# COMPETITIVENESS IN THE BRAZILIAN OIL INDUSTRY - THE BRAZILIAN « OIL DIAMOND »

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*It is recognized the economic benefits that might follow the opening process of the Brazilian oil and natural gas industry, which shall experience a fast expansion with the arrival of national and international private investors. However, we should not neglect the broader impact of this process on the future development of all that cluster of national agents that lived around and served the former national oil monopoly, managed by the Brazilian National Oil Company, Petrobras. This work focuses on this larger perspective, discussing about the capacity of Brazil to sustain and expand its competitiveness in the oil business as well as to obtain the maximum economic development from the exploration of its oil and gas reserves. We adopt the work of Michael Porter, from the University of Harvard, about the Competitive Advantage of Nations, as a theoretical model to analyze the Competitive Advantage of Brazil in the global oil industry. By introducing the concept of « oil diamond », adapted from the notion introduced by this author, we develop a new understanding of national competitiveness in the oil sector. In this paper, we present the general model as well as a brief characterization of the results found for Brazil. Subsequently, we focus on just one leg of the model, for which we discuss, with more detail, about the competitive condition of the country in the opening-up scenario. This leg regards the so-called supporting and supplementary industries that constitute what is denominated in the French tradition the « para-petroleum » industry. We analyze the conditions for the Brazilian domestic « para-petroleum' industry » to survive and grow in the new competitive environment.*

## I. — INTRODUCTION

When a country has a difficult challenge ahead, it should seek for solutions through looking at its past successful as well as bitter experiences. The close observation and understanding of the historic moment as well as the social, economic, cultural and political context in which it finds itself, may help a country to take new opportunities, reduce risks and avoid threats created by major changes in the competitive scenario of major businesses. The globalization of the economy and the open up of particular sectors to private investors create numerous opportunities for expansion and modernization of suppliers as well as for cost reduction, more supply reliability and increasing products quality that usually benefit final consumers. However, one can not neglect the impacts that those changes may also have on all those agents that live within and around a particular business. Those broader impacts are usually very important for considering whether or not a country will be really better off and more competitive after changes have taken place in this particular business.

Michael Porter, from the University of Harvard, in his seminal work, *the*

*Competitive Advantage of Nations*, has tried to systematize a generic theoretical framework for analyzing the competitiveness of nations (rather than individual companies) in particular industries. [1]

As shown by the author, for each sector, some national environments seem more stimulating to advancement, modernization and progress than others do. The winning economies usually stand out worldwide showing a strong cohesion of positive forces that lead to progress and success. These forces are almost unbeatable and ultimately translated into economic power of domestic companies that will grow externally as well as internally, increasing market share and determining the more important variables that will allow the firms to control the particular sector or market niche.

We adapt this generic model to draw out the present competitive position of the Brazilian oil industry, asking whether or not this industry is prepared to face the new challenges of the global oil business. The open up of Brazil to private national and international oil investors, started formally in 1995, with the approval of the Ninth Amendment to the Federal Constitution. It ended the former national oil monopoly managed by Petrobras, the Brazilian Oil Company, and will certainly create new business opportunities in the country, with important economic benefits and high perspective for growth. Nevertheless, we should not neglect the broader impacts of this process on the future development of all those agents that lived around and served the former national oil monopoly. Whether this industrial cluster will adapt to the new competitive scenario and improve its competitive advantages in the global oil market is an essential question to see if Brazil will be able to obtain the maximum economic development from the exploration of its oil and gas reserves.

In the next section, we present the general aspects that constitute Michael Porter's theoretical approach, introducing the concept of « oil diamond » which is directly derived from Porter's diamond notion. Then, we present a general characterization of the Brazilian oil diamond, summarizing the most relevant results. Finally, we analyze with more details the new relationships between the Brazilian oil and gas sector and all the supporting and supplementary industries that are related to the oil and gas business and which constitute what the French tradition calls the « para-petroleum » industry. We conclude with some recommendations that Brazil should consider if it is willing to improve its competitive position in the global oil market.

