Shifts in Modes of Governance and Sustainable Development in the Brazilian Oil Sector

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Highlights

- We analyse shifts in modes of governance using the case of the Brazilian oil sector.
- Shifts on modes of governance were driven by actors, institutional and policy features changes.
- We examine the impacts of modes of governance on sustainable development.
- Recent mode of governance contradicts relevant aspects of sustainable development.

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This article discusses shifts in modes of governance in the Brazilian oil sector over a 60-year period. On the basis of Driessen et al.'s (2012) framework, we discuss the impact of these shifts on sustainable development. Our results suggest that changes in modes of governance were driven by regulation and mostly associated with shifts in both actors and institutional features but that the underlying rationale of prioritising economic outcomes remained unaffected. The results also confirm that a central governance structure remained in place over time and co-existed in different modes of governance. Petrobras was the backbone of this structure and instrumental in empowering and disempowering non-state actors. This article stresses that a mode of governance furthering sustainable development should promote interactions of large numbers of actors and may require active participation of Petrobras to encourage rationales that support improvements in social and environmental domains.

Keywords: Sustainable development; modes of governance; oil sector; Petrobras; Brazil

Introduction

The oil sector has been considered a 'controversial industry' because some of its business practices can cause a negative impact on economic, social and environmental dimensions (Cumbers, 2000; De Roeck & Delobbe, 2012). Examples of negative consequences related to the oil sector are global climate change, impacts on biodiversity, deterioration of air and water quality, and the 'resource curse' (Du & Vieira, 2012). Thus, achieving sustainable development in the oil sector is a challenge (Escobar & Vredenburg, 2011).

Companies acting in the oil sector are mostly large multinational corporations (MNCs) that operate in different parts of the world through subsidiaries. Although the oil sector is under constant social pressure, any changes in business practices seem to be related to host country interpretations of sustainable development (Cumbers, 2000; Escobar & Vredenburg, 2011). The literature stresses that the absence of integration between MNCs and governance at the

macro level can contribute to failures in solutions furthering sustainable development[1] (Heuer, 2012; Idahosa, 2002; Idemudia, 2009; Ketola, 2006; Wheeler, Fabig, & Boele, 2002).

Our research aims to contribute to the debate on the existing conflict between economic growth and sustainable development by analysing changes in modes of governance in the Brazilian oil sector. This paper gives special attention to the role that Petroleo Brasileiro S.A. (Petrobras)[2] has played in supporting changes in governance in Brazil. We take this approach because of Petrobras's shared public–private ownership, enabling the government's influence on the oil sector. In 2007, Petrobras announced the discovery of the largest oil deposits in the world, formally named 'pre-salt' (Petrobras, 2006, 2007). The pre-salt oil discovery has triggered interest in researching the effects of oil sector activities on sustainable development[3].

Our research adds to the above literature by pursuing two main objectives. First, our study aims to outline the impacts of change in modes of governance on sustainable development, considering the Brazilian oil sector. A special emphasis is placed on understanding what forms of governance lead to (un)sustainable[4] impacts caused by oil sector operations and the role of Petrobras in these impacts. Polette and Seabra (2013) analysed issues related to sustainability and governance; however, this article does not include the analysis of the influence that Petrobras may have had on sustainability matters. This is a relevant aspect to study because Petrobras is a state-owned organisation and has acted as a facilitator of the implementation of governmental policies in the oil sector in recent years. This contribution also differs from that of Paz (2015), which concentrated on analysing how institutions influenced Petrobras to sustain financial performance over time. Second, our research aims to identify changes in modes of governance considering the Brazilian oil sector using a

framework proposed by Driessen et al. (2012). This framework allows for the analysis of how a variety of actors, institutional features and policies can influence shifts in power and, in turn, influence modes of governance[5]. Polette and Seabra (2013) concentrated mainly on discussing governance in the pre-salt period and as a result did not include a longitudinal analysis of modes of governance and why/how features evolve to influence changes that may lead to (un)sustainable practices. Moreover, this article adds to Ribeiro & Novaes' (2016) research by analysing changes in modes of governance towards a sustainable development approach.

The remainder of this article is organised as follows. This article starts by providing an overview of modes of governance as applied to sustainable development. The following section explains the research methods used in this study. This paper continues by including an analysis of shifts in modes of governance from 1953 to 2013. It also relates the changes in modes of governance in the Brazilian oil sector and their impact on sustainable development. Finally, the last section provides a final discussion and conclusions.

Modes of Governance: A Sustainability Approach

The literature notes that there is no clear and mature interpretation of the meaning of sustainable development (Kemp, et al., 2005). Thus, for the context of this study, we will work with notions of sustainability that call for global justice and human development[6] within a fragile natural environment that must be preserved (Lange, et al., 2013). Notions of sustainable development require social transformation, long-term perspectives, and multidimensional objectives (Lange, et al., 2013). Thus, it is claimed that sustainable development cannot be achieved without changes in governance. The nature of sustainable development is complex, involving the collective action of different stakeholders (van Zeijl-Rozema, Cörvers, Kemp, & Martens, 2008) over an array of environmental and social issues

utilising a long-term perspective (Hysing, 2009, 2010; Lange, et al., 2013). Analysis of modes of governance can help in making decisions furthering sustainable development, in the sense that it allows a search for political structures that establish a common approach by different actors (Berger, 2003) in different economic sectors with the objective of achieving collective goals (Berger, 2003; Hysing, 2009, 2010; Kemp, et al., 2005; van de Meene, et al., 2011; Weber, Driessen, & Runhaar, 2011). A detailed analysis of changes in modes of governance can entail the identification of features that encourage high levels of transparency and accountability, allowing broader societal integration and, consequently, less hierarchical structures (Lange, et al., 2013).

