

## ABSTRACT

Our research question is whether a local content policy might be successful in the Brazilian system of innovation in the oil sector. In this respect we trace a comparative trajectory between the Brazilian and Norwegian system of innovation in oil&gas. The neo-Schumpeterian concept of system of innovation, neo institutionalism and network theory are used as focusing devices.

## I. INTRODUCTION

The Brazilian oil&gas industry is the result of the creation of Petrobras as a national oil company (NOC) in 1953 by a nationalist movement started by Monteiro Lobato and led by nationalist military as General Horta Barbosa and Felicissimo Cardoso. A similarity that the Brazilian oil&gas industry share with the Norwegian is that they both created their national oil company (NOC) before significant discoveries were made. Statoil was created by the Labour Party in 1972, after the discovery of Ekofisk (Thurber and Tangen Istad, 2010). The Conservatives would have preferred to use Norsk Hydro, an industrial conglomerate in which the Norwegian government had raised its shares to 51% at the time.

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The two state firms, Petrobras and Statoil were created to implement the public policies of their respective states in the oil sector. These two firms faced similar technological challenges with oil exploration in deep waters in Brazil, in the Campos Basin and in the Norwegian case, the North Sea. As large state firms they have little or no possibility of bankruptcy which allowed them to develop a culture of technological innovation and long-term technical development, something that is aided by the hegemony of engineers in their middle management.

The partnership with international oil companies helped both Petrobras and Statoil in the learning by doing. Both companies experienced a partial privatization in the 90's. One major difference is that Statoil was part of an effort to create one of the most dynamic sectoral system of innovation in oil&gas while Petrobras failed in this matter. One hypothesis is that Petrobras was focused in the public policy of searching for energy self-sufficiency and the timing of the development of its majors discoveries in the Campos Basin were in the 1990's when more liberal orthodoxy reigned.

In 2006, Petrobras decided to drill a well in the field of Tupi, 160 miles off the coast of Rio de Janeiro, 6,600 ft below the water line and through 16,000 ft of salt. This was not a simple decision considering that the cost of the well reached \$ 264 million but the NOC would have to return the field otherwise according to L 9478/97. BG stated that the well flowed 4,900 barrels per day of sweet 30 API crude oil and the upper field reserves estimates of recoverable oil is 8 billion barrels. The field was discovered in a geological formation known as the Pre-Salt layer and is a new petroleum play which is thought to contain significant volumes of oil and natural gas. A window of opportunity was opened to the system of innovation in the oil sector in Brazil (SIO SB) with the prospect of hundreds of billion dollars of investments needed to the development of the production of this geological province. Petrobras Business Plan 2011-2015 estimates investments of \$ 224.7 billion, \$ 117.7 billion in Exploration and Production and \$ 53.4 billion in the Pre-Salt.

The effects of these discoveries in the Brazilian society are yet to be seen. Regarding the income of the oil itself, there is the issue of Dutch disease and resource curse. To Mjoset and Capellen (2011) Norway has been an example of a country that has known how to deal with the oil wealth without allowing its presence to generate a process of de-industrialization of its economy characteristic of Dutch disease. Maybe this success comes from the ability of the Norwegian society to extract the rent from the oil industry. Heum et al (2009) define oil rent as part of its market price that exceeds the amount required to pay the production factors

used in its extraction. This rent resulting from the extraction of a finite natural resource can be appropriated by the society through taxes, consumption (low prices of gas) or local content policies to develop economic activities that might survive the end of the natural resource.

In terms of local content policies, Heum et al (2009) considers that the country most successful in capturing oil revenue through local content has been Norway because of a combination of good institutions, a reasonably developed shipbuilding industry and a window of opportunity represented by high oil prices and the Arab nationalism of the 1970s. Maybe, with the discovery of the Pre-Salt, Brazil also have a window of opportunity to develop this industry. But the question is, can a local content policy work in Brazil?

In Section 1 we present a comparative institutional trajectory among Norway and Brazil's systems of innovation in the oil&gas sector. In section 2 we present the theoretical framework that revolves around the concept of neo-Schumpeterian innovation system, neo-institutionalism and network theory. In section 3 we describe the Brazilian system of innovation in the oil sector and try to establish that the local content policy can be the center of this system. In Section, 4 we outline a brief conclusion and discuss the intended directions of the research.

## II- COMPARATIVE INSTITUTIONAL TRAJECTORY AMONG NORWAY AND BRAZIL'S SYSTEM OF INNOVATION IN THE OIL&GAS SECTOR.

In this section, we will try to establish some comparisons between the system of innovation in the oil sector in Brazil and Norway. The purpose is to try to find the reasons of the Norwegian success and Brazilian failure in this matter.

The Norwegian success can be explained by their previous experience in the shipbuilding industry, their local content policies, the direct involvement of the government with the development of the projects through "good will agreements" that forced investment in local universities and research centers.

Engen (2007) conceives the formation of the System of Innovation in Oil&Gas in Norway (SIOSN) in five phases. The first phase begins in the 70s when the Norwegian shipbuilding industry had expanded from fishing boats to 20% of the tonnage of oil tankers in the world. Norsk Hydro, which had appeared to produce fertilizer for agriculture in the beginning of the century, becomes a powerful industrial conglomerate that is nationalized. The Norwegian Labour Party creates the state-owned Statoil, the regulator (Norsk Petroleum Directorate) and the sector ministry (Ministry of Oil and Energy). International Oil companies (IOC) are forced to adopt a platform design that enables the use of Norwegian technology. In the next phase of consolidation is a breakthrough in project management and demands for local content. In the maturation phase will emerge the good will agreements requiring the IOCs to hire research institutes in Norway. In the late 80s, began a phase of reorganization with the fall in oil prices leading to a cost reduction of 50% and the imitation of the British model by reducing state intervention in the sector. Later with a strategy to compete in the international market, the government promoted the merger Statoil with Saga and the Hydro oil division eliminating virtually eliminating competition among the Norwegian peers in their national market.

This author emphasizes that prior to the oil industry the Norwegian had a fair shipbuilding industry that was eager to take part in the new industry. There was a window of opportunity also in the geopolitics of petroleum as the Arabian nationalistic politics in oil that induced the international oil companies (IOC) to accept the Norwegian demands in local content matters. Aker and Kvaerner eventually merged to become a major service company able to compete internationally. Maybe, this is one of the SIOSB problems, a lack a major national service company.

In the Brazilian case, there was not an entity to regulate the oil sector but Petrobras so there was not a separation of function. This made the sector policies very dependent on the company's will and the company's priority seemed to be the search for the self-sufficiency in energy to Brazil. Something extremely necessary to reduce the impact of oil imports in our trade balance. In fact this deficit combined with the debt crisis were responsible to end Brazilian experience with imports substitution.

The main organization of the SIOSB is the Petrobras Research Center (CENPES). It coordinates R&D activities of Petrobras, its articulation with R&D Networks involving universities and research centers, and participation in the Sectoral government fund CT-Petro

although local content policies are coordinated by a network centered in the presidency of the company and mostly through the Procurement Department.

Cenpes was founded in 1963, 10 years after the creation of the NOC on the island of Fundão, alongside the Federal University of Rio de Janeiro. Since its inception, the center helped Petrobras to develop the technological skills needed to meet its challenges, which passed through the deployment of a refining capacity and with the discovery of giant fields in the Campos Basin in the 1980s, the development of technological skills for the operation of these fields, at depths greater than 400 meters.

In this period, Cenpes had a great learning experience in technology management according to Almeida and Melo (2010). Such learning has gone through a growing involvement of internal customers in defining the portfolio of R & D projects, the creation of committees involving the company's business areas and the creation of R&D networks of cooperation with research institutions and universities in the 2000s.

This process was not cheap. Neto and Dalla Costa (2010) claim that the CENPES came to have 1% of the company's gross income available to invest in its portfolio of R & D programs as a Procap (1986-1991), which aimed to improve the technical competence of the company in the production of oil in water depths up to 1000 meters.

Furtado and Freitas (2011) analyzed seven R&D projects developed by Petrobras in the late 1980s: underwater pumping (developed in isolation); TLP, ANM, Vitoria Regia and Manifold through acquisition of foreign technology; ROV with a national company; and Octos 1000 platform with a local university. All these projects have failed in the sense of not being able to pass the prototype, however, they have generated a learning process that led the company to adopt a strategy of reducing the lock-in and adopting technological plurality, improving the company's ability to negotiate the acquisition of technologies, increasing the specification of critical knowledge for new equipment, the ability to monitor international developments and to assimilate new technologies.

The 1990s were not easy for Petrobras and Statoil with the Dated Brent under \$ 20 per barrel and a much more liberal political environment. In the case of Statoil, Norway was already in what Thurber and Tangen Istad (2010) called the Norwegian approach to separating policy, regulatory and commercial functions as the canonical model of good design for the oil sector bureaucracy. This regulatory design was not sufficient to prevent the scandal of the

Mongstad refinery and the feeling in the Norwegian society that Statoil was becoming too powerful.

The new ruling party, the Conservatives created the State's Direct Financial Interest to separate a significant part of the assets that once belong to Statoil. It was created the Government Pension Fund to invest abroad the revenues of the oil to avoid the Dutch disease. And with the first signs of exhaustion of the Norwegian oil reserves, Statoil planned to internationalize. As part of this effort, it was made a partial privatization to dissociate the company from the state. Statoil IPO led to the creation of Petoro, a 100% state owned company responsible to manage the State oil assets.

In the case of Petrobras, circumstances were a little different; Petrobras still had its best discoveries to explore in the Campos Basin but as part of Federal Government Budget in a time when the country had to fulfill obligations to the International Monetary Fund (IMF) implicated in containing state investments to generate a budget primary surplus. Thus, Petrobras could not have the necessary budget to develop this giant fields discovered in the previous decade.

In view of this situation, the federal government under Social Democratic Party rule decided to open the exploration sector to other companies that could afford these investments. The Constitutional Amendment 6/1995 ceased Petrobras legal monopoly of the sector. Under L 9478/97 it was regulated a new regime and created conditions for partial privatization of the NOC by selling shares and subsidiaries. However, as highlighted by Pacheco (2007), a concern to ensure that investments in R & D continued in the new regime led to the incorporation of multiple devices in this law that eventually made it the legal framework of the SIOSB.

Besides the care with R&D, this law created a more competitive environment that led Petrobras to utilize the special customs regime for fictitious imports (REPETRO) of platforms and turn-key contracts with major international engineering companies, undermining the company's commitment in the development of local suppliers (Araújo, 2011).

The L 9478/97 has created two organizations important to SIOSB: the National Energy Policy Council (CNPE) and the National Petroleum Agency (ANP). The CNPE has the legal competence to establish minimum levels of local content and the definition of the policy of technological development of the petroleum industry. The ANP would be the regulator

responsible for oversight of investment in R & D provided in the concession contracts. This separation has been made by the Norwegian almost two decades earlier.

The financing of R&D in SIOSB under L 9478/97 occurred through royalties and special participation. It stipulated that 25% of which exceeds the rate of royalties of 5% to a maximum rate of 10% will be allocated to the Ministry of Science and Technology (MCTI) for research programs in R & D in the petroleum sector. It is up to ANP to establish the royalties rate for each field. It also provides that 40% of these funds for the MCTI are intended for scientific and technological development of the north and northeast, which led to the creation by the Financier of Studies and Projects (FINEP), decentralized body of the MCTI, of the Network-North Northeast in 2001.

Clause 24 of the concession contracts, established in 1998 by ANP, provides for the obligation of the operator to invest 1% of gross revenues from a field under which applies the special participation in R & D, with at least 50% of these resources being applied in R & D projects in national institutions. This contractual provision was regulated by ANP Resolution 33/2005 and its annex, the ANP Technical Regulation 5/2005. In 2006, Petrobras launched a new model of technological partnerships with universities and research centers, called Thematic Network, coordinated by CENPES funded by these resources.

The discovery of the Pre-Salt in 2006 represented the possibility of proven reserves of the order of magnitude of Venezuela or Saudi Arabia that could make the country a major producer and exporter of oil (Sauer et al, 2010). In 2006, the federal government under the Labour Party rule also commemorated the conquest of the national self-sufficiency in oil by Petrobras although according to BP Statistical Review 2012 data, the oil production curve was always under the consumption curve.

Anyway, these events had a catalyst effect and put the discussion of the regulation of the oil sector again in the agenda. As a result, it was edited the L 12.351/2009 which changed from concession to partnership. Lima (2010) considers the new regime quite appropriate considering the risk involved is much lower. In fact, the success rate of drilling in the Pre-Salt fields has been 100%. This solution is coherent with the garbage can models, which consider that there are solutions looking for problems and not the other way around. The old nationalist aspirations that were responsible for the creation of Petrobras in 1953 gave the monopoly in operation in Pre-Salt fields to Petrobras. This decision was criticized by the Brazilian Institute of Oil&Gas (IBP) which assembles the other operators, the international oil

companies (IOCs) in a Senate hearing in the discussion of the law. The Union also gave its non-bid fields in the Pre-Salt to Petrobras in a process that according to Lima (2010) underestimated the value of the reserves. In fact, he emphasizes that the most correct should have been to unitization of the fields.

In the Pre-Salt areas under concession, that law states that the share of royalties and special participation due to the Union are destined for a Social Fund for poverty eradication, among others. Anyway, as emphasized by Lima (2010), in the areas of Pre-Salt that the Union transferred to Petrobras, there is no special participation. Considering that, funding R & D in the petroleum sector will be largely at the expense of Post-salt fields and in accordance with Law 9478/97. As already noted by Furtado (2003), the SIOSB continued centralized at Petrobras, despite the institutional changes of the 90s that introduced new actors and dynamics.

### III-THEORETICAL FRAMEWORK

It is our intention to work with three focusing devices: the system of innovation framework, the neo institutional theory and the network theory. In our opinion, the SI framework helps to show the systemic and iterative characteristics of the process of innovation. The neo institutional theory helps to understand the dynamics of the institutions and organizations that are part of the SI. And the network theory can help to understand the network formed by companies and organizations in the SI.

The Systems of Innovation (SI) approach is a neo-Schumpeterian proposal that aims to explain the economic development function as the interaction of the agents present in a given system of innovation. Two points much discussed by the authors in this field are the definition and boundaries of the systems. Cassiolato and Lastres (2002) see an affinity between the structuralist view of development of CEPAL and the neo-Schumpeterian innovation systems because these approaches reject general recipes of development such as the Washington Consensus.

The SI is defined by Nelson (2006) as a set of institutions whose interactions determine the innovative performance of the system. Lundval (1992) has a narrower definition of System of Innovation, understood as a set of institutions that deliberately promote the acquisition and



dissemination of knowledge and are the main sources of innovation. Edquist (2001) presents a schematic definition, divided into economic, social, political and organizational influences that affect the discovery, dissemination and use of innovation.

The issue of delimitation of the system of innovation is discussed by several authors emphasizing national, sectoral or regional boundaries. Edquist (2001) considers that the system's boundary should be defined by each research and identify the causes of innovation can help to define the boundaries of the system. Freeman (2002) prefers to emphasize the complementarity and alignment between national and sectoral institutions as key to development.

The concept of innovation systems is rightly criticized for the alleged lack of rigor of their definitions, boundaries or applicability. Amable (1999), for example, within a broad definition of innovation systems, proposes the concept of social system of innovation (SSI), which would have five components: the wage-labor nexus, forms of competition, international relations, money and public authorities.

The outline of sectoral innovation system is proposed by Malerba (2002) from two traditions, one of case studies and other industrial economy, which ignores the learning process of firms. The author defines the elements of an innovation system as products, agents, learning processes, core technologies, interaction mechanisms and institutions (standards, regulations and labor relations, ...).

To Malerba (2002), firms are key players in an innovation system. Suppliers and consumers are presented as very important. The author emphasizes that the interactions between agents go beyond the competition and command. To the author much innovation occurs through informal networks that are beginning to be better studied. The sectors can be differentiated according to their institutions. A key aspect is the sectoral institutions. The birth of these institutions should be studied. Therefore, we intend to use the neo institutionalist approach in the study of these institutions.

Sanders (2006) sees the neo institutionalism as a rebellion against the pluralism and behaviorism. North (1992) believes that its definition of rational institutions reconcile individualism with the structuralist approach. For him, institutions are the "rules of the game" and organizations are "the players". For Hall and Taylor (1996), the new institutionalism theorists tend to see institutions not only as a system of rule to reduce uncertainty and transaction costs, but as a system of symbols and cognitive schemas guided by two approach:

an instrumental and another of social desirability. Diermeier and Krehbiel (2003) also offer their definition of institutions as a set of contextual characteristics that define constraints and opportunities for individual behavior in an environment. Other authors like the idea of institutions as a kind of Nash equilibrium.

A common feature of the system of innovation approach, the neo institutionalism and the network theory is that they are contemporary to the crisis of the 1970s. They sought to articulate an individual behavior with the influence of institutions or the shape of its articulation network. In this sense, these approaches seem complementary and methodologically consistent.

A landmark of the network approach is the paper by Granovetter (1973) connecting the micro (individual) with the macro (social). Calmon (2011) sees the network approach as a compromise between methodological individualism and structuralism. The network approach is proposed to study how a sum of individual actions can be combined to generate social action.

Granovetter (1973) defines ties as a combination of time, emotional intensity and reciprocal services. He contradicted the common sense that strong ties generate social capital and social action. He sees the weak ties as fundamental because the bridges between networks are always weak ties. To Dodgson (2007), social networks contribute to the formation of new combinations, therefore, innovations by integrating across organizational boundaries. To this author weak and strong ties are complimentary because an entrepreneur requires both kinds of ties to his activity. Dodgson (2011) has a less enthusiastic view of weak ties to point out that weak ties allow the transmission of important information, but have difficulty in mobilizing resources and tactical knowledge. Strong ties on the other hand, can remedy these deficiencies but may suffer from inertia and lock-in. In his article, the author explains that an entrepreneur would be important to the combination of the two types of ties, and this occupies a position in the broker structural holes between dense networks.

Pelegrim, Balestro and Junior (2010) see a complementarity between sectoral innovation systems and networks. For these authors, which features a backward country is poor coordination between the agents within a system of innovation. In this situation, the government can induce the development through sectoral networks centered in their organizations.

Lazzarini (2011), on the other hand, has a more critical position about the the role of the government in networks in the Brazilian case. For this author, the model of privatization in the 1990s used the National Bank for Development (BNDES) to finance the public servants pension funds and their partners in the financial structures that were used to acquire most privatized state companies. The government used this strategy to minimize political criticism and also to maximize the value of the companies sold. Considering that this pension funds were already very important institutional investors and that most of long term finance to large companies were offered by the BNDES which in many cases hold shares with voting rights it resulted that the BNDES and the public servants pension funds occupied a central position in the network of ownership of the most important Brazilian companies. So the author concludes that privatization did not change the Brazilian capitalism, on the contrary it strengthened its ties to the ruling party and increased the effect of the political game on the corporate strategy.

In conclusion, we believe that this three focus devices can be important in the definition of the boundaries of the system of innovation in oil&gas and can help to explain its dynamics. For example, Silva and Britto (2009) believes that the purchasing power of Petrobras not necessarily may develop the suppliers. Using the network theory they evaluate a cluster of small and medium suppliers in Macae which Petrobras does not want to have a direct contract anymore. The company prefers to hold few contracts with large suppliers that can attend the many requirements instead of dealing and coordinating a network of small companies with a lot of defficiencies. In the author's opinion, the Engineering Procurement Companies are not ready to do this job either and the lack of contact with Petrobras may hamper the diffusion of innovation. So, the study of the purchasing power in this respect may be an important issue.

#### IV-SYSTEM OF INNOVATION IN THE OIL SECTOR IN BRAZIL AND THE LOCAL CONTENT POLICY

Hatenaka et al (2006) considers that in order to exist innovation in the petroleum sector it is necessary the presence of three types of firm (the operator, big service companies

and small highly specialized engineering firms). In the SIOSB, Petrobras is the main operator with recognized technical and financial capacity. There is an incipient presence of IOCs, some multinational service companies and a set of engineering firms that in its large majority are not in the technological frontier in their fields as was mentioned by Silva and Britto (2009). Thus, innovation in this sector is highly dependent on the inducing action of the state operator, Petrobras and the most important institution of the system the L 9478/97. Together with Pre-Salt discovery and the local content policy there is a window of opportunity for catching-up in this supply chain.

Petrobras seems quite prepared to the role of development inducer. In large numbers, it is a company that had sales revenue of \$ 145.9 billion in 2011. In the period 2001-2011, the company increased its reserves of 10.6 to 16.4 billion barrels, raised its daily production of 1.7 to 2.6 million barrels, net income reached \$ 20, 1 billion, and increased its market value by about 7 times. Let us not forget also that the Dated Brent went from a level of U.S. \$ 20 to \$ 120 in the period. For the development of its reserves, Post-and Pre-Sal Salt, the company provides in its Business Plan 2011-2015 investments of \$ 224.7 billion, so the purchasing power of the company can represent a great incentive for the SIOSB provided how the chain of suppliers will react to its purchasing policy.

The state-owned Petrobras has conflicting objectives regarding the issue of local content. On the one hand, it has to maintain a certain level of investment and a schedule of works that are in the Growth Acceleration Program (PAC) of the Federal Government. On the other, has to meet an industrial policy to develop providers. And yet, by another, though less important, has to deliver to private shareholders. As the state will deal with these goals will determine how it will use its role as the main agent of innovation network in the petroleum sector with its most important policy, the local content policy.

Petrobras is deeply involved with this matter. The definition of the limits of local content occurred in the context of Mobilization Program of the Petroleum Industry (PROMIMP), created in 2003 by the Federal Government, through Decree 4925, in order to support the national industry in the goals of local content. This organization is composed of a Steering Committee, led by the Ministry of Mines and Energy (MME), and the Ministry of Development, Industry and Commerce (MDIC), Petrobras, the National Bank of Development (BNDES), the Brazilian Petroleum Institute (IBP), the National Organization of the Petroleum Industry (ONIP). The Executive Committee consists of members of the lower ranks of these organizations and various industry associations: the National Industry Confederation (CNI), Brazilian Association

of Infrastructure and Basic Industries (ABDIB), Brazilian Association of Industrial Engineering (ABEMI), and other associations of industries. The executive direction of this program is carried out by Petrobras, whose engineers in practice and through their tacit knowledge have established the limits of local content for equipment that should be met by industry and operator.

The issue of local content is present today in 2020 Petrobras Business Plan which, in its Productive Development Policy provides for the reactivation of the shipbuilding industry by consolidating sites, establishment and consolidation of the supply chain through a local content policy. As a result of this policy, Petrobras expect an increase in international competitiveness, which was also as a consequence of professional qualifications and increased R & D. It also defined the company's strategy in relation to local content, which provides the following actions: to consolidate demands and achieve long-term contracts with increasing local content requirements, implement actions to increase the participation of subcontractors in the national procurement of Petrobras, induce development of domestic firms, add vendors outside the supply chain IP & G to increase supply capacity, support initiatives to train staff of the supply chain, expand the use of the project PROGREDIR (vendor financing through the use of the contract with Petrobras as collateral), lead to the installation of factories in Brazil by foreign groups.

For the R&D effort necessary to the Business Plan, Petrobras has the CENPES that with its recent expansion, has come to occupy an area of 300,000 square meters, making it one of the largest research facilities in the world. In December 2011, there was 831 researchers, 24% D. Scs. and 43% M. Scs. The R&D investment of the company was around \$ 160 million a year in 2001-2003 . It increased 6 times in 2004-2008 and reached a level of \$ 900 million. In 2009-2011 the average investment in R&D reached \$ 1,041 billion. From the total of \$ 3,1 billion invested in 2009-2011, 47% were in Exploration and Production. From these investments, 52% were made internally, 25% in partnership with national research institutions and 19% in partnerships with national companies.

In 2001, Finep launched the Cooperative Research Networks focused in the development of the North and Northeast of the country, in compliance with the legal device that determines the allocation of at least 40% of CTPetro Fund resources in these regions. Thus were created 13 networks. In 2002, Finep approved Petrobras' participation in this program. Since then, Petrobras signed a cooperation agreement with the anchor institutions of each of

these networks. The implementation of each project has been going through the conclusion of specific agreements.

A considerable part of these investments occurred under Law 9478/97 and the scope of Thematic Networks (TN) created by Petrobras in 2006. TN was created to develop R&D projects in areas of interest for the development the company Business Plan. Networks were established in the following areas: Exploration, Production, Supply, Natural Gas, Energy and Sustainable Development, and Technology Management. There were created two models of relationships: excellence centers and technological issues.

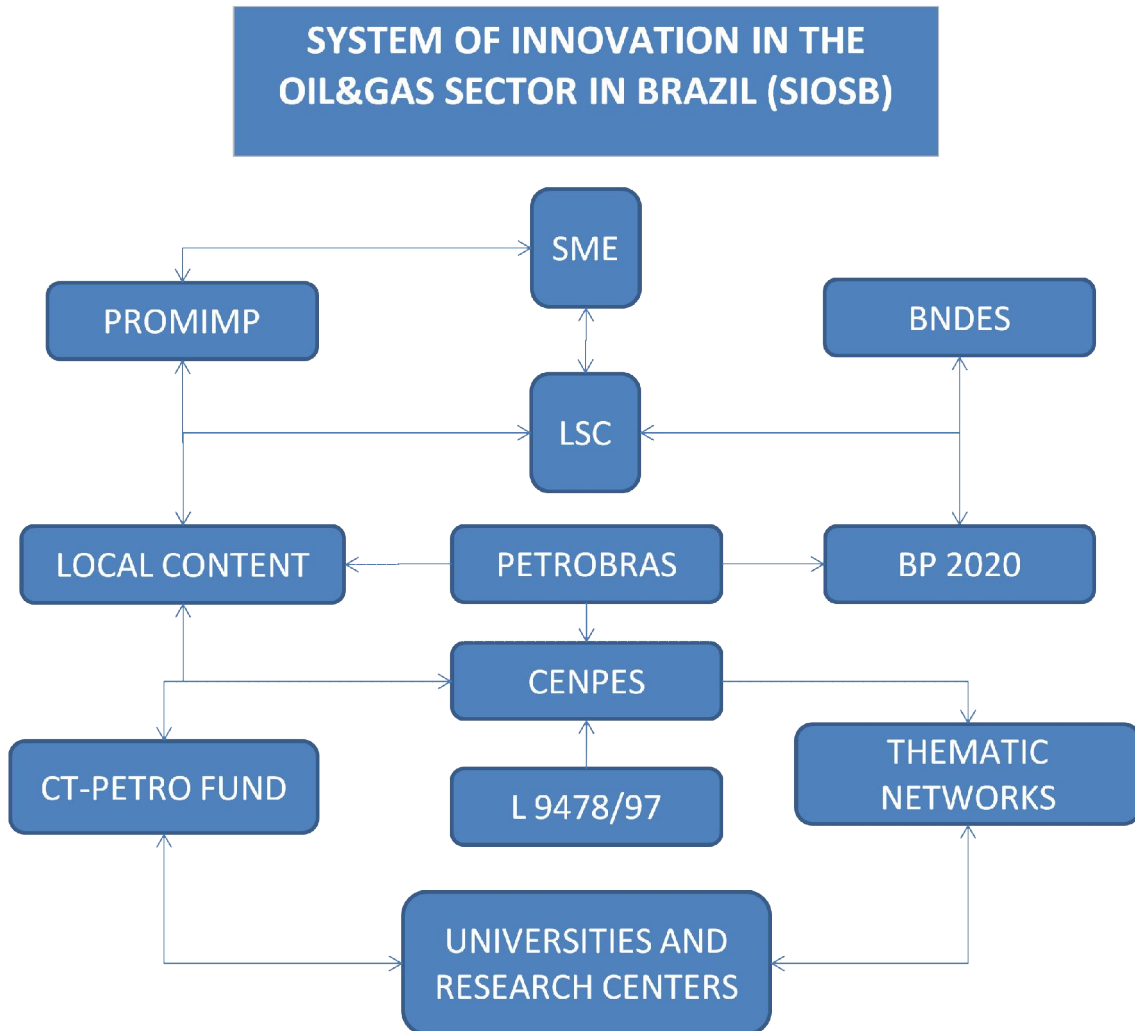
The excellence centers were established in oil, gas and energy in regions of intense operational activity of the company. The institutions selected were: the Federal University of Rio Grande do Norte, Bahia Federal University, Catholic University of Rio de Janeiro, State University of the North Fluminense, Federal University of Espirito Santo, Federal University of Sergipe and the Army Technological Center.

The second model addresses technology issues of strategic interest for Petrobras with the creation of 42 Thematic Networks. In this model, the projects will be developed through networks, in a format that will seek the cooperation of institutions of recognized competence in the topics selected. Thematic networks have a guiding role of investment which does not prevent the Cenpes Technology Committees to decide for investments that they consider most appropriate in institutions that are not part of the Networks.

Petrobras, through the CENPES, participates in the CT-Petro as an intervener in their edicts and the Steering Committee, the orientation of the guidelines and annual investment budget. The CT-Petro was created in 1999 to stimulate the oil and natural gas production chain, also under the L 9478/97. The target audience were nonprofit research institutions. In fact, the rules of the fund provide that the institutions that form partnerships with companies to develop projects take precedence over the other in the approval of their projects.

According to the Ministry of Science and Technology (MCTI), during the period of 1999-2012 were invested by the CT-Petro approximately \$ 2,5 billion of which 54.27% in support of technological innovation in enterprises, 19.26% in infrastructure and promoting scientific and technological research and 5.47% in the training of human resources for S, T & I, among others. The remaining resources were sprayed on initiatives ranging from the Space Program up to Programs of Popularization of S, T & I.

Schematically we can describe the system of innovation in the oil sector in Brazil (SIOSB) as follows:



SME: Small and Medium Enterprises  
 LSC: Large Service Companies  
 BP 2020: Business Plan 2020

## V-CONCLUSION

The research agenda in systems of innovation involves: factors influencing the innovation system (Nelson 2006), failures of catching-up (Freeman 2002), empirical studies focusing on organizational learning processes and the role of states (Edquist 2001), innovation through networks, the question of the birth of institutions, heterogeneity of firms, sectors taxonomy (Pavitt), modeling of evolutionary dynamics and discussion of public policies (Malerba 2002).

Our research question is, can a local content policy work in Brazil in the system of innovation of oil&gas? In order to answer this question we intend to deepen the comparison with the benchmarking in this matter, Norway. And also, study the competitiveness of the Brazilian oil&gas supply chain. PROMIMP has a Consolidated Report that can be very helpful in this matter. This report found three problems in the supply chain: lack of skilled labor for engineering firms, dismantling of the supply chain which is mitigated by Petrobras leadership and weak articulation of EPCist with domestic suppliers. It seems the purchase power of Petrobras and its purchasing policies are fundamental in this matter.

A proposed research agenda is the description of the interactions of the organizations of the system under institutions like the L 9478/97 and the local content policy. The central position occupied by Petrobras suggests that any policy to work needs to have its full cooperation. In the case of the local content policy, the architecture of the companies' network in the supply chain may explain the success in innovations in specific technologies demanded by the local content policy or not. The CT-Petro Fund and Thematic Networks interaction with the supply chain deserves investigation to evaluate if they can develop the innovations necessary to the demanded local content.



## REFERENCES:

ALMEIDA, Maria Fatima Ludovico. MELO, Maria Ângela Campelo. Gestão da tecnologia e aprendizagem organizacional: evolução das práticas de uma empresa brasileira de energia na direção do desenvolvimento sustentável. Revista Parcerias Estratégicas, Brasília. DF, v.15, n. 30, p. 279-296, jan-jun 2010

AMABLE, Bruno. Institutional Complementarity and Diversity of Social Systems of Innovation and Production. Universidade de Lille II & CEPREMAP. Sept. 1999.

ARAUJO, Bruno. Petrobras e o Setor de Bens de Capital. Cap. 5 da publicação O Poder de Compra da Petrobras, Ipea 2011.

BP Statistical Review of World Energy 2012.  
<http://www.bp.com/sectionbodycopy.do?categoryId=7500&contentId=7068481>

CALMON, Paulo. Redes e Governança das Políticas Públicas. Universidade de Brasília, 2011.

CASSIOLATO, José E. LASTRES, Helena M. M. Lastres. Discussing Innovation and Development: Converging Points between the Latin American school and the Innovation System perspective? Working Paper Series No. 08-02 GLOBELICS

DANTAS, Eva. BELL, Martin. The Co-Evolution of Firm-Centered Knowledge Networks and Capabilities in Late Industrializing Countries: The Case of Petrobras in the Offshore Oil Innovation System in Brazil. World Development, Vol. 39, No. 9, pp- 1570-1591, 2011

DODGSON, Mark. Exploring new combinations in innovation and entrepreneurship: social networks, Schumpeter, and the case of Josiah Wedgwood (1730-1795). Industrial and Corporate Change, Volume 20, Number 4, pp. 1119-1151, 2011

EDQUIST, Charles. The System of Innovation Approach and Innovation Policy: An Account of the State of the Art. Lead Paper presented at the DRUID Conference, Aalborg, June 12-15, 2001, under Theme F: 'National Systems of Innovation, Institutions and Public Policies'

ENGEN, Ole Andreas H. The development of the Norwegian Petroleum Innovation System: A historical overview. TIK Working Paper on Innovation Studies No. 20070605. University of Stavanger.

FAGENBERG, Jan. Schumpeter and the revival of evolutionary economics: an appraisal of the literature. *Journal of Evolutionary Economics* (2003) 13: 125-159

FREEMAN, Chris. Continental, national and sub-national innovation systems – complementarity and economic growth. *Research Policy* 31 (2002) 191-211.

Fundo Setorial do Petróleo

<http://sigcti.mct.gov.br/fundos/rel/ctl/ctl.php?act=projeto.visualizar&idp=17841>

FURTADO, André Tosi. Institutional Change and Innovation in the Brazilian Petroleum industry. Department of Science and Technology Policy. Institute of Geosciences – UNICAMP. Coloquio Internacional “Energia, Reformas Institucionales y Desarrollo em América Latina”, Universidad Nacional Autónoma de México – Université PMF de Grenoble, México, D.F, 5-7 noviembre 2003.

GRANOVETTER, Mark S. The Strength of Weak Ties. *American Journal of Sociology*, Vol. 78, No. 6, (May. 1973), pp. 1360-1380. University of Chicago Press.

HATAKENAKA, Sachi. WESTNES, Petter. GJELSVIK, Martin and LESTER, Richard K. The Regional Dynamics of Innovation: A Comparative Case Study of Oil and Gas Industry Development in Stavanger and Aberdeen. Massachusetts Institute of Technology Working Paper Series, November 2006

HEUM, Per. KASANDE, Robert. EKERN, Ole Fredrik. NYOMBI, Alex. Policy and Regulatory Framework to Enhance local content. Yardsticks and Best Practices. Working Paper No 02/11 SNF project No 1286. Institute for Research in Economics and Business Administration, Bergen, January 2011.

LAZZARINI, Sérgio G. *Capitalismo de Laços. Os donos do Brasil e suas conexões*. Rio de Janeiro, Elsevier, 2011.

MALERBA, Franco. Sectoral Systems of Innovation and production. *Research Policy* 31 (2002) 247-264.

MJOSET, Lars. CAPPELEN, Adne. The Integration of the Norwegian Oil Economy into the World Economy. The Nordic Varieties of Capitalism. *Comparative Social Research* Vo. 28 University of Oslo, Norway.

NELSON, Richard R. As Fontes do Crescimento Econômico. Sistemas Nacionais de Inovação: Retrospecto de um Estudo. Ed. Unicamp, 2006

NELSON, R. Richard. WINTER, Sidney G. Evolutionary Theorizing in Economics. The Journal of Economic Perspectives, Vol. 16, No. 2 (Spring. 2002), pp. 23-46.

NETO, Benedito Ortiz Neto. COSTA, Armando João Dalla. A Petrobrás e a exploração de Petróleo Offshore no Brasil: um approach evolucionário. Revista Brasileira de Economia. V. 61 n.1/p.95-109, Jan-Mar 2007.

NORTH, Douglas C. Economic Performance through time. The American Economic Review; Jun 1994; 84, 3; ABI/INFORM Global pg. 359.

PACHECO, Carlos Américo. As reformas da política nacional de ciência, tecnologia e inovação no Brasil (1999-2002). Cepal, Chile, 2007.

PELEGRIN, Ivan. BALESTRO, Moisés Villamil. JUNIOR, José Antônio Vale. DIAS, Sérgio Luiz Vaz. Dynamizing Innovation Systems through Induced Innovation Newtworks: a Conceptual Framework and the Case of the Oil Industry in Brazil. Journal of Technology Management & Innovation, 2010, Vol. 5, Issue 3.

Plano de Negócios Petrobras 2020. <http://www.petrobras.com.br/pt/noticias/conheca-nosso-plano-de-negocios-2011-2015/>

PROMIMP

<http://www.prominp.com.br/data/pages/8A95488830FCBB0C013123EAF69E3559.htm>

Redes Temáticas Petrobras

[http://www.petrobras.com.br/minisite/comunidade\\_cienciatecnologia/portugues/sobre.asp](http://www.petrobras.com.br/minisite/comunidade_cienciatecnologia/portugues/sobre.asp)

SANDERS, Elizabeth. Historical Institutionalism. Cap. 3 Rhodes, R.A.W., Sahah A. Binder e Bert A. Rockman. The Oxford Handbook of Political Institutions. Oxford: Oxford University Press, 2006

SAUER, Ildo. SEGER, Sonia. PUERTO RICO, Julieta. Reforma Del setor petrolero y disputa por La renta en Brasil . Energia em America Latina. Latinoamerica no. 51 México jul/dic. 2010

SILVA, Roberto Cezar Rosendo Saraiva da. BRITTO, Jorge. O Aglomerado de Empresas Atuantes no Segmento Off-Shore de Macaé: impactos da política de subcontratação da Petrobras na Bacia de Campos. Revista Brasileira de Inovação, Rio de Janeiro (RJ), 8 (1), pp. 121-166, janeiro/julho 2009

THURBER, Mark. C. ISTAD, Benedicte Tangen. Norway's Evolving Champion: Statoil and the Politics of State Enterprise. Working Paper # 92 May, 2010. Program on Energy and Sustainable Environment. Freeman Spogli Institute for International Studies. Stanford.