



Strategic patenting in the upstream oil and gas industry: Assessing the impact of the pre-salt discovery on patent applications in Brazil



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ABSTRACT

For most of its history, Brazil needed to import oil to complement its internal production to supply the internal demand. However, in 2007, the Brazilian Federal Government announced the discovery of huge hydrocarbon resources in the pre-salt layer of the country's Southeastern coast. This study examines the impact of this discovery accomplished by Petróleo Brasileiro S.A. (Petrobras) on patent applications in Brazil associated with upstream oil and gas technologies. Then, this article provides empirical evidence that the pre-salt discovery significantly affected patent strategizing of Multi-Nationals Companies (MNCs) operating in the upstream oil and gas industry, thereby generating a boom in patent filings in Brazil from the official pre-salt announcement onwards.

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1. Introduction

The processes of competition in capitalist markets involve purposive experimentation through competition among alternative products, systems, processes, and services, as well as the technical and organizational processes that deliver them [38]. Consequently, as the value of companies is increasingly determined by their ability to innovate, the protection of intellectual property rights (IPRs) has become absolutely paramount in the current knowledge-based economy [27,29,9,25]. As such, patenting is no longer an administrative burden or a peripheral concern but rather a vital source of competitive advantage [30]. As companies are increasingly aware of the competitive advantage provided by a well-developed and strong portfolio of patents, patent strategizing is influenced by a large number of factors, which are likely to vary in different technological areas [1,16,14,43].

Despite the different patterns of patent filings in different industries, it is evident that different countries are characterized by different levels of technological capability [2,3,29,26,18]. The technological capability of an organization is defined here as its stock of resources such as skills, knowledge, and experiences embodied in workers and in the organizational system [2]. As a

matter of fact, developed countries are already on the frontier of technological development, applying for the overwhelming majority of patents [29], while developing countries still need to catch up [3,11,22,29].

According to Chang [10], there is currently great pressure on developing countries from developed countries, as well as the international development policy establishment (IDPE) they control, to adopt a set of 'good policies' to foster their economic development. In addition, Nelson [35] reports that there is an increased tendency of companies in advanced countries to enforce their intellectual property rights in developing countries. In this way, advanced countries are likely to be far more aggressive and effective in protecting their intellectual property rights, thereby creating a kind of 'Patent Tax' for developing countries with development-related implications such as, the cost of medicines, cost of agricultural inputs, protection of bio-diversity, and costs of developing infant industries in general [29,35].

Provided the huge economic implications of patents in the current knowledge-based economy, the formulation of strategies regarding patent applications has been gaining attention as a problem that deserves investigation [1,30,14,33,8]. However, despite the growing visibility of patents as a crucial form of intellectual property, patent strategizing in the oil and gas industry in a developing country context has received limited treatment in the extant literature. Here is worth highlighting that the oil and gas industry is usually divided into two major segments: upstream and downstream. The upstream oil segment is also commonly known

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as the exploration and production (E&P) sector, while the downstream segment concerns heavy oil and gas processing by refineries [34]. So far, the extant literature on patent information has covered the oil and gas industry when it comes to downstream oil and gas technologies [13], but is largely silent on upstream oil and gas technologies. Hence, to our knowledge, this article is the first contribution addressing patterns of patent application filings related to upstream oil and gas technologies in a developing country context.

Therefore, given the social implications of patents in the national economy of a developing country, we seek to create a context argument around the decision of MNCs in the upstream oil and gas industry to patent their inventions in a developing country. As such, the purpose of this paper is to further the development of strategic thinking, relevant for both academics and practitioners, about patents in the specific context of the oil and gas industry in a developing country. To this end, we examine the impact of the announcement made by the Brazilian Federal Government confirming the discovery of huge hydrocarbon resources on patent filings in Brazil concerning upstream oil and gas technologies.

This paper is structured as follows. After this introduction, in Section 2, we examine the literature on patent strategizing and examine the context of the oil and gas industry in Brazil in order to formulate research hypotheses. Section 3 describes our research method. In Section 4, we examine the results and discuss patterns of patent applications in Brazil concerning upstream oil and gas technologies. Finally, in Section 5, our concluding remarks are put forward.

2. Literature review and research hypotheses

This section presents a literature review on patent strategizing and examines the context of the Brazilian oil and gas industry in recent years. This is accomplished in order to formulate our research hypotheses prior to analyzing patent information associated with upstream oil and gas technologies.

2.1. Patent strategizing

As pointed out by Pavitt [38], innovation is inherently uncertain, given the impossibility of predicting accurately the cost and performance of a new artifact and the reaction of users to it.

Hence, the logic behind the patent system assumes that firms invest in risky R&D activities in order to generate a varying number of innovative new technologies or products [3,24]. These firms can protect their new technologies by applying for a patent to the Patent Office [5,22,40]. According to Ref. [38], empirical evidence and theoretical understanding have been developed by researchers concerned with patenting as a quantifiable dimension of innovation.

Once granted, a patent provides national protection for twenty years, but some countries, like Brazil, also grant utility model patents with a shorter duration, e.g. of fifteen years. In case, the patent-holder intends to commercialize the invention in other countries, a patent application needs to be filed in the national Patent Office of each desired country, where it is subjected to a new examination process. This implies that translation costs, validation fees and renewal fees are incurred in each country of interest [44].

In essence, a patent can be regarded as packaged knowledge rendering it a legal entity, in the sense that it delimits and draws boundaries around a piece of knowledge [16,33]. In this way, not all patents are equally valuable everywhere. The value of a patent is dependent upon a number of factors such as the potential for licensing to other businesses, quality of the patent [39], the

importance of the market covered by the patent [17], and the effectiveness and stringency of patent enforcement [30].

Additionally, various authors stress that the patent system is characterized by an increasing level of complexity [8,44,39]. Besides, modern products are often highly complex and it is common to have single products incorporating hundreds of patents, thereby creating legal disputes involving a large set of patents, rather than just one. Hence, the costs involved in negotiating and licensing the relevant patents are continuously increasing [20]. Consequently, Dolfsma [14] argues that firms attempting to develop a patent strategy face several degrees of freedom for which they can conceivably make a strategic decision.

The international patent system gained significant importance towards the end of last century. Due to many technological developments associated with the Second World War, new technologies were developed in fields such as computer science, materials, telecommunications, biotechnology, and nuclear energy [9]. The large-scale adoption of these technologies has transformed society into a knowledge-based economy that generates an increasing amount of inventions needing to be protected against unauthorized copy [20]. For instance, van Zeebroeck et al. [45] described that Western Universities have significantly increased their patent filings over the last two decades. Conversely, Godinho and Ferreira [22] report that both China and India have been experiencing a historical take-off in the amount of patent applications in recent years, which is strongly correlated with the growth of the innovative performance of these countries. Therefore, patent information and meta-information are becoming a critical assets for understanding the trajectory of different types of technologies [16,8,13,32,40,42].

Accordingly, policy makers started to rely on the number of patent applications as a measure for both patent office attractiveness [19], global level of economic activities, and the effort level on R&D activities [17,22]. Nevertheless, Boldrin and Levine [7] claim that there is no empirical evidence that patents serve to increase innovation or productivity, but rather to demonstrate power in a highly competitive environment. In practice, as firms began to depend primarily on intellectual property as the main source of economic gains, they started realizing the increasing importance of intellectual property rights (IPRs) [24]. As such, according to Birckbeck and Marchant [6], a development-oriented approach to the international patent system must be promoted to stimulate the development of business activities, the educational system and the national science and technology institutions.

Despite the clear benefits associated with the current international patent system, there is also criticism regarding its current configuration. Although, at present, scientific and technical communities in different countries are also more connected than they used to be [35], nations that lack the capacity to innovate globally tend to consider intellectual property protection as nothing more than tax, which increases profits for the developed countries. As an illustration, the problem of providing the sub-Saharan African countries with AIDS medications exposed ethical dilemmas associated with intellectual property protection. Clearly, in this case, intellectual property obligations created barriers for public health in countries too poor to pay supra-competitive prices. On the other hand, pharmaceutical companies also need to generate sufficient revenues to cover the enormous costs of developing new drugs that are both effective and safe [5]. Therefore, given the deep public health implications, there is constant debate with respect to the relationship between intellectual property and the pharmaceutical industry.

In addition, various scholars point out structural factors hampering firms in developing countries in generating revenue from patents, which include the limited quantity and intensity of

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