The literature also sought to characterise dimensions that describe different modes of governance to illustrate the application of the above-mentioned pre-requisites (Hysing, 2009, 2010; van de Meene, et al., 2011; Weber, et al., 2011). In particular, Lange, et al. (2013) suggested that an analysis of changing on modes of governance (furthering sustainable development) should include three dimensions (Lange, et al., 2013): (i) political process (politics), (ii) institutional structures (polity) and (iii) policy contexts (policy). Politics refers to the types of actors (e.g. public and private) and how these actors interact in different governance modes. Polity provides an analysis of how interactions are built, reflecting on the structure of governance and rules in place. Policy concentrates on the types of policy enacted and their formulation, content and implementation.

Lange, et al. (2013) analysed different types of frameworks and concluded that frameworks do not always address politics, polity and policy. Moreover, Lange, et al. (2013) identified the framework suggested by Driessen, et al. (2012) as that which included these three necessary dimensions (politics, polity, and policy). Thus, our research uses the framework on shifts in modes of governance, suggested by Driessen, et al. (2012), as a lens to answer the following research questions[7].

RQ1: What drove shifts in modes of governance over time in the Brazilian oil sector?

RQ2: Did shifts in modes of governance in the Brazilian oil sector contribute to sustainable development?

These questions are relevant because although debates on shifts in modes of governance have evolved over the years, the possibility of explaining the changes is still considered a gap to be addressed in this field (Rhodes, 2007). Additionally, the literature emphasises not only the importance of practical studies to understand when, how and why shifts in modes of governance occur (Lange, et al., 2013) but also the relevance of research focusing on specific sectors, such as the Brazilian oil sector (Driessen, et al., 2012).

The case of the Brazilian oil sector can be considered unique. This is because in recent decades, most Latin American countries have implemented changes in their oil sector governance by moving from a nationalist approach towards a system that incentivises foreign investment (Monaldi, 2014). Brazil took a different perspective and adopted a 'milder form of resource nationalism' in which the government increased its participation in contracts with foreign companies and changed parameters to distribute rents from the sector (Monaldi, 2014, p. 4). Petrobras (multinational state-owned oil company and leader in promoting Latin America's energy integration) was instrumental in the implementation of this particular approach, which has shown a lack of investments on energy integration, little expansion of oil exploration and production abroad (Calich, Weber, Closs, & Roberto, 2014; Monaldi, 2014), and corruption (Ribeiro & Novaes, 2016). In the Brazilian case, policy can be identified as the main driver of changes in governance to address issues related to market forces. Understanding the impact of these features on actors and institutions is helpful to identify causes of (un)sustainable practices and reflect on possible methods of improvement.

The framework proposed by Driessen, et al. (2012) ('the framework' hereafter, see appendix) is instrumental to understanding the Brazilian context because it includes aspects of political processes, institutional structures and policy content (Lange, et al., 2013). The framework considers five different governance arrangements[8]: centralised governance (the central government is in charge), decentralised governance (power is distributed within local government), public–private governance (the market and the government work hand in hand), interactive governance (there is equal collaboration between the government, market and civil society) and self-governance (private initiatives). These interactions are considered non-linear, and they could vary through a combination of three features: actors, institutions and policy. Driessen, et al. (2012) listed different topics to be considered when describing these governance arrangements. Narrative research involving these features over a period of time will provide the basis to analyse groups' abilities to create meanings to support changes and sustain patterns.

For example, to position a mode of governance according to its actors' features, an analysis should include characteristics in the following categories: key public actors (relationship among the state, market and civil society), the position of other stakeholders (this could vary between governance dictated by the central authority and self-governing), the policy level at which actors operate (e.g. national and international) and the basis of power of key actors (e.g. authoritative as opposed to autonomy). The aspects used to describe institutional features are as follows: the model of representation of actors (e.g. elections), the type of rules used for interaction (e.g. formal as opposed to informal) and the mechanisms in place for social interaction (e.g. top down as opposed to bottom up). Finally, the following aspects are used to describe the features concerning policy: types of goals in place (e.g. uniform as

opposed to tailor-made), policy instruments used (e.g. legislation and voluntary instruments), type of knowledge used for policy preparation (e.g. generic knowledge as opposed to an expert) and the level of policy integration (e.g. segregated and integrated sectors).

An important limitation of this framework is the simplification of complex social structures that exist in the real world (Lange, et al., 2013). Thus, features of each mode of governance should be interpreted with caution. However, the framework allows benchmarking of modes of governance at the meta level and compilation of data over long periods of time (Lange, et al., 2013). This is an advantage of this framework because the main objective of this study is to identify the direction and intensity of different shifts in modes of governance driven by regulations to promote sustainable development, considering a 60-year time horizon.

Research Methods

This is a narrative research that aims to elicit the causal explanation underlying the changes in the arrangement of governance in the Brazilian oil sector (Berg, 2004; Eriksson & Kovalainen, 2010). This narrative is presented chronologically from 1953 to 2013 (Eriksson & Kovalainen, 2010). The study uses archival data to address the research questions. Data was collected from four[9] main sources[10]: (i) the laws that were the basis for the construction of the new regulatory framework for pre-salt oil exploration (from 1953 to 2013), (ii) environmental and sustainability reports produced by Petrobras, (iii) the former president Luiz Inácio Lula da Silva's 2009 speech illustrating the benefits of the pre-salt oil exploration in the country[11] and (iv) the 2012 Brazilian national energy balance and report from the Brazilian National Agency of Petroleum and Biofuels (Table 1).

The data are analysed using a deductive thematic approach[12] (Boyatzis, 1998; Joffe & Yardley, 2004) based on the framework proposed by Driessen, et al. (2012) to structure a narrative (Eriksson & Kovalainen, 2010) on shifts in modes of governance furthering sustainable development. This narrative was also built to highlight dilemmas created and patterns sustained by actors over the time. To develop the plot of this narrative, segments from archival data were organised into a sequential timeline matrix (Miles & Huberman, 1994). A summarised version of this matrix is presented in Table 1.

