

**Patentes e estratégias das principais empresas farmacêuticas do Brasil**  
**Patenting and strategies of major pharmaceutical companies in Brazil**  
**Patentes y estrategias de las principales compañías farmacéuticas en Brasil**

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**Resumo**

Diante das mudanças contemporâneas que intensificaram a concorrência no mercado, estratégias de sobrevivência são essenciais para a sustentabilidade de uma empresa, como a proteção de ativos intangíveis por meio das patentes, que conferem diversas vantagens. Na indústria farmacêutica, onde os produtos são resultado de processos caros, as patentes se tornaram um incentivo importante. Este artigo realizou uma análise sistemática de patentes na indústria farmacêutica brasileira, avaliando os indicadores de patentes das principais empresas farmacêuticas no Brasil, a fim de categorizar suas estratégias. Os resultados indicaram a liderança da Aché em pedidos de patentes, um número extremamente pequeno de concessões, caracterizando a maioria dos depósitos como Patentes de Invenção, e a falta de parcerias com universidades e/ou fundações para apoio à pesquisa. As empresas EMS e Eurofarma apresentaram desempenho estratégico analítico, a União Química, defensor, e Aché e Hypermarchas, desempenho prospectivo.

**Palavras-chave:** Estratégias; Indicadores; Indústria farmacêutica; Patentes.

## **Abstract**

Facing the contemporaneous changes which have intensified the market competition, survival strategies are essential for the company sustainability, such as the protection of intangible assets through the patents, which confer several advantages. In the pharmaceutical industry, where the products are result from expensive processes, the patents have become an important incentive. This article has undertaken a systematic analysis of patenting in the Brazilian pharmaceutical industry, evaluating the patents indicators of the major pharmaceutical companies in Brazil in order to categorize their strategies. The results indicated the leadership of Aché in patent applications, an extremely small number of concessions, characterizing the majority of the deposits as Invention Patents, and the lack of partnerships with universities and /or foundations for research support. The EMS and Eurofarma companies have presented analytical strategic performance, the União Química, defender, and Aché and Hypermarcas, prospector performance.

**Keywords:** Strategies; Indicators; Pharmaceutical industry; Patents.

## **Resumen**

Frente a los cambios contemporáneos que han intensificado la competencia en el mercado, las estrategias de supervivencia son esenciales para la sostenibilidad de la empresa, como la protección de activos intangibles a través de las patentes, que confieren varias ventajas. En la industria farmacéutica, donde los productos son el resultado de procesos costosos, las patentes se han convertido en un incentivo importante. Este artículo ha llevado a cabo un análisis sistemático de patentes en la industria farmacéutica brasileña, evaluando los indicadores de patentes de las principales compañías farmacéuticas en Brasil para clasificar sus estrategias. Los resultados indicaron el liderazgo de Aché en las solicitudes de patentes, un número extremadamente pequeño de concesiones, caracterizando a la mayoría de los depósitos como Patentes de Invención, y la falta de asociaciones con universidades y / o fundaciones para el apoyo a la investigación. Las empresas EMS y Eurofarma han presentado el desempeño analítico estratégico, el União Química, defensor, y Aché e Hypermarcas, el desempeño prospectivo.

**Palabras clave:** Estrategias; Indicadores; Industria farmacéutica; Patentes.

## 1. Introduction

The fierce competition that constitutes the current business environment requires constant training and continuous improvement of the companies that aim to survive and prosper (Piscopo, 2010). At this juncture, the legally protected intellectual property (IP) has become an important asset for the competitiveness of businesses of the companies which aspire to maximize the value of their intangible assets (Jungmann and Bonetti, 2010). The economic value of the knowledge contents grows embedded in the new processes or products, also increasing the relevance of the industrial property in two aspects: it allows private protection of the new knowledge and provides the possibility of extracting income through the propriety of new knowledge (Pereira, 2011).

Florêncio et al. (2020), evaluating the biotechnological production in Brazil, showed that the majority of patents (90%) are owned by non-residents, with emphasis on private companies, and a United States domain, with 35.4% of the documents granted. A Social Network Analysis (SNA) pointed a weak technological collaboration, having as indispensable action the dissemination of the culture of intellectual property for public institutions and the business sector.

