.e. remaining BRICs and the United States.

By applying the systems view as methodology and adapting the NIS-framework we have been able to identify key issues within the societal system level and R&D specific micro behavior. Despite they are listed separately in the following, there is a clear relation between them, which is of high importance to keep in mind. The Brazilian key findings are summarized into the following figure:
The first key finding is an unfavorable regulatory environment. The institutional red tape issues are consolidated into the drug approval organization ANVISA. As the regulatory environment is an institution, it has been affected by its relation to the political sphere. Our findings point towards a multi-party system that slows decision-making time as well as the higher autonomy held by states have caused an asymmetric regulatory discourse. As a consequence, this institution hampers the potential economic growth illustrated by the complex tax regime and the regulatory fragmentation of states that diminish the scale benefits of a large market. This is consolidated into the pharmaceutical industry and R&D environment where the red tape problems decrease the incentives to conduct R&D and apply for patents. Consequently, the amount of patent grants decreases. Further, the approval process of new pharmaceutical products is time consuming compared to the assessed peers, which decreases time to market and hence affect profitability.

The second key issue is the political instability and corruption. This issue is inherited from a history of political instability with military coups. As this issue primarily lies within the political sphere it has directly influenced the institutional environment, which may explain the presence of the informal institution i.e. corruption. However, as institutions directly influence the political environment as well, the Petrobras corruption scandal reaching far into the government and major companies has lately fuelled the political instability. As a consequence, the Brazilian citizens have extremely low trust in politicians but also tend to show very low social trust in other Brazilians. As informal institutions also
affect the economy, corruption influences the economic development. Consequently, it has influenced the investments level from foreign companies, which, similar to the unfavorable regulatory environment, may hamper the potential economic growth and hence the accompanying benefits from foreign investments. Further the political instability and corruption is negative considering R&D centers deal with business critical information and any leek would have a significant effect on the individual company’s return on investment.

The third issue deals with the challenging market access. In the political sphere there is a support towards generic products as social groups and the Constitution demand universal healthcare, which currently does not exist. For the pharmaceutical industry this is a high risk factor, as initiatives as Programa Farmácia Popular has been implemented as institutions and reduced the economic attractiveness of investing in R&D. These will increase challenges in obtaining reimbursement for premium branded products and thus set a higher direct market access barrier. Potentially, the lower incentives to conduct pharmaceutical R&D will result in less inflow of high-skilled employees and technologies from developed countries. This is unbeneﬁcial with regards to progress from the middle-income trap. Further, the geographical infrastructure complicates the access to consumers for traditional MNPCs. However at the same time creates an opportunity to provide home healthcare services, where e.g. R&D in medical devices is demanded.

The low level of human capital is the fourth issue, which is found in the economic resources. Despite high educational enrollment rates, Brazil’s educational quality is low compared to peers. This is especially within math and science, which are of high importance for the R&D community. The consequence is a relative small talent pool, which decreases the initiatives and abilities to establish R&D. The poor situation is acknowledged politically where programs e.g. “More Doctors” and “Bolsa Família” are implemented to improve the institutional environment required for increasing the future economic resources. Improvements within this area are needed to improve the foundation for pharmaceutical R&D establishments.

The fifth issue is related to the high Brazilian inequality. The issue is both linked to income and healthcare, where especially the income inequality is on a significant level. Despite improvements since 2000, the latest reported GINI coefficient from 2013, shows a set-back in the positive development. The high inequality is equally present in access to healthcare. This is a consequence of institutional insufficiencies that promise universal healthcare but is incapable of providing sufﬁcient medicine and services. As a result people are forced into the expensive private out-of-pocket market. As many people are suffering from the income inequality they are not able to afford the products on
the private market. For the MNPCs this means that some people will not be able to consume their offerings and hence results in a potential loss of sales.