[Table 1 around here]

Data analysis was conducted in four different stages by two coders, both authors of the paper. In the first stage, the first coder collected relevant regulations on the Brazilian oil sector and identified three significant changes in them. In the second stage, the first coder collected supplementary archival data (e.g. reports produced by public and private Brazilian institutions) to identify main institutions and actors linked to these regulations and their impact on sustainable development. The second coder conducted the third stage with the aim of compiling and organising the information collected. At this stage, the framework was applied to give a structure to the information collected within an explanatory longitudinal scheme involving changes in modes of governance, policy, institutions and actors. Finally, during the fourth stage, the first coder cross-checked the analysis conducted by the second coder, and differences were discussed. After discussing the differences and consulting academic literature on specific topics, discrepancies were amended to reflect the agreed-upon results. There were a small number of discrepancies, and these disagreements were mostly to rearrange the data in a more clear and detailed manner.

The analysis involves a 60-year period because this is a reasonable time frame to understand relevant changes in modes of governance in the Brazilian oil sector. This is because significant changes in modes of governance only began after a 40-year period under monopoly mode, and these changes were highly influenced by policy reforms (Ribeiro & Novaes, 2016, Assis & Araújo, 2011). An important advantage of the archival analysis is the possibility of compiling large amounts of information that can be difficult to explore using other research methods (Eriksson & Kovalainen, 2010). Archival analysis also allows the scrutiny of historical records within a longitudinal perspective. However, archival analysis also presents limitations. For example, it may be difficult to cover all the existing material on a specific topic (Eriksson & Kovalainen, 2010). Additionally, the volume of information available may present a challenge for organising the data in a structured manner that allows logical inferences (Eriksson & Kovalainen, 2010). To reduce these limitations, the authors narrowed the time scale and used a framework accepted in the literature to provide a reliable interpretation of the data collected within the boundaries of a coding scheme.

The Brazilian Oil Sector Context

This section uses a framework to describe shifts in modes of governance in the oil sector in Brazil. Three distinctive stages characterise the shifts in governance that occurred throughout the period studied.

Monopoly from 1953 to 1997

In terms of multiple levels of governance arrangements, centralised governance was in place in the period of monopoly from 1953 to 1997 (Zacour, Pereira, Cristofaro, & Ferreira, 2012).

Petrobras was created within a nationalist approach to produce oil efficiently and for national advantage (Smith, 1972). The *main actors* were the Federal Government and Petrobras, which were organised to support centralised power with monopolistic exploitation, production, refining and bulk transport of oil (Dantas & Bell, 2009). *Policy* was mainly set by the Federal Government, and the Law No. 2,004/53 defined the *stakeholder position*. The *power base* of the actors was also defined in this regulation, which contained the main operating rules of the oil sector. This regulation was in place for over 40 years.

With regards to *institutional features*, Petrobras was created to lead oil exploration, and other stakeholders were only indirectly involved (Dias, 2010; Dias & Quaglino, 1993; Smith, 1972). Petrobras not only represented the country in terms of the oil sector but was also a relevant platform for the implementation of government policies at economic and industrial levels (Smith, 1972). For example, Petrobras had the goal of expanding national oil production and incentivising the use of biofuels to address the oil crisis and the Brazilian internal debt crisis in the 1970s (Figueiredo, 2009; Spetic, Marquez, & Kozak, 2012; Zapata & Nieuwenhuis, 2009).

During this period, the *rules of integration* were formal and mainly determined by regulation (Dantas & Bell, 2009, Assis & Araújo, 2011). Thus, top-down relations were the dominant *mechanism of social integration*. Petrobras had the monopoly on most oil activities. As a result, there was little need for social integration due to an economic and financial centralized framework of rules (Surrey, 1987). The wealth generated by the oil sector was decided at the highest levels of government, in which oil may have been an instrument for corruption (Smith, 1972).

In terms of *policy content*, goals and targets were set either by the Federal Government or through regulation. The *instrument of policy* normally used to set the context was command-and-control-type regulations (Assis & Araújo, 2011). There was little *policy integration*, and the sectorial approach was the most used. In terms of environmental concerns, the environmental agency called the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) was the main instructional body (Mariano & La Rovere, 2007). Petrobras needed IBAMA's previous license to perform activities. The *science-policy interface* was based on selective expert knowledge. Only in the 1970s was offshore extraction opened up to international companies, and Petrobras was responsible for administering related contracts (Surrey, 1987).

Monopoly abolition from 1998 to 2010

The governance arrangements in this period were characterised by decentralised governance with some aspects of public–private integration. The 1988 Federal Constitution abolished the monopoly in the oil sector (Assis & Araújo, 2011). The central government decentralised the power to regulate the oil sector among different government bodies. Additional new actors emerged in this period. These actors were two governmental organisations: (i) the National Petroleum Agency (ANP), which regulated the economic issues within the sector and ensured environmental protection, safety in operations and oil resources conservation, and (ii) the National Energy Policy Council, which provided assistance in formulating policies and guidelines on energy. Additionally, a system of concession areas was established to develop exploration and production of oil and natural gas in Brazil. Under this system of concessions, organisations that bid the highest in an auctioning system were entrusted with exploration areas. The concessionaries assumed all the exploitation risks. These companies also paid royalties to the Brazilian Government to compensate for the negative impact produced by oil

exploitation and production (ANP, 2007; Assis & Araújo, 2011; Câmarados Deputados, 2005). Companies from the US, UK, Canada and Australia together make up 48% of companies that exploit Brazilian oil (Departamento Intersindical de Estatistica e Estudos Socioeconomicos, In English: Department of Statistics and Socioeconomic Studies DIEESE, 2008). Consequently, under the concession system, most oil revenue would be in the hands of the international concessionary companies. Table 2 shows a timeline of the regulatory framework for oil exploration noted above.

[Table 2 around here]

In terms of *stakeholder position*, the Federal Government still played an important role (Pereira & Ortega, 2010). However, there was space for more stakeholder involvement because ANP was responsible for promoting and organising auctions and assigning oil exploration regions to national and international companies. Regarding the *policy level*, a new regulatory framework established new principles and general objectives for energy policy. A new Federal Constitution was approved in Brazil in 1988. This document consolidated the rights of the Federal Government regarding mineral resources, including subsoil deposits. It also established the alternative of hiring private companies to perform oil exploration. Consequently, the *power base* of actors changed considerably. Under the new policy, the underground natural resource continued to belong to the Federal Government. However, from the moment the oil was brought to the surface, it would become the property of those companies that had participated in public auctions. Under this scenario, the concessionary companies that extracted oil would be able to commercialise it either internationally or, in some cases, nationally (DIEESE, 2008).

13

Regarding *institutional features*, there is an overlap of indirect stakeholder participation and corporatist approach because of the existence of formalised public–private governing arrangements by concession areas. In terms of *rules of interaction*, an important event occurred in relation to the distribution of royalties within the exploitation of mineral resources on Brazilian soil. Three laws and a decree (Law No. 7,990/89, Decree No. 1/91, Law No. 8,001/90 and Law No. 9,478/97) emerged to regulate the economic exploitation of mineral resources, water resources for electric power generation, and oil and natural gas, respectively. The rates of royalties and special participation addressed in the above legislation made it possible for oil-producing states and municipalities to benefit from oil extraction and production in Brazil (Brasil, 2000, 2008). The *mechanism of social interaction* is hierarchical, in the sense that the central government sets the rates of royalties, but producing states and municipalities in Brazil are autonomous in managing financial resources allocated to them. This was a relevant social change because it allowed decentralised wealth distribution.

Policy content, goals and targets for concessions are formally set; however, concessionaries also have decision-making power in their activities. *Policy instruments* used were mostly legislation and concessions that were allocated through auctioning. Regarding *policy integration*, there is a sectorial approach to economic aspects, which overlaps with concessions and autonomy of states and municipalities to distribute royalties across society. However, in terms of environmental aspects, integration was difficult.

The new regulatory agency (ANP) began attempting to address environmental matters after deciding the concession areas (Mariano & La Rovere, 2007). During the first years of this period, there were no changes in the environmental legislation, although the new regulatory agency (ANP) also had responsibility for environmental protection (Mariano & La Rovere,

2007). The previous environmental agency (IBAMA) had been founded to use the precautionary principle excessively (Mariano & La Rovere, 2007). Moreover, there was a lack of official environmental data to assess different areas of the country. Only a few years later (in 2002), ANP could resolve this predicament after the credibility of internal systems was questioned and challenged by the international markets. The *policy-science interface* was primarily based on generic expert knowledge; however, because of concessions, there was also dominance of particular issues, such as specific knowledge on producers and consumer relations (Dantas & Bell, 2009).

Pre-salt oil discovery from 2010 to 2013

The third period analysed followed pre-salt oil discovery, and this phase can be defined as having a hybrid governance arrangement. In 2007, two potential oil reserves were discovered in Brazil (Petrobras, 2006, 2007). These reserves, called "pre-salt," lay below a thick layer of salt and below the seabed (Petrobras, 2007).

In 2010, the following three new regulations were approved relating to the oil sector: Law 12,276, Law 12,304 and Law 12,351. Two of these regulations directly influenced *actors* in the sector. The Law 12,276 allowed Petrobras to pursue the exploration and production of oil, natural gas and other hydrocarbon fluids. Law 12,304 inserted a *new actor* called Empresa Brasileira de Administração de Petróleo e Gás Natural S.A. – Pré-Sal Petróleo S.A. (PPSA). This institution is linked to the Ministry of Mines and Energy, and its key purpose is to manage the production and commercialisation contracts of the oil that belongs to the Federal Government. Thus, in terms of *stakeholder position*, the central government limited the autonomy of the market by designating Petrobras and PPSA as boundary setters. With regards to the *policy level*, the central government, Petrobras and PPSA play important roles.

With reference to the *power base*, the Brazilian Government examined models from around the world for granting rights to exploration and production of oil and natural gas (see for example Barbi & Silva, 2008; Martins & Loro Netto, 2012; Seabra, Gonçalves, Polette, & Casillas, 2012; Silva, 2008). The model used by the Norwegian Government was considered the best solution (see for example Barbi & Silva, 2008; Martins & Loro Netto, 2012; Seabra, et al., 2012; Silva, 2008). Norway typically enters as a partner of companies operating in the petroleum wells, managing the resources. The company's earnings are invested in a Government Pension Fund, which acts as a sovereign fund to be used for pension benefits of future generations (Jafarov & Leigh, 2007).

In 2010, Law 12,351 introduced the production-sharing regime, which established that the oil brought to the surface would no longer be the property of the concessionary. Only part of the oil explored would be given to concessionaries as compensation for the risks incurred while carrying out their activities (Assis & Araújo, 2011). Concessions would be based on sharing contracts. Petrobras and PPSA would be an integral part of all contracts. PPSA would represent the Brazilian Government with regards to management of the oil brought to the surface, and it would be responsible for implementing the production-sharing regime (Assis & Araújo, 2011; Jacques, Chaves, Veigas, & Freitas, 2009). Petrobras would be responsible for managing operations and conducting and executing direct or indirect activities (Assis & Araújo, 2011; Gomes & Przybyzesky, 2010). In this scenario, Petrobras could participate in auctions. If Petrobras won the auction, then the government would set up a consortium with Petrobras as PPSA's partner in the contract (Assis & Araújo, 2011). If another company won, then Petrobras would have to participate at a minimum of 30% in the consortium, with PPSA also a partner (Assis & Araújo, 2011). Some authors have highlighted that this new system

returns to Petrobras vast control of the Brazilian oil sector, and that Petrobras is operating as a quasi-monopoly (Antolín & Cendrero, 2013).

Corruption is a serious issue in a quasi-monopoly. Indeed, a series of scandals related to contracts established by Petrobras was recently uncovered (StrategicComments, 2015)[13]. Moreover, to allow Petrobras to actively participate in the new contract system, there was a need for government investment (Lamounier & Medeiros, 2012; Sousa, 2011). It was estimated that $260 billion would be invested during the period from 2011 to 2015 (Le Prioux & Muxagato, 2011).

In analysing institutional features, the *model of representation* is characterised by indirect stakeholder participation overlapping with a corporatist approach, formalising public–private arrangements by concessions. There are formal *rules of interaction* with overlapping autonomy of states and municipalities. In terms of *mechanisms of social interaction*, Law 12,351 created a social fund in Brazil. This social fund aims to assist social programmes in need of help from government revenue to benefit future generations in areas such as education, poverty alleviation and technology (Duarte, 2009; Lima, 2009). However, pre-salt oil extraction also brought high economic risks, which apparently had not been thoroughly considered and included in the regulations in place. Examples of such risks are infrastructure costs, negative impacts on the food chain, and political and fiscal challenges (Afonso & Gobetti, 2008; Lamounier & Medeiros, 2012; Martins & Loro Netto, 2012).

Regarding the *policy content*, there are uniform *goals and targets* for the oil sector; however, concessionaries can also influence the production level. Additionally, each state and municipality has the autonomy to manage resources obtained from royalties. In terms of

policy instruments, the main change was created by Law 12,734/12, which modified the rules for distribution of royalties among federal states. The new distribution of royalties promoted tension between oil-producing and non-producing states (Brandão, 2013).

Regarding *policy integration*, the sectorial approach (specific to the oil sector) continued to play a relevant role. However, there was an attempt to promote the integration of other activities from other sectors. For example, there is still a debate on how to invest resources from the social fund to improve social issues, such as education, science and research (IMF, 2012). There are intentions to allocate part of these rents to increase productivity in the non-oil sector to avoid 'Dutch Disease' (IMF, 2012) and reduce the country's dependence on oil rents. Thus, it is reasonable to state that the *policy-science interface* is mainly concentrated on generic expert knowledge in combination with specific knowledge from concessionary companies (Dantas & Bell, 2009) but that there is also an interdisciplinary attempt in terms of the introduction of the social fund and investment in non-oil sectors.

The three main shifts in modes of governance identified in the particular case of the oil sector in Brazil are summarised in Table 3.

[Table 3 around here]

How Did Shifts in Governance Modes Contribute to Sustainable Development?

The *monopoly period* can be defined as top-down control by the central government over the market and civil society. There was limited engagement[14] and collaborative interaction to discuss dilemmas involving social justice, human development and the natural environment. The negative impact of oil wealth distribution on the social dimensions is normally associated

with the lack of an adequate legal framework, accountability and transparency (Marcel, 2013; Okoye, 2012). This leads to corruption associated with deviation of oil rents for personal gain (Marcel, 2013; Okoye, 2012). Corruption is a common problem of high incidence in Latin American countries. One of the main challenges is to appropriately use the wealth from the oil sector for human development purposes.

The period after the *monopoly abolition* reflects changes in features; however, these changes were concentrated on economic aspects of oil sector operations. Environmental aspects were practically neglected at the initial stages. Later in this period, environmental considerations were driven by market forces because the absence of environmental criteria for oil exploitation began to pose a risk to external investment (Mariano & La Rovere, 2007). The structural modifications offered more power to non-state actors, which is considered an alternative to reduce corruption and improve public services (Okoye, 2012). However, the unbalanced power provided to actors linked to economic aspects reflected a prioritising of financial considerations over the natural environment. Social aspects also began to be discussed with debates around protection of property rights and oil rent distribution. The literature on sustainable development stresses that wealth distribution should be planned through social consensus (Alvarez, 2010; Aydin, 2012; Okoye, 2012; Valdivia, 2008; Valdivia & Benavides, 2012), avoiding political criteria (Alvarez, 2010), which tend to increase income inequalities (Aydin, 2012). The Brazilian case shows progress towards a more planned distribution of oil rents. However, changes in this area were slow, with the oil rents initially distributed only among oil-producing states and municipalities.

During the post-monopoly period, there was also debate on the negative impacts caused by the increasing dependency on international partners (Acha & Cusmano, 2005; Baxter, 1999).

This was mostly because MNCs and domestic businesses control a large portion of developing economies, having increased their control over capital and technology (Schneider, 2009). Additionally, employees (who in developed countries may signify a rich source of social integration and driver of change) in developing countries are subject to high levels of turnover because of low levels of education (Schneider, 2009). This generates weak trade union associations and little collective bargaining power, making labour relations highly politicised and state controlled (Schneider, 2009). Consequently, modes of governance favouring a more decentralised approach should be carefully implemented in developing economies to avoid exacerbating inequality. In the specific case of Brazil, Petrobras is a MNC and state-owned firm that not only controls significant amounts of labour and capital but also wields significant political influence. For example, recently, Petrobras has been utilised as a major part of Brazil's offensive against the financial crisis. The Government also tends to control the price of oil to contain inflation (Cruz, 2016). The fact that Petrobras is a MNC can call into question its pure interest in furthering national objectives (Ribeiro & Novaes, 2016).

The period after the *pre-salt oil discovery* was driven by discussion on the regulation of pre-salt oil extraction and how to achieve the best outcome in terms of economic gains and how to distribute them. The distribution of oil rents changed to include non-producing oil states and municipalities. A social fund was instated to promote human development; however, its effectiveness remains unproven (IMF, 2012). In addition, in this period, Petrobras took back a considerable proportion of oil activity, increasing the intensity of nationalistic protection. A higher level of government investment in the oil sector was required, compromising the application of economic resources to actions that would support sustainability, such as the

development of renewable sources of energy (Borba, et al., 2012; Goldemberg, Schaeffer, Szklo, & Lucchesi, 2014).

The pre-salt period also showed that a centralised structure of power co-existed with non-state power during the other two past modes of governance identified (Assis & Araújo, 2011). Petrobras, as a state-owned firm, was the backbone of this structure of co-existence of public and private power (Ribeiro & Novaes, 2016), which allowed flexible movements to empower and disempower non-state actors. In line with Driessen, et al. (2012) and Paz (2015), it is possible to infer that in the case of the Brazilian oil sector, modes of governance did not completely replace one another but rather were built on the basis of previous structures (Assis & Araújo, 2011). Thus, if the evolution of modes of governance depends on past structures, a more radical change may require Petrobras' involvement.

The literature notes that changes in modes of governance are more likely to occur when there is a failure (or shock) in the features of governance (Driessen, et al., 2012). The recent series of corruption scandals related to Petrobras probably signify a need for reflection because they call for scrutiny of power structures and actors to prevent mistakes similar to those in the past. A governance form that tends towards centralisation does not enable sufficient dynamic flow between actors to solve societal problems. Indeed, a new bill 131/2015 is being discussed by the Brazilian congress. The proposal is that Petrobras not be required to participate in all contracts for oil exploitation. This bill has been suggested to address economic difficulties in which Petrobras is operating at the moment after the recent corruption scandals.

Economic interests seem to be driving, once again, possible new changes in governance. This article proposes a more ambitious approach in which Petrobras would intervene to promote a rationale towards social and environmental development as opposed to overconcentration on economic interests. This would prompt broader involvement of and participation by more balanced actors. A possible alternative change in modes of governance would require, for example, more transparency in Petrobras operations and management. Petrobras could also achieve deeper social integration by empowering employees and increasing engagement with groups of social representation, such as trade unions. Moreover, there is a high potential for Petrobras to drive significant changes to ameliorate environmental impacts. Petrobras has already shown its relevance to these efforts in its development of the use of biofuels in Brazil in the 1980s (Hira & Oliveira, 2009).

Final Comments

This research provides two different but complementary contributions to the literature on governance in the Brazilian oil sector. First, it explores differences in modes of governance over a 60-year period. Second, it analyses how the changes in modes of governance can be associated with (un)sustainable practices. These analyses not only contribute to the literature on governance but also help explain how the features of different modes can contribute to sustainable development. The findings of this research report on a very specific context of the Brazilian oil sector, and future research in this area could explore modes of governance in other Latin American countries. Despite this limitation, the Brazilian oil sector context represents a unique scenario, and our results can help inform policy makers about possible ways to enhance Brazilian oil sector governance to further sustainable development. This is

particularly important in the current Brazilian context because the Government has been discussing changes in regulation after the Petrobras corruption scandals.

Another relevant contribution of this study is the application of a framework that structures characteristics of different modes of governance at the meta-level by analysing policies, actors and institutions. This coding instrument not only provides a measure of the time horizon of changes but also illustrates how policies, actors and institutions could relate to (un)sustainable practices in different modes of governance. This article reports on analyses of archival data considering a time horizon from 1953 to 2013. Hence, another interesting possibility for future research is to apply the framework to explore how governance may change after the Petrobras corruption scandals. Another possible avenue for future research is fieldwork exploring how Petrobras has responded to these scandals and the role that new policies will have in driving sustainable development in the Brazilian oil sector context. The results would contribute to the debate on how a particular governance feature can adapt and influence the evolution of a governance mode after a disruptive event.

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Table 1: Sources of archival data

1. Archival material from organisations

N	Sources	Type	Description
1	ANP	Technical note	Models of contracts for the exploitation and production of oil and natural gas n.21/2007
2	BNDES	Magazine	Article on oil revenue and taxes v.15/2008
3	BNDES	Report	Title: 'O BNDES em um pais em transição', v.17, which considers challenges in the oil and gas sector
4	Brazilian Congress	Magazine	The pre-salt's challenges, notebook series of high studies n. 5
5	Brazilian Congress	Report	Challenges in the pre-salt (n.5/2009)
6	Brazilian Congress	Report	Legal framework for mining of Brazilian reserves of oil and gas (n. August/2008)
7	Brazilian Congress	Report	Challenges, impacts and management of pre-salt exploitation (n. November/2008)
8	Brazilian Congress	ASLEGIS	The pre-salt's regulatory framework approved by the chamber of deputies (n.38/2009)
9	Brazilian Congress	ASLEGIS	Pre-salt's concessions and Petrobras capitalisation (n. Fevereiro/2011)
10	Brazilian Government	Regulation	Decree n. 1/1991
11	Brazilian Government	Regulation	Law n. 2,004/1953
12	Brazilian Government	Regulation	Federal Constitution
13	Brazilian Government	Regulation	Law n. 7,990/1989
14	Brazilian Government	Regulation	Law n. 8,001/1990
15	Brazilian Government	Regulation	Law n. 9,478/1997
16	Brazilian Government	Regulation	Law n. 12,734/2012
17	Brazilian Government	Regulation	Constitutional Amendment n.9
18	Brazilian Government	Recommendations	Recomendação nº 001/08/GABRO/PRDF/MPF
19	Brazilian Government	Porta Brasil - Webpage	Economic impacts of pre-salt's discoveries (10.10.2014)
20	Brazilian Senate	Discussion paper	Evaluation of regulatory framework for pre-salt (n.64/2009)
21	DIEESE	Technical note	Brazilian energy matrix n.43
22	DIEESE	Technical note	Oil and gas discoveries in Brazil n.71
23	EPE	Report	Brazilian energy balance 2012, Year 2011
24	Folha de São Paulo	Newspaper	Investigations by the Federal Police on oil exploitation (16.08.2008)
25	Folha de São Paulo	Newspaper	President Lula's speech (06.09.2009)
26	Folha de São Paulo	Newspaper	Losses of oil royalties put at risk Rio de Janeiro's finances (18.03.2013)
27	IMF	Staff consultation	Statement by the Executive Director for Brazil (article IV/2012)
28	IMF	Working paper	Alternative fiscal rules for Norway (n. 07/241/2007)
29	IPEA	Discussion paper	Study on royalties (n.1412/2009)
30	IPEA	Communications	Inequality, poverty and politics of revenue (n.155/2012)
31	O Globo	Newspaper	Criticism on the social fund (07.09.2009)
32	O Globo	Newspaper	Petrobras finds oil in pre-salt at Campos Bazin (08.06.2007)
33	Petrobras	Magazine	Petrobras background (1993)
34	Petrobras	Report	Social and environmental balance 2006-2008
35	Petrobras	Report	Sustainability report 2009-2013
36	Petrobras	Notes to investors	Discoveries under salt's layer (29.03.2007)
37	Petrobras	Report	Annual reports 2006-2013
38	Rio de Janeiro's government	Annual report	Report for the department of environment 2011
39	World Bank	Economic premise	Pre-salt oil discoveries n.113/2013