Among the factors that have attributed higher value to the intellectual property, the political visibility stands out due to the great economic importance of the countries and the fact that the intangibles of an industry, in general, are more valuable than the whole of its material assets (Pereira, 2011). The data present in the patent can be turned into strategic indicators for the competitive analysis of the characteristics of technologies, opportunities, and threats, of the organizations and relevant researchers, in addition to other associated aspects (Scopel et al., 2013). Patent applications are among the most reliable and comprehensive sources of formal information of research, development, technology and innovation (RDT&I) and may be considered essential indicators in a particular type of industry to assess the technological summary in a specific area (Oliveira et al., 2010).

The patent information may be used in important areas of technology management in order to provide relevant data about strategies of R&D of the competitor to evaluate the competitive potential of the technologies, identify and evaluate options for the external generation of technological knowledge, store relevant knowledge as a central element of knowledge management, and as a tool for the human resources management in R&D. The companies should realize the value of this information and evaluate them regularly as part of

their strategic planning, as well as analyze the communication strategy to external stakeholders (Ernst, 2003).

The economic gains generated by patent protection, including the royalties, have corroborated to the nutrition of the continuity of the inventive process converging the interests of inventors, organizations, market and State under the aegis of social interest (Quintella and Teodoro, 2013).

In the world, commercial licensing operations move annually about hundreds of billions dollars. However, apart from the economic factor, the patenting also plays a social function as the banks of global patents, with coverage of 80% of all scientific and technological knowledge available, has become a rich source of information and prospection of the new market trends for innovative companies that wish to develop and improve products, processes and services in favor of the consumer (Jungmann and Bonetti, 2010).

The launch of new or improved products is a key element for the industry competitive standard, in particular in the pharmaceutical industry, allowing the technological innovation, requiring substantial investment in research and development and high marketing and advertising costs (Carvalho et al., 2009).

The pharmaceutical industry is one of the most productive and profitable sectors on a global scale (Figueiredo, 2010). Its relevance consists in the capacity to provide solutions for health problems of society (Peralta et al., 2014). The research activities and product innovation of this industry are mainly in the hands of the leading laboratories in developed countries, called Big Pharma, developers of patented product known as blockbusters, drugs which alone generates more than \$ 1 billion dollar in annual sales (Sztulwark and Juncal, 2014).

In Brazil, the pharmaceutical industry has been growing in the recent decades. In 2011, the Brazilian pharmaceutical market exposed revenue of about 43 billion reais (Vargas et al., 2012). In 2013, it obtained an estimated value of \$ 35 billion and, according to IMS Institute (2017), it's expected an average growth of 10% a year on the sector until 2016 (Novaretti et al., 2014). Presently the country is the 4<sup>th</sup> consumer market for medicinal products on the global scenario, surpassed only by the United States, China and Japan, position mainly due to the introduction of generic drugs, which have made possible the population's access because of their lower cost, (Novaretti et al., 2014).

The motivation for this paper was generated because of the patenting activity importance and of the pharmaceutical sector to the economy and society, considering that recent studies in Brazil have not covered the discussion of certain patent indicators related to

the pharmaceutical industry<sup>1</sup>. The aim was mainly to present a systemic analysis of the patenting of the Brazilian pharmaceutical industry, evaluating patents indicators of the leading pharmaceutical companies in Brazil to categorize their strategies.

## 2. Methodology

As recommended by Pereira et al. (2018), a research aims to obtain or achieve new knowledge. The present study does a descriptive and exploratory research, with a qualitative and quantitative approach, in order to provide a better understanding of a phenomenon under study.

Initially it was identified 05 largest pharmaceutical companies with fully Brazilian equity control based on the 2013 ranking, established from the leadership in net sales, published by Exame Magazine (2015). The choice of these companies occurred not only because this magazine is specialized in economics and business, but especially for presenting the latest survey in the country on the industry-leading companies. The quantitative of the companies was defined based on the method adopted by Weenem et al. (2013).