The last finding is the *low and ineffective private R&D spending and processes*, which emerges from the interplay and synergies between politics, institutions and economy. The micro behavior analysis has shown the private R&D sector in Brazil is relative inefficient in turning innovative inputs into actual outputs compared to the peers. Our study reveals that the low spending and ineffective processes is a result of both red tape issues in the approval process, low human capital and weak patent protection. Further, the pharmaceutical industry is affected by the increasing popularity of generics reducing the incentives for developing premium products. Additionally, the low spending results in relative low amount of personnel. The reasons for low private personnel are found in a relative higher employment of R&D in government and university entities together with a general low level of human capital. Meanwhile the politics, institutions and economy has a negative effect on pharmaceutical R&D, a reverse causality is present creating a negative spiral. This means the low and ineffective private R&D spending and processes will contribute negatively to the economic development and desired escape from middle-income trap.

Based on the unfavorable regulatory environment, political instability, low and ineffective private R&D environment, market access challenges, shortages in human capital and high income- and healthcare inequality, we are able to reject hypothesis A and conclude that the Brazilian host environment is not properly developed and provides the necessary conditions for foreign pharmaceutical R&D. Further we are able to accept hypothesis B and conclude the Brazilian host environment is premature for MNPCs' R&D subsidiaries. Despite a current premature market due to the above listed challenges, the government is aware of the insufficiencies of e.g. delivering necessary medicines and shortage in human capital. Therefore, it has implemented programs as “More Doctors” and “Programa Farmácia Popular”. It can be expected that the current and short-term premature market, can be expected to become more appropriate for pharmaceutical R&D activities in the medium-long term, which speaks in favor of MNPCs monitoring the market development. Finally, by accepting hypothesis B, we can conclude, as answer to the problem statement, that the reason for why none of the examined MNPCs have any R&D centers in Brazil are related to a premature host environment caused especially by low growth, political instability, low investments in R&D, low level of human capital and the identified negative synergy between these.
8 Implications and potential pitfalls
The analysis and conclusion does not come without implications and potential pitfalls. During and upon completion of the project, a gap between desired and realized data collection has materialized. Especially the collection of R&D data related to sector specific performance across time and entities has proven to be a challenging task. To perform a sufficient analysis, recent and historical data across the peers and different sectors (government, university and enterprise), from reliable and identical sources, would be preferable. This has shown to be unattainable due to data limitations. As a result either of two different data collection approaches has been accessible; I) the analysis could be build upon data from similar, reliable sources, but fail to embrace historical data, II) alternatively from non-similar, less reliable, sources supplying evolutionary data. While the former approach deliver comparable and reliable data, the latter provides some information about the development in sector specific expenditure but fails on comparability and reliability. As different sources disclose varying information and calculate R&D expenditures differently, it has been assumed, that comparing data across unknown sources would be attached with too much uncertainty and biasedness. It is thus estimated that the benefit of option II does not outweigh the risk of only presenting data from one point in time i.e. 2011. To cope with the disadvantage of only presenting a single period about R&D expenditure, the number of R&D personnel along with alternative qualitative information has complemented the 2011 data to estimate future and past tendencies. As this approach is not assumed to provide the optimal conditions, the conclusion should be interpreted with a degree of caution.

Another potential pitfall emerges from the established project scope. The assumptions, along with the theoretical background, imply that the problem statement is answerable through an assessment of host environmental factors, framed by the conceptual National Innovation System framework. I.e. to answer the problem statement, an analysis of the system level (represented by the PIE-framework) and micro behavior (represented by S&T inputs and outputs) along with its dynamics and interrelations would be appropriate. This may in itself be a potential pitfall. Some insiders argue that the establishment of R&D facilities in major, less developed countries such as China and Russia is a result of host public and government pressure. This means, that de corporate decision-making towards R&D locations may be conditional upon pressure from foreign governments, requiring local R&D in return of operation legitimacy. This means, for MNPCs to be able to benefit from the host market revenue, the government requires local investments in R&D, which will benefit the NIS and hence the national productivity, efficiency, attractiveness and competitiveness. This will additionally have improved spillover effects on local job creation and competence building. In case this is the reality, a host environment analysis as ours will be insufficient in explaining the true reason for offshoring R&D to an emerging market.
9 Suggestions for further research