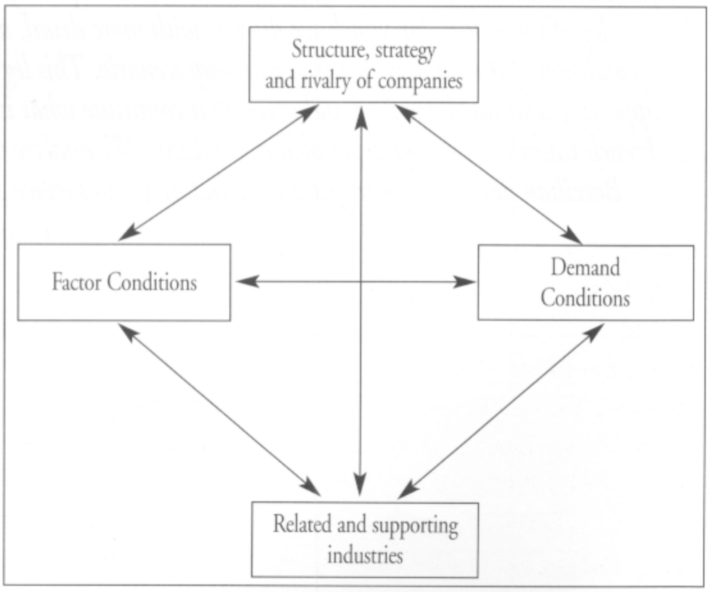
## II. — MICHAEL PORTER'S GENERIC MODEL AND THE CONCEPT OF DIAMOND

According to Porter [1], for a nation to be successful in a business, it should create strong competitive advantages, which must be sustainable over long time. To achieve that, the country will have to develop a favorable and winning system, integrating positively some leading determinants for the national competitiveness in that specific activity. As a generic scheme, Porter characterizes this system according to the four major determinants presented in the Figure 1 ; they are : (i) *the factor conditions* ; the availability and quality of inputs or factors of production. (ii) *the demand condition* ; the existence of a challenging domestic demand that incite suppliers to modernize and constantly improve its production. (iii) *the so-called supporting or supplementary industries*. And, finally (iv) *the competitive environment in which the industry operates* (the structure of the industry, the level of rivalry and the strategies of companies). The combination of those determinants represents schematically the industrial « diamond » which helps us to analyze the national competitiveness in the particular sector.

The « diamond » is a dynamic system. The relationships between the four principal determinants evolve continuously. In a « diamond » where constructive and positive forces prevail, the four determinants, which are equally important for the competitive advantage of the nation, reinforce mutually and conduce the country to increasing competitiveness. When the determinants weaken or diverge, the national competitiveness will be jeopardized, with the domestic companies ultimately losing their leadership in the global market.

Adopting this model as an instrument to analyze the competitiveness of nations in the global oil business, we introduce the concept of « oil diamond ». Through this

**FIGURE 1 - Determinants of the Competitive Advantage of Nations**




*Source :* Porter [1]

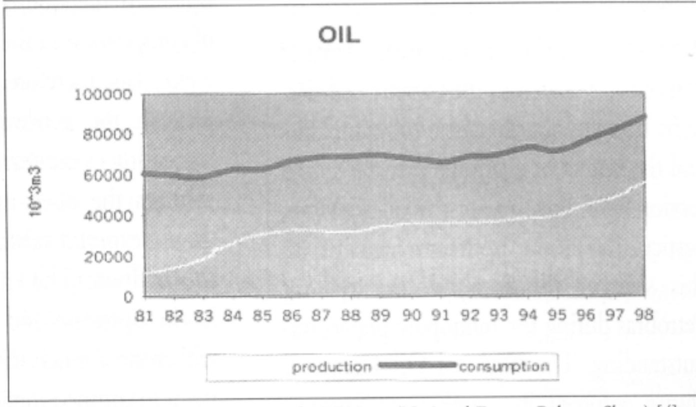
theoretical approach, we aim at establishing a modern vision of a competitive national oil industry. In particular, we attempt to analyze the competitive conditions of Brazil to face the challenges of opening up its domestic oil and natural gas sector to global competition.

## III. — THE BRAZILIAN OIL DIAMOND – THE PRINCIPAL CHARACTERISTICS

We initiate the discussion about the Brazilian competitiveness in the oil business by presenting the main characteristics of Brazil's « oil diamond ». By describing the four determinants of competitive advantages suggested by Porter, we draw a generic picture which positions to a great extent the country's major strengths and weaknesses in the global oil world.

We start with the *factor conditions*, because we believe this is the most sophisticated attribute of the Brazilian oil diamond. In terms of physical resources, Brazil contains 29 sedimentary basins that extend over a five million and six hundred thousand square kilometers area (one million, six hundred thousand are to be found in the ocean, the so-called offshore areas). These basins show various stages of exploration. The exploration investments made by Petrobras during the monopoly period were mainly concentrated on 8 of the 29 basins, which represent a little more than one third of the total area to be explored. The most explored regions are located in the following Federal States : Bahia, Sergipe, Rio Grande do Norte, Amazonas, Ceará, Alagoas and Paraná (for onshore activities) ; and Ceará, Rio Grande do Norte, Alagoas, Sergipe, Bahia, Espírito Santo, São Paulo and Rio de Janeiro (for offshore activities). In particular, Petrobras invested so far more than US$20 billion in the Campos basin, Brazil's more prominent sedimentary basin in the offshore area of Rio de Janeiro. The Campos basin currently answers for more than 70 % of the national crude oil production, with an average daily production of more than 600 thousand barrels /day. [2] [3]

**FIGURE 2**




*Source :* Balanço Energético Nacional - BEN 99 (National Energy Balance Sheet) [4]

Brazil's domestic crude oil production reached the one million barrels/day mark at the end of 1997, and is expected to reach the 1.3 million b/d mark by the end of 2000. Today, national production corresponds to approximately 55 % of the country's daily oil needs. Figure 2 shows the recent evolution of domestic production and national consumption. Although the country has been unable to diminish its dependence on crude oil imports, one must recognize Petrobras' effort of continuously increasing production to serve a fast growing oil demand. The construction of infrastructures and the development of human resources and technology to feed this great expansion certainly improved the country's competitiveness, making Brazil an attractive place for private investors today.

In the world ranking, the Brazilian oil and gas reserves cannot be deemed expressive, however Brazil has developed an advanced technology for deep-and-ultra-deep water offshore exploration and production activities. In this fast growing segment of the offshore business, Brazil holds a leading position with Petrobras appearing as a major global player. The potential of new giant discoveries in the Brazilian deep waters is still high, attracting the main leading international oil companies, high level professionals and a series of frontier technologies, which place Brazil in an outstanding position in the global offshore market. The arrival of foreign companies, with new technological approaches and different competencies will likely create even more dynamics in the competition environment. The country will certainly improve its factor conditions, maintaining and updating its competitiveness in the international oil business.

In what regards to the quality of Brazil's *oil demand*, related primarily to the consumption of refined products, which affects the competitiveness of the downstream segment, one must recognize that the country presents a very poor demand. The Brazilian market might be attractive for its volume and growth potential. However, the final consumers do not have the power to influence positively the other attributes of the « oil diamond ». By accepting high sulfur fuel oil and diesel as well as low quality gasoline, the final users do not represent any especial challenge for the domestic refineries, which lack important upgrading investments. Product specifications are relatively soft in the country, making it difficult for domestic producers to export into other more sophisticated markets. On the other hand, with the open up of the national market to imported refined products, the Brazilian refineries may be attacked in the segment of high-quality-and-high-margin products. This side of the demand condition is Brazil's weakest competitive determinant. The country has to improve its domestic demand, making it not only large and with growing potential, but also sophisticated. [5]

Another dimension regarding the demand condition is related to the commercial relations between the domestic oil companies and the bunch of equipment, material and service firms that supply the oil activities, particularly in the upstream segment. In this side of the demand, the role of Petrobras during the monopoly period was outstanding. The National Oil Company always enforced its suppliers to improve production and the quality of its products. Petrobras' suppliers lead the list of ISO 9000 and ISO 14000 holders in Brazil. They have been introduced into major technology development programs with the hands of the state Oil Company that very often sets up multi-agent research programs including its Brazilian partners. At this side of the demand, Brazil has developed a strong competitive determinant, which has been influencing very positively the other determinants. It sets up investment priorities and induces innovation and technological efforts. It stimulates the strengthening of business relationships between buyers and vendors, making the commercial success of new products and technologies more likely.

Albeit the preeminence of Petrobras in this regard, the open up of the national market is expect to induce an even more substantial sophisticated demand, with positive results in terms of the national competitiveness. The arrival of new oil companies will create more business opportunities and new technological approaches. It will also reinforce the internal rivalries, as the domestic suppliers will have to fulfill the new demand while having to face an increasing competition with other foreign suppliers that will start selling their products on the Brazilian market. The Brazilian demand condition tends therefore to improve in the next years, multiplying its positive effects.

The third determinant of the model is the *internal rivalry*. The way in which the companies are managed and compete with each other is tremendously affected by the degree of competition in the country. The internal rivalry has, therefore, an important role to play in the process of innovation and increasing competitiveness. In Brazil, through the open up of the market, we should expect a substantial revitalization of this attribute. The entrance of new players in the upstream and downstream markets will create a much more favorable environment to competition, leading to more innovation and efficiency as well as lowering costs, improving quality and increasing productivity.

Brazil should not find difficult to attract investors into its upstream business. The reason are three main factors : the overall oil economics improving with the maintenance of the international oil prices above the 20 US$/barrel level ; the natural resources already discovered in the national territory and the technological leadership already acquired by Petrobras. There are two ways of getting involved with upstream activities in Brazil : through partnerships with Petrobras or participating in the annual bidding rounds organized by the recently created Brazilian National Petroleum Agency (ANP). Although many companies have already shown great interest in working in joint-venture basis with Petrobras, few agreements (approximately 21) had been established until the end of 1999. On the other hand, the Brazilian first bidding round of upstream activities was organized in June 1999, in the middle of a strong economic crisis, having achieved partial success (only 12 out of 27 blocks have been granted to oil companies). Substantial structural and institutional changes are still necessary if Brazil is to speed up competition in its upstream business. The government must enforce Petrobras to accelerate its asset restructuring or then some partial (or total) privatization of the state Oil Company will be needed.

Regarding the downstream, and particularly the refining business, the rivalry level is still very low. It prevails a monopoly structure controlled by Petrobras. The ANP has been focusing its attention on this issue, even suggesting that Petrobras should ultimately divest from some of its refineries, creating more competition. However, the politics is still not clear and the changing pace may not be as fast as expected.

In short, even though the Brazilian « oil diamond » has quickly improved in terms of the rivalry parameter, Brazil is still a long way off from being the most sophisticated and competitive market in the world. In the upstream side of the business, the opportunities seem clearer to set up more competition. The high attractiveness of exploration and production activities in Brazil might motivate the fast entrance of other competitors, increasing significantly the internal rivalry. The transformation of this competitive attribute constitutes already the principal driving force for the long-term improvement of the national « oil diamond ». In the downstream, entry barriers are still high and competition is almost no existent, overlapping some of the gains expected in the upstream. The fast expansion of the domestic refined products market can nevertheless speed up the competition process, making the construction of new refining units by new economic agents attractive and viable. In this case we should also have an intensification of the internal rivalries in the downstream.

## IV. — THE ROLE OF THE « PARA-PETROLEUM » INDUSTRY IN THE OIL DIAMOND

*The related and supporting industries*, the so-called « para-petroleum » industry, are the ones that create the transferable factors for the oil industry. These are the suppliers of material, equipment, services and technology to the oil companies. Following Porter's theoretical approach, these industries must be equally competitive to increase the national oil competitiveness. As already described, during the monopoly period, Petrobras introduced a systematic demand-side approach, giving rise to a relatively sophisticated national « para-petroleum » industry. However, as indicated by a recent research [6] [7], due to the lack of competition and a great deal of paternalism from the national Oil Company, many of these Petrobras' suppliers became completely dependent on their former reserved market. Now, some of these companies are finding difficult to create or maintain sustainable competitive advantages that can last in a more competitive and open market.

The government (Petrobras' major shareholder) has been enforcing the state Oil Company to become a more commercial-driven and competitive firm. Petrobras is also under strong pressure to reduce costs in its expensive offshore activities as well as to improve the quality of products and operation procedures. There are therefore few room for the old-style « import substitution » policy where the domestic « para-petroleum » sector could enjoy a reserved market, producing at any price, with low quality, without taking and/or sharing risks with the oil operator and with low technological commitment. The open up of the national market to external competition will likely cause many Brazilian oil-related-and-supporting companies to lose their share in the domestic market without finding a way of compensating with expansion on the international markets.

The Brazilian « para-petroleum » sector, differently from what is happening in more developed countries, is far from becoming a major technology creator to the oil industry. In Brazil, the development of new technologies is still a Petrobras' affair. The National Oil Company has developed a strong relationship with the Brazilian science and technology system, building a series of long-term-and-strategic partnerships with Brazilian (as well as foreign) universities and research institutes. On the other hand, the « para-petroleum » companies have never absorbed this same tradition and continue very distant from the country's R&D apparatus. They have no major laboratories, being completely dependent upon the technology developed in the Petrobras' Research Center (CENPES) or on technology acquisition abroad.

Petrobras has always played the integrating role, assembling its suppliers and assigning small functions to each company. Therefore, the Brazilian « para-petroleum » industry is in a long way off from the current global trend of integrating activities ; managing the cluster ; reducing the number of suppliers and concentrate activities. It is also far from the more recent trend of merging a series of different companies into a one-stop business, where the oil companies can find integrated solutions for its problems. Being too much dispersed, the Brazilian « para-petroleum » organizations will likely fall into international hands. They might become mere commercial offices of much larger international corporations. It is also unlikely that any individual domestic player can, by its own, start a major restructuring process with a strong merge and acquisition policy. Capital constraints impede the financing of this process without the government participation. In addition, a private aggressive player would certainly find tremendous obstacles in the familiar structure that still control most of these companies as well as in the competition-control regulator.

Finally, despite Petrobras' old tradition of investing in human capital resource : sending high level professionals to study in Brazilian universities as well as in the leading foreign institutions, or developing diversified in-home training programs, very often including professionals from the « para-petroleum » sector, Petrobras' suppliers have never adopted the same training approach. As the market is becoming more competitive, they are following the shorter track of hiring high level professionals (most of them giving up its job in the state Oil Company for better-paid opportunities in the private initiatives). Albeit acceptable as a short-term strategy to deal with a fast-changing competitive environment, this model is unlikely to be sustainable in the long term.

We might therefore conclude that the Brazilian « para-petroleum » sector is in an edging moment. The companies that manage to improve their competitiveness in quality, price, integration of activities and innovation, with larger technology commitments, will likely benefit from the opening up of the Brazilian oil and natural gas market. Investments tend to increase, creating more business opportunities. Those companies will add more value to their final clients, protecting themselves from sharper competition and declining margins. They will also improve their position in terms of securing demand, as they will be less dependent upon the vagaries of the national oil monopoly. In addition, by tightening stronger partnerships with the oil companies, they might ease their way towards the international markets. On the other hand, the companies that insist in the old model will likely qualify themselves to disappear (at least as independent entities).

For the country as a whole, whether or not the domestic « para-petroleum » sector is able to adapt to a new competition environment is absolutely essential. It is not only a question of nationalistic feeling but rather a systemic vision that understands the complexity and the integrated relations within the national « oil diamond ». If this leg of the diamond loses its dynamic forces, the consequences will likely spread over the other legs of the diamond, jeopardizing the whole national competitiveness in the oil business.

## V.— CONCLUSION

Michael Porter's model presents a new paradigm to understand the competition of a nation in the oil business. His premises applied in the study of the competitiveness in the oil industry go far beyond the outdated static vision of competition based only on the geological advantages of the natural resources. It is evident that, in the oil business, there will always be the parameter « chance », which can eventually influence the model. The discovery of a large oil field can completely change the interest of oil investors in a country. On the other hand, large oscillations in international oil prices can compromise (or at least delay) the improvement of the national « oil diamond » in those countries where the oil resources are more costly. The fact that France has one of the most competitive « oil diamond » in the world, without any major domestic resource. And, that many leading oil export countries, with plenty of oil, have never been able to obtain the maximum economic development from their oil and gas. These are important issues to justify a better comprehensive analytical model for study the national oil competitiveness.

In an industry where prices behave with strong volatility, changing the market perception of attractiveness all the time, the countries must create a more sustainable position. In particular, nations with less competitive geological resources such as Brazil will only be competitive if they can hold a dynamic and sophisticated « oil diamond », capable of resisting to the price pressures in the international market.

A more comprehensive analytical model is also important for governments to set up a new oil policy agenda. Certain political factors influence the profitability of oil enterprises. Namely, the fiscal climate and the contract terms have usually important impacts on the economic conditions of oil and gas projects. Therefore, focusing on oil taxation and contractual aspects of the oil industry became the primary approach adopted by the companies to analyze the competitiveness of a country and its attractiveness to new investments. However, we believe that this fiscal and contractual discussion, when it is not considered under a broader perspective, might lead us to an outdated concept of competitiveness. The greatest the capacity of a nation to create and maintain a competitive advantage based on political stability, sophisticated human resources or continuous effort on innovations, the least this country will have to renounce in terms of taxation and contracting to attract investors. Brazil should therefore provide the investors with impartial operating conditions, with legal stability and transparent fiscal rules, with a strong national commitment towards innovation and technology development as well as investment in human capital.

One observes a significant potential growth in the Brazilian oil industry. For example, over this next decade investments from US$ 30 to 40 billion will be necessary to find and develop the oil and natural gas already discovered in the Brazilian very-deep water (offshore fields situated at water depths above 1000 meters) basins [6] [7]. This development will not be possible only with Petrobras' efforts. Various sources of funding will be needed from other Brazilian or foreign firms, coming to operate in the exploration and production side, but also in transportation, refining as well as in the downstream distribution and marketing. In fact, leaving its rigid oil monopoly, which has had its merits in the early stages of the industry, the Brazilian oil sector must now experience a new economic boom. The recent political reforms have placed the country and its oil and natural gas industry into a new global strategy, characterized by the opening of the country to strong international competition and reduction of entry barriers. We must nevertheless analyze whether the necessary conditions for Brazil to attract investors and become more global are present and sustainable over the long period.