2. Archival material produced by Brazilian academia

Journal articles (25); books (07) and conference papers (03).

Table 2: Regulatory framework timeline from 1953 to 1997

1953	1988	1989	1990	1995	1997
Law N. 2,004	**Federal Constitution**	**Law N. 7,990**	**Law N. 8,001**	**Constitutional Amendment N. 9**	**Law N. 9,478**
Petrobras holds monopoly	Mineral resources belong to Federal Government	Basis for calculation of distribution of royalties	Sets new basis of calculation of royalties	End of Petrobras' monopoly	Petroleum Law Creation of ANP

Table 3: Timeline matrix for governance changes

Period	Key Events External and Internal Contexts	Type of Governance and rationales	Key Outcomes: (i) actors; (ii) institutional; (iii) content features
Monopoly 1953-1997	External • Dictatorship in which wealth generated by the oil sector was distributed by the central government. • Existence of corruption. Internal • Monopolistic exploitation, production, refining and bulk transport of oil.	Centralised governance with high levels of protectionism. Petrobras was created to pursue national interests, for example, to overcome the oil crisis in the 1970s and turn Brazil into an independent oil producer.	Actors • Central government agencies coordinate exploitation and allocate resources received from it. • Policy is established at (supra) national level under coercion and authority. Institutions • Formal rules in a top-down format of command and control. Content • Centralised goals and targets within sectorial approach. • Use of expert knowledge for issues related to oil.

Monopoly abolished 1998-2010	External • Decentralised power to regulate oil sector. • Oil rents distributed to producing states and municipalities. Internal • System of concessions. • Foreign companies carried out 48% of oil exploitation. • Royalties paid by companies to cover impacts of oil exploitation and production.	Decentralised governance with some aspects of public–private integration. Idea that competition drives not only changes in the oil sector (e.g., modernisation of the sector) but also advantages for consumers (e.g., lower prices) and society (e.g., wealth distribution).	Actors • High likelihood of stakeholder involvement. • Participation of the government at its various levels of aggregation. • Concessions allow private sector to exploit and produce oil. Institutions • Top-down, command-and-control approach allowing some autonomy for sub-national government (e.g., states and municipalities) and interactions with different other types of stakeholders (e.g., governmental agencies and private companies). Content • Centralised goals and targets for concessions system combined with targets set by specific actors (e.g., government agencies, producing states and municipalities and more freedom for private exploitation). • Use of not only generic knowledge but also specific knowledge implemented by concessionaries.

| **Pre-salt oil discovery 2010-2013** | External | Hybrid governance arrangement, in which indirect stakeholder participation overlaps with corporatist approach, formalised by public–private contract arrangements. There is a sense of nationalism in which the oil belongs to the society; therefore, all states and municipalities are entitled to benefit from it. Social wellbeing is also discussed (e.g., social fund). | Actors |

External

- Petrobras is operating as a quasi-monopoly.
- Oil rents distributed to all states and municipalities.

Internal

- Production-sharing regime.
- Concessions are based on sharing contracts, and Petrobras is participating in all of them.

Hybrid governance arrangement, in which indirect stakeholder participation overlaps with corporatist approach, formalised by public–private contract arrangements. There is a sense of nationalism in which the oil belongs to the society; therefore, all states and municipalities are entitled to benefit from it. Social wellbeing is also discussed (e.g., social fund).

Actors

- High likelihood of stakeholder involvement.
- Participation of the government at its various levels of aggregation.
- Sharing contract involves private sector in oil production and exploitation.

Institutions

- Authoritative rules for production-sharing regime set at (supra) national level; however, this system also allows lower levels of government participation (e.g., Petrobras and PPSA) and private sector engagement.

Content

- Targets and goals set in a centralised manner within the production-sharing regime and contracts managed by Petrobras and PPSA.
- Relevant changes in wealth distribution allow transdisciplinary attempts to promote social integration.