After completing this thesis certain questions are of high importance to reflect upon. Is the scope of the thesis after delimitations adequate in providing a reliable answer to the problem statement? How is the validity of the underlying assumptions behind the problem statement, and should they be considered differently for future studies? May other methodologies be equally or more valuable in explaining the underlying rationalities?

The first question deals with the delimitations i.e. certain methodological principles and theoretical viewpoints that have scoped the thesis. These have been necessary to steer the report in a specific direction but also to align scope with the information and time resources available for a master thesis. Based on this we see further research and investigation via other methodological approaches and theories on this topic advisable.

Firstly, the methodological systems view has shown an explanatory value regarding analyzing the overall host environment. However, as mentioned in the introductory part, the decision of dividing R&D responsibilities between headquarter and subsidiaries depend on three factors; domestic and host environment together with the global corporate strategy. From this perspective we see an interesting opportunity to apply another of Arnbor and Bjerke's approaches to investigate the aspect of global corporate strategy among the MNPCs. We see a beneficial way to do this by using the actor's view, towards analyzing individual companies' strategies and decisions via interviews. Creating an interview guide with closed- and open ended questions regarding the increasing importance of emerging markets and conduct the survey among the 25 largest companies could provide valuable data for analysis. This data should be analyzed for potential similarities in the companies' preferences and thoughts related to R&D and emerging market strategies. The benefits from a study of this kind will be a deeper insight to internal company thoughts and decisions on what is important in an emerging market and the possibility to identify any patterns in choosing R&D locations. The disadvantage of this approach is the challenge of conducting these interviews. The attitudes among the pharmaceutical companies we have been in contact with have been unfavorable towards sharing this kind of information.

The second question relating to the underlying assumption behind the problem statement also needs to be addressed. The arguments of a high Brazilian pharmaceutical market size and growth and
theoretical recommendations of investing in R&D led to the applied problem statement. In this relation it is interesting to question the validity of pharmaceutical market growth expectations and whether these are correlated to the macroeconomic growth. The applied sources concerning prediction of the pharmaceutical market potential in Brazil are one-two years old (these are the most recent available studies). As the GDP growth rate in Brazil recently has shown to be close to zero, the pharmaceutical market predictions may have changed as a result of general economic trends, if a correlation between pharmaceutical market growth and GDP growth appears. As a result, it could be interesting to study the degree of correlation between GDP growth and industry growth to determine the influence of the recent growth stagnation on the future market size. However, the applied sources attribute the demographic trends as the most determining factor, which argues if favor of a continuing attractive pharmaceutical market.

Finally, we find it valuable to ask why China? Why India? Why Russia? Analyze why and how these emerging markets have attracted foreign pharmaceutical R&D investments instead of why not Brazil. Knowing these answers will strengthen the results of this thesis, as it only answers why not Brazil supplemented by indicators of these peers, but not fulfilling answers to why invest in the others. To identify the insufficiencies in Brazil, we see the benefits from a more thorough comparative analysis where Brazil is contrasted to the remaining BRICs. By doing so, the researcher will derive a pattern from what is observed regarding the R&D investments in Russia, India and China. The benefit from this will be a more open-minded understanding to the underlying reasoning behind the decisions to invest in R&D. From this understanding the researcher will be able to identify patterns from which a potential theoretical framework could be established.
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11 Appendixes

11.1 Appendix A – Global top 25 pharmaceutical companies and related R&D measures

<table>
<thead>
<tr>
<th>Pharmaceutical company</th>
<th>R&amp;D centers</th>
<th>R&amp;D as % of revenue 2014</th>
<th>Region</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfizer</td>
<td>United States, United Kingdom</td>
<td>16,9 %</td>
<td>EU, US</td>
<td>(Pfizer, 2015)</td>
</tr>
<tr>
<td>Novartis</td>
<td>China, India, Italy, Japan, Singapore, Switzerland, United States</td>
<td>8,3 %</td>
<td>Asia, EU, US</td>
<td>(Novartis, 2015)</td>
</tr>
<tr>
<td>Roche</td>
<td>Denmark, China, Japan, Germany, Switzerland, United States, United Kingdom</td>
<td>18,8 %</td>
<td>Asia, EU, US</td>
<td>(Roche, 2015)</td>
</tr>
<tr>
<td>Merck &amp; Co</td>
<td>China, Germany, France, Japan, South Korea, Taiwan, United States, United Kingdom</td>
<td>17 %</td>
<td>Asia, EU, US</td>
<td>(Merck &amp; Co, 2015)</td>
</tr>
<tr>
<td>Sanofi-Aventis</td>
<td>France, Germany, Canada, United States, China, Japan</td>
<td>14,3 %</td>
<td>Asia, EU, US</td>
<td>(Sanofi, 2015)</td>
</tr>
<tr>
<td>GlaxoSmithKline</td>
<td>Belgium, Canada, China, France, Germany, Singapore, United Kingdom, United States</td>
<td>13,5 %</td>
<td>Asia, EU, US</td>
<td>(GSK, 2015)</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>Belgium, China, France, Germany, India, Ireland, Netherlands, Russia, Spain Switzerland, United Kingdom, United States</td>
<td>11,4 %</td>
<td>Asia, EU, US</td>
<td>(Janssen Research &amp; Development, 2015)</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>China, India, Poland, Sweden, Russia, Japan, United Kingdom, United States</td>
<td>20,4 %</td>
<td>Asia, EU, US</td>
<td>(AstraZeneca, 2015)</td>
</tr>
<tr>
<td>Lilly</td>
<td>Australia, China, Japan, Singapore, Spain, United Kingdom, United States</td>
<td>24,1 %</td>
<td>Asia, EU, Australia</td>
<td>(Lilly, 2015)</td>
</tr>
<tr>
<td>AbbVie</td>
<td>N/A</td>
<td>17 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teva</td>
<td>N/A</td>
<td>7,3 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amgen</td>
<td>N/A</td>
<td>21,4 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Takeda</td>
<td>China, Japan, United Kingdom, United States</td>
<td>21,5 %</td>
<td>Asia, EU, US</td>
<td>(Takeda, 2015)</td>
</tr>
<tr>
<td>Bristol-Myers Squibb</td>
<td>Belgium, India, France, Japan, United Kingdom, United States</td>
<td>28,6 %</td>
<td>Asia, EU, US</td>
<td>(BMS, 2015)</td>
</tr>
<tr>
<td>Boehringer Ingelheim</td>
<td>Austria, Germany, Italy,</td>
<td>19,9 %</td>
<td>Asia, EU, US</td>
<td>(Boehringer</td>
</tr>
<tr>
<td>Company</td>
<td>Locations</td>
<td>R&amp;D Locations</td>
<td>R&amp;D Spending</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------------------------------</td>
<td>---------------</td>
<td>--------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td><strong>Novo Nordisk</strong></td>
<td>Denmark, United States</td>
<td>China, China</td>
<td>15.8%</td>
<td>(Novo Nordisk, 2015)</td>
</tr>
<tr>
<td><strong>Bayer</strong></td>
<td>Germany, Finland, Norway, United States</td>
<td>8.5%</td>
<td>EU, US</td>
<td>(Bayer, 2015)</td>
</tr>
<tr>
<td><strong>Astellas</strong></td>
<td>Japan, Netherlands, United States</td>
<td>16.6%</td>
<td>Asia, EU, US</td>
<td>(Astellas, 2015)</td>
</tr>
<tr>
<td><strong>Daiichi Sankyo</strong></td>
<td>Japan, Switzerland, India, United Kingdom, United States</td>
<td>17.1%</td>
<td>Asia, EU, US</td>
<td>(Daiichi Sankyo, 2015)</td>
</tr>
<tr>
<td><strong>Otsuka</strong></td>
<td>China, Germany, Japan, United States</td>
<td>17.1%</td>
<td>Asia, EU, US</td>
<td>(Otsuka, 2015)</td>
</tr>
<tr>
<td><strong>Gilead Sciences</strong></td>
<td>N/A</td>
<td>11.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Baxter</strong></td>
<td>Austria, Belgium, Japan, United States</td>
<td>8.5%</td>
<td>Asia, EU, US</td>
<td>(Baxter, 2015)</td>
</tr>
<tr>
<td><strong>Merck KGaA</strong></td>
<td>China, Germany, France, Japan, South Korea, Taiwan, United States, United Kingdom</td>
<td>15%</td>
<td>Asia, EU, US</td>
<td>(Merck &amp; Co, 2015)</td>
</tr>
<tr>
<td><strong>Eisai</strong></td>
<td>Japan, United Kingdom, United States</td>
<td>21.7%</td>
<td>Asia, EU, US</td>
<td>(Eisai, 2015)</td>
</tr>
<tr>
<td><strong>Biogen Idec</strong></td>
<td>United Kingdom, United States</td>
<td>23.1%</td>
<td>EU, US</td>
<td>(Biogen, 2015)</td>
</tr>
</tbody>
</table>

*Table 20 “top pharmaceutical companies, R&D locations and R&D spending” Source: (PMLiVE, 2013)*
11.2 Appendix B – PIE-model overlaps

**Politics:**
Power game between parties, government, presidency etc.

**Social groups:**
Conflicts/alliances, Parties, organizations

Level and distribution of: income, resources

**Institutions:**
- **Political institutions:** Constitutions, human rights
- **Enforcement:** judiciary, rule of law, corruption
- **Economic institutions:** Economic policies, Property rights, privatization, Regulation, liberalization
- Incentives

**Informal institutions (cultures):**
Social thrust
Values: deep beliefs (religion), norms, preferences

**Economy:**
Flows: growth, Investment, Exports, imports, Inflation etc.

**Resources:**
Created: human capital, production structure, technology, infrastructure
Natural resource, geography, environment

Surrounding world

Development on different markets

Financial markets

Figure 18 "overlap of components and relations in PIE-framework" Source: (Mygind, 2007)
11.3 Appendix C – Brazilian healthcare money flow

Figure 19 "money flow in the healthcare sector" Source: (Livro Branco, 2015)
11.4 Appendix D – Selected economic measures

**Figure 4.1**
GDP and terms of trade (% var. YoY)

**Figure 4.2**
Exports (12-month export accumulation, % YoY)

**Figure 20** "GDP and terms of trade and export measures" Source: (BBVA, 2015)
### Appendix E – Calculations of innovative inputs (R&D personnel)

**All Economies**

**Researchers in Full-time equivalents (FTE)**

Source: UNESCO, 2015

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>588</td>
<td>597</td>
<td>612</td>
<td>629</td>
<td>667</td>
<td>710</td>
</tr>
<tr>
<td>China</td>
<td>923</td>
<td>1.067</td>
<td>1.186</td>
<td>853</td>
<td>890</td>
<td>963</td>
</tr>
<tr>
<td>India</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>160</td>
<td>160</td>
</tr>
<tr>
<td>Russia</td>
<td>3.231</td>
<td>3.265</td>
<td>3.140</td>
<td>3.078</td>
<td>3.078</td>
<td>3.120</td>
</tr>
</tbody>
</table>

**Brazil**

Researchers by sector of employment in full-time equivalents (%)

Source: UNESCO, 2015

<table>
<thead>
<tr>
<th>Sector</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business enterprise</td>
<td>37,6</td>
<td>35,1</td>
<td>32,8</td>
<td>30,8</td>
<td>28,2</td>
<td>25,9</td>
</tr>
<tr>
<td>Government</td>
<td>5,1</td>
<td>5,1</td>
<td>5,1</td>
<td>5,4</td>
<td>5,5</td>
<td>5,5</td>
</tr>
<tr>
<td>University</td>
<td>56,3</td>
<td>58,8</td>
<td>61,1</td>
<td>63</td>
<td>65,5</td>
<td>67,8</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0,9</td>
<td>0,8</td>
<td>0,8</td>
<td>0,8</td>
<td>0,8</td>
<td>0,7</td>
</tr>
</tbody>
</table>

**China**

Researchers by sector of employment in full-time equivalents (%)

Source: UNESCO, 2015

<table>
<thead>
<tr>
<th>Sector</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business enterprise</td>
<td>63,5</td>
<td>66,4</td>
<td>68,6</td>
<td>61,4</td>
<td>61,1</td>
<td>62,1</td>
</tr>
<tr>
<td>Government</td>
<td>17,2</td>
<td>16,2</td>
<td>15</td>
<td>19</td>
<td>19,1</td>
<td>19</td>
</tr>
<tr>
<td>University</td>
<td>19,3</td>
<td>17,4</td>
<td>16,4</td>
<td>19,5</td>
<td>19,8</td>
<td>18,9</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**India**

Researchers by sector of employment in full-time equivalents (%)

Source: UNESCO, 2015

<table>
<thead>
<tr>
<th>Sector</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business enterprise</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>38,7</td>
<td>38,7</td>
</tr>
<tr>
<td>Government</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>45,6</td>
<td>45,6</td>
</tr>
<tr>
<td>University</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>11,5</td>
<td>11,5</td>
</tr>
<tr>
<td>Private non-profit</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Russia**

Researchers by sector of employment in full-time equivalents (%)

Source: UNESCO, 2015

<table>
<thead>
<tr>
<th>Sector</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business enterprise</td>
<td>51</td>
<td>50,6</td>
<td>50,2</td>
<td>48,9</td>
<td>47,8</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>2007</td>
<td>2008</td>
<td>2009</td>
<td>2010</td>
<td>2011</td>
</tr>
<tr>
<td>----------------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Brazil</strong></td>
<td>0,029988</td>
<td>0,030447</td>
<td>0,031212</td>
<td>0,033966</td>
<td>0,036685</td>
<td>0,03905</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>0,158756</td>
<td>0,172854</td>
<td>0,1779</td>
<td>0,16207</td>
<td>0,16999</td>
<td>0,18297</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td></td>
<td></td>
<td>0,07296</td>
<td></td>
<td></td>
<td>0,07296</td>
</tr>
<tr>
<td><strong>Russia</strong></td>
<td>1,069461</td>
<td>1,06439</td>
<td>1,01736</td>
<td>1,018818</td>
<td>1,009584</td>
<td>0,98592</td>
</tr>
<tr>
<td><strong>United States</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Government</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>University</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Private non-profit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**United States**

Researchers by sector of employment in full-time equivalents (%)

Source: UNESCO, 2015

**Business enterprise**

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brazil</strong></td>
<td>0,331044</td>
<td>0,351036</td>
<td>0,373932</td>
<td>0,39627</td>
<td>0,436885</td>
<td>0,48138</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>0,178139</td>
<td>0,185658</td>
<td>0,194504</td>
<td>0,166335</td>
<td>0,17622</td>
<td>0,182007</td>
</tr>
<tr>
<td><strong>India</strong></td>
<td></td>
<td></td>
<td>0,0184</td>
<td></td>
<td></td>
<td>0,0184</td>
</tr>
<tr>
<td><strong>Russia</strong></td>
<td>0,504036</td>
<td>0,532195</td>
<td>0,5338</td>
<td>0,541728</td>
<td>0,587898</td>
<td>0,62712</td>
</tr>
<tr>
<td><strong>United States</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**University**

Data derivation: \(((\text{Researcher in full-time equivalents} \times \text{percentage university personal}) / 1000))\)

**Enterprise**

Data derivation: \(((\text{Researcher in full-time equivalents} \times \text{percentage enterprise personal}) / 1000))\)

Table 21 "calculations of innovative inputs"
### 11.6 Appendix F – Summarized data on innovative inputs and S&T outputs

<table>
<thead>
<tr>
<th>Summarized data on innovative inputs and S&amp;T output</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. R&amp;D expenditure as percentage of GDP</td>
<td>1,21</td>
<td>1,09</td>
<td>0,81</td>
<td>1,84</td>
<td>2,75</td>
</tr>
<tr>
<td>2. R&amp;D personnel as percentage of GDP</td>
<td>0,70443</td>
<td>3,11104</td>
<td>0,15336</td>
<td>0,962977</td>
<td>N/A</td>
</tr>
<tr>
<td>3. Patent applications per 100,000 inhabitants</td>
<td>3,4</td>
<td>24,33</td>
<td>1,46</td>
<td>41,41</td>
<td>146,51</td>
</tr>
<tr>
<td>4. Patent grants per 100,000 inhabitants</td>
<td>0,467</td>
<td>16,402</td>
<td>0,259</td>
<td>8,76</td>
<td>66,007</td>
</tr>
<tr>
<td>5. Patent in force per 100,000 inhabitants</td>
<td>2,1</td>
<td>92,4</td>
<td>1,6</td>
<td>36,9</td>
<td>535,8</td>
</tr>
<tr>
<td>6. Scientific articles per 100,000 inhabitants</td>
<td>6,64</td>
<td>9,896</td>
<td>1,817</td>
<td>6,654</td>
<td>67,617</td>
</tr>
<tr>
<td>7. Patent applications per 100,000 inhabitants / R&amp;D expenditure as percentage of GDP</td>
<td>2,80991735 5</td>
<td>22,3211009 2</td>
<td>1,802469 136</td>
<td>22,5054347 8</td>
<td>53,276363 64</td>
</tr>
<tr>
<td>8. Patent grants per 100,000 inhabitants / R&amp;D personnel as percentage of GDP</td>
<td>4,82659739 1</td>
<td>7,82053589 8</td>
<td>9,520083 464</td>
<td>43,0020654 7</td>
<td>N/A</td>
</tr>
<tr>
<td>9. Patent grants per 100,000 inhabitants / R&amp;D expenditure as percentage of GDP</td>
<td>0,38595</td>
<td>15,04771</td>
<td>0,319753</td>
<td>4,76087</td>
<td>24,00255</td>
</tr>
<tr>
<td>10. Patent grants per 100,000 inhabitants / R&amp;D personnel as percentage of GDP</td>
<td>0,662947</td>
<td>5,272192</td>
<td>1,688837</td>
<td>9,09679</td>
<td>N/A</td>
</tr>
<tr>
<td>11. Scientific articles per 100,000 inhabitants / R&amp;D expenditure as percentage of GDP</td>
<td>5,48760330 6</td>
<td>9,07889908 3</td>
<td>2,243209 877</td>
<td>3,61630434 8</td>
<td>24,588</td>
</tr>
<tr>
<td>12. Scientific articles per 100,000 inhabitants / R&amp;D personnel as percentage of GDP</td>
<td>7,79013288 2</td>
<td>2,91828426 6</td>
<td>14,62708 579</td>
<td>3,75533823 5</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 22 "summarized data on innovative inputs and S&T outputs" Source: (IMD, 2014)