Then a research was conducted at the database of the Instituto Nacional de Propriedade Industrial (INPI) in May 2015, about the application for patent deposits corresponding to the identified companies, and it was used for the data collection, the name of each of the selected companies with the search term “Name of Depositor” by advanced search. The exclusive choice of the INPI database occurred because the object of the search is related only to the reality of patenting of the pharmaceutical industry in Brazil and because the institute is responsible for the management of the Brazilian system of concession and guarantee of the intellectual property rights. It was used for the data collection, the name of each of the selected companies with the search term “Name of Depositor” by advanced search, and all the documents found were considered valid for the analysis and the pending, rejected, granted or filed documents were not filtered. The bibliographic data were stratified by number of patents, types of patent (Invention Patent and Utility Model), granting of patents and patents resulting from co-partnership with educational/ research institutions, contributing to a preliminary analysis.

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<sup>1</sup> A preliminary survey was conducted in Science Direct, Web of Science e Scielo using the key words “*patent, indicator performance, Brazilian*” and it was not identified any scientific production, from 2011- 2015, referring to Brazilian pharmaceutical industry and patent indicators used in this work.

The strategies of the leading companies of the pharmaceutical industry were categorized from patent indicators combined with the characteristics of the companies, namely: of relative patent position, patent distribution, average of patent citations, product distribution<sup>2</sup> and market share. The relative patent position (RPP) refers to the counting of patents owned by the company in its technological field where there are more patents, divided by the counting of the patents in technology (Equation 1), which maximum value is 1. It is an indicator used to measure degrees of leadership in various technological areas (Chen and Chang, 2010).

$$RPP = \frac{\text{Number of patents owned by the company in the technological field where it has more patents}}{\text{Number of patents of the leader in the technological field}} \quad (1)$$

The other indicators (Equations 2 to 6) were evaluated by the method of Weenem et al. (2013), and the patent distribution corresponds to the percentage of all patents attributable to a company and the average number of citations concerning to the average number of patents previously known which indicates whether an invention is radical or incremental. The average of citation received is regarded to the average number of times that the patents have been cited, indicating whether an invention is relevant and valuable. The product distribution, allusive to the percentage of all products in industry attributable to a company and the market share, refers to the percentage of the total sales attributed to the company.

$$\text{Patent distribution} = \frac{\sum \text{Total of patents owned by the company}}{\sum \text{Total of patents in the market}} \cdot 100 \quad (2)$$

$$\text{Average citations} = \frac{\sum \text{Number of citations in all patents}}{\sum \text{Number of patents owned by the company}} \cdot 100 \quad (3)$$

$$\text{Average of citations received} = \frac{\sum \text{Number of citations received in all patents}}{\sum \text{Number of patents owned by the company}} \cdot 100 \quad (4)$$

$$\text{Product distribution} = \frac{\sum \text{Total of products owned by the company}}{\sum \text{Total of products in the market}} \cdot 100 \quad (5)$$

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<sup>2</sup> The information of the product was obtained from December, 2014 to January, 2015 on the company electronic site.

$$\text{Market share} = \frac{\sum \text{Annual revenue the company}}{\sum \text{Annual revenue of the brazilian pharmaceutical industry}} \cdot 100 \quad (6)$$

The data analysis for the above categorization was performed mainly based on the model of typology of organizational strategies by Miles et al. (1978), used by Weenem et al. (2013), which reflects 4 ideal strategic behaviors: analytical, defender, prospector and reactor.

### 3. Results and Discussion

Based on Exame Magazine (2015), 05 leading pharmaceutical companies and their position in terms of net sales were identified in Brazil, as shown in Table 1.

**Table 1** - Leading companies in the pharmaceutical sector in Brazil in 2013.

Position	Company	Net Sales (US\$ millions)
1 <sup>st</sup>	Hypermarcas S/A	1,900.20
2 <sup>nd</sup>	EMS S/A	809.6
3 <sup>rd</sup>	Eurofarma Laboratórios S/A	738.5
4 <sup>th</sup>	Aché Laboratórios Farmacêuticos S/A	587.3
5 <sup>th</sup>	União Química Farmacêutica Nacional S/A	254.9

Source: Exame Magazine (2015).