Sources: Adapted from Driessen et al. (2012), Miles and Huberman (1994) and Thompson (1990)

Table 5: Abbreviations and acronyms

ANP	Agência Nacional do Petróleo (In English: National Oil Agency)
BNDES	Brazilian Development Bank
DIEESE	Departamento Intersindical de Estatística e Estudos Socioeconômicos (In English: Department of Statistics and Socioeconomic Studies)
EPE	Empresa de Pesquisa Energética (In English: Organisation of Research on Energy)
IMF	International Monetary Fund
IPEA	Instituto de Pesquisa Econômica Aplicada (In English: Institute of Applied Research in Economics)
ASLEGIS	Associação dos Consultores Legislativos e de Orçamento e Fiscalização Financeira da Câmara dos Deputados (In English: Association of Legislative, Budgetary and Fiscal Economic Consultants from the Brazilian Congress)
PPSA	Empresa Brasileira de Administração de Petróleo e Gás Natural – Pré-Sal Petróleo S.A. (In English: National Petroleum and Gas Enterprise and Management)
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (In English: Brazilian Institute of Environment and Renewable Natural Resources)

Notes

[1] This is because sustainable development implicitly requires changing the role of the state to

[2] In 2014, Petrobras achieved R$ 26.6 billion in net profit (http://www. investidorPetrobras.com.br/en/financial-results/). The Brazilian government owns 50.26% of Petrobras' common shares (http://www.investidorPetrobras.com.br/en/governance/capital-ownership/). The board of directors contains 10 members, and 7 of them are appointed by the Brazilian government.

[3] Examples of possible impacts that pre-salt oil exploitation can cause on sustainable development were clearly highlighted in the literature, and these impacts can be classified into three main areas: (i) environmental: risks of environmental disasters, greenhouse gas emissions, damage to the ecosystems, etc; (ii) social: unfair distribution of oil rents (corruption) as well as long-term social dependency on oil rents and (iii) economic: negative impact on some economic activities such as fishery and tourism, need of infrastructure to accommodate the migration of specialised personnel who will work in oil exploitation, necessity of investments in specific technology to exploit oil in pre-salt geographic layer, committing resources to renewable energy, etc. (Costa, 2012; Gonçalves & Granziera, 2012; Lamounier & Medeiros, 2012; Polette & Seabra, 2013).

[4] The analysis in our paper identifies real-life situations that link modes of governance and (un)sustainable outcomes. According to Lange et al. (2013), studies that highlight (un)sustainable practices are rare but essential to illuminate new forms of governance that may accommodate better sustainable development initiatives.

[5] This is because sustainable development requires policy integration to promote innovation through a dynamic type of governance, which allows multiple actor interaction over a variety of levels (Kemp et al., 2005).

[6] Global justice and human development, in this study, can be interpreted as an improvement of human well-being and equalising of wealth distribution, e.g. health care improvements, better levels of education and poverty reduction (Okoye, 2012).

[7] Lange et al. (2013) analysed three conceptualised modes of governance, including the one suggested by Driessen et al. (2012). Lange et al. (2013) mentioned that researchers should be clearly informed that these conceptual arrangements are ideal formats and not a fixed set of classifications. Thus, conceptual arrangements may change depending on the context analysed, and hybrid arrangements formats may emerge. Lange et al. (2013) also suggested,

as future research, for example, that new interpretations on governance arrangements should improve the justification of features that characterise a particular governance mode to simplify classifications. Despite these limitations, Lange et al. (2013) found that the frameworks analysed meant a significant development to interpret the 'complexities of governance arrangements'. Moreover, the use of these frameworks to study real-life contexts was also considered by Lange et al. (2013) as a very useful analysis to understand the characteristics of modes of governance that can best promote sustainable development.

[8] The five modes of governance suggested by Driessen et al. (2012) are simple representation of real social arrangements. These five modes of governance are 'archetypical descriptions' for analysis purposes (p.148).

[9] The selection of secondary data was based on Lustick (1996) who recommended the search for data to be based on 'facts' to test a theory/framework of interest. This procedure allows scientists to organise the data into categories that can explain differently a sequence of events. The fact that scientists are not confined to a specific fixed set of rules to collect secondary data supports the development of a theory/framework, giving meaning to a sequence of events rather than reproducing stories. In sum, Lustick (1996) suggested that narratives should be constructed and not merely discovered, and thus, researchers can and should demonstrate 'self-consciousness' in the data selection to test theories/frameworks, allowing the development of the existent knowledge.

[10] Academic material produced in Portuguese was also considered as a source of data. This is because the material selected presented an interpretive and/or critical approach (Richard & Bettner, 1997). There is evidence that an interpretive and/or critical approach encourages reflection, creating knowledge in the form of a narrative. Thus, it can be inferred that science is a form of a narrative that contains many stories (Czarniawska, 1997)

[11] The pre-salt discovery is relevant to the Brazilian context because it is one of the largest oil deposits in the world (Petrobras, 2006, 2007). The forecast is that the pre-salt oil reserve will produce around 15 billion oil barrels with an extra potential reserve that can reach approximately 50–100 billion oil barrels (International Monetary Fund IMF, 2012). This large amount of oil can drive deep changes in the political agenda of the country, influencing governance arrangements. According to Cohen (1995), presidential rhetoric can give a clear indication on changes in public's agenda because the more a president emphasises a political area, it is more likely is that the public will react to it, increasing public concerns on the topic.

[12] This method allows the qualitative analysis of a narrative, using themes that already exist in the literature. For example, this article uses the framework suggested by Driessen et al. (2012) to analyse the narrative of the data collected.

[13] See http://www.bbc.co.uk/news/world-latin-america-31775677 and
http://www.bbc.co.uk/news/world-latin-america-32329517.

[14] As given in Table 3, this period mostly coincides with the military dictatorship in Brazil, and thus, top-down decisions were more frequent. Evidence of the impacts of military dictatorship on sustainable development is well discussed in Brazil. See, for example, the following link: http://www.encontro2014.sp.anpuh.org/simposio/view?ID_SIMPOSIO=1773