As described in this paper, there are four competitive determinants that must be considered in an integrated way : *the factor conditions ; the demand conditions ; the related and supporting industries ; and the level of internal rivalry.* Briefly, in Brazil despite its relatively poor oil and natural gas reserves as compared to other major producers, the country has a well developed and very challenging *factor conditions.* It has a sophisticated natural resource base, skilled human resources and the command of related leading technologies. As far as the *demand condition* is concerned, the specific demand for downstream activities (final consumers) seems not to have the required sophistication to stimulate the national competitiveness. The national demand related to the upstream activities has a different profile. Brazil has developed with the leadership of Petrobras a sophisticated demand for material, equipment, services and technology, challenging the complex industrial system that expects to supply the oil industry. The recent regulation creates real conditions for the opening of the Brazilian oil sector to private capital. It has therefore been created the context where the *domestic rivalry* will increase and the competition environment will become more dynamic. Finally, as far as *the related and supporting industries* are considered, the Brazilian « para-petroleum » industry will have to face a new competitive challenge, and will need to adapt very fast to a new environment, having to improve efficiency, reduce costs, integrate activities, add more value and redefine its global strategies.

Brazil has excellent assets in oil and natural gas reserves, important infrastructures for refining and distribution as well as a world class technology, mainly in deep water offshore activities. However, those features will unlikely be sufficient to guarantee a sustainable competitive advantage to the nation.

The participation of new economic agents will depend on the creation of a favorable investment climate in the country. Circumstances must incite investors to innovate, create and adopt new technologies and sophisticated productive methods as well as to improve the skills of human resources. The understanding of Michael Porter's theoretical model will help the Brazilian authorities to move the country towards a more competitive position in the global oil industry. The adoption of such comprehensive approach will help to define the strategies that can drive the country towards the refinement of its « oil diamond ». We believe that working towards a more dynamic and sophisticated « oil diamond » is relevant and coherent. It should be the major target of any oil policy. Only such kind of energy policy will be sustainable in the long run.

Eventually, it might be worth concluding this paper by mentioning the following statements : Progress comes from change and not from rigid stability that obstructs transformation. Globalization makes the countries more important rather than less in the investment decisions of companies. The elimination of protectionism and other deformities that hamper competition makes the national features more decisive. Therefore, we must study new concepts and analytical approaches that can capture those features and translate them as the major determinants of the Competitiveness of Nations in the Global Oil Business ■

**REFERENCES**


[1] PORTER, M.E. (1990) ; « The Competitive Advantage of Nations ». The Free Press, New York.

[2] *Revista Brasil Energia* (Brazilian Energy Magazine) ; number 207, Fev/98.

[3] MARTINS, L.A.M. (1997) ; « Política e administração da exploração e produção de petróleo no Brasil ». CETEM/CNPq, Rio de Janeiro.

[4] Balanço Energético Nacional - BEN - 1999 (The National Energy Balance Sheet).

[5] With regard to the domestic refined products market, the average annual growth is estimated at approximately 5 % per year up to the year 2005. This growing perspective is by itself very attractive. The demand of refined products is projected at 2.3 millions barrels/day by the end of 2000, which will be significantly larger than the existing domestic refining capacity, which process approximately 1.8 million barrels/day of final products. Since the opportunities for quantitative investments are still big, one may not expect substantial natural pressures towards qualitative investments. Therefore, there might be a room for governmental policy and regulation in this issue.

[6] ZAMITH, R. ; DOS SANTOS, E.M. ; FAGÁ, W. M. (1998) ; « Vantagens Competitivas Brasileiras no Setor de Petróleo e Gás Natural. Conveniência de uma política industrial para o setor ». PIPGE/IEE/USP. Anais do Rio Oil & GAS Conference'98. Rio de Janeiro.

[7] ZAMITH, R. (1999) ; « A indústria parapetroleira nacional e o seu papel na competitividade do "Diamante Petroleiro" Brasileiro ». Dissertação apresentada ao Programa Interunidades de Pós-Graduação em Energia - PIPGE/IEE, da Universidade de São Paulo - USP. São Paulo.