The Table 1 demonstrated that Hypermarcas is the leader in the ranking with wide difference (134.7%) in comparison with the 2<sup>nd</sup> in position (EMS) and 645.5% in comparison with the 5<sup>th</sup> in position (União Química). As for deposited patents documents in INPI, it was evident that the company Aché prevails in the number of deposits (29), followed by Hypermarcas (22), EMS (15), Eurofarma (13) and União Química (6). In relation to the totality of these deposits, it was found that 88% are invention patents and 12% are utility model patents. In this respect, the highlights were, respectively, the companies Aché, EMS and Eurofarma, which deposited 100% of the applications for invention patents.

In the database of INPI it was identified the total of 84 deposits of patent applications from 1988 to 2014, related to the five leading Brazilian pharmaceutical companies in the country, as shown in Table 2.

**Table 2 - Patent Distribution /Partnership.**

<b>Company</b>	<b>Deposits</b>	<b>Invention Patents</b>	<b>Utility Models</b>	<b>Granted Patents</b>	<b>Patents with Partnership</b>
Aché	28	28	0	1	2
Hypermarcas	22	14	8	6	0
EMS	15	15	0	1	2
Eurofarma	13	13	0	1	3
União Química	6	4	2	0	2
<b>Total</b>	<b>84</b>	<b>74</b>	<b>10</b>	<b>9</b>	<b>9</b>

Source: Authors.

Another noticeable fact was the extremely small number of concessions in comparison to the quantity of deposits made, since of the total number of applications deposited only 10% reached grant letter. Among the five surveyed companies, Hypermarcas has obtained more concessions, as they were granted 21% of the total of deposit applications. However, Aché, EMS and Eurofarma have obtained only 01 patent concession, while União Química has not yet obtained concession. This result may reflect the *backlog* of in INPI, understood as the accumulation of the number of patent deposits waiting to be analyzed, since in Brazil, the average period for the examination of a patent is approximately 11 years. In 2013, the national *backlog* was 184,224 patents for 192 examiners; this corresponds to 9,595 applications per examiner, a divergent situation comparing with other global offices, as for example, the USA that accounts 771.1 application per technician (CNI, 2014).

The company with the highest quantity of partnerships is Eurofarma (34%), followed by Aché (22%), EMS (22%) and União Química (22%) while Hypermarcas, leader in sales in the Brazilian market, has no partnership concerned to the deposited patents.

Concerning the patent deposits data resulting from partnerships, it was found that of the total of 84 deposits only 9 resulted from partnerships with universities and foundations of research support. These processes identified 6 partner institutions (5 universities and 1 research support foundation): Universidade Federal de São Paulo, Universidade Estadual Paulista Julio de Mesquita, Universidade de São Paulo, Fundação Universidade do Vale do Itajaí, União Brasileira de Educação e Assistência – maintainer of PUC RS, Fundação de Amparo à Pesquisa do Estado de São Paulo, of which Fundação Universidade do Vale do Itajaí and Fundação de Amparo à Pesquisa do Estado de São Paulo come out more often in patent applications, each one with participation of 02 deposits.



To characterize the main pharmaceutical companies in the country and their strategies, the indicators of relative patent position (RPP), patents and products distribution, market share and average of patent citations made and received were analyzed, as shown in Table 3.

**Table 3** - Indicators of the leading pharmaceutical companies.

Company	Aché	EMS	Eurofarma	Hypermarcas	União Química
*RPP (maximum value = 1)	1	0.53	0.46	0.78	0.21
Patents Distribution (%)	33.33	17.85	15.47	26.19	7.14
Citations (radical < incremental)	0.00	13.33	92.30	18.18	0.00
Citations received (low value < high value)	0.00	0.00	0.00	**4.54	0.00
Product distribution (%)	22.28	17.59	16.24	34.81	9.05
Market share (%)	13.68	18.86	17.21	44.28	5.94

\* Regarding the degree of technological leadership in the Brazilian pharmaceutical industry.

\*\* Company self-citation.

Source: Authors.

The average number of citations indicates whether patents were based on previous knowledge of Brazilian patents, relating them to radical or incremental innovations. Aché and União Química, indicate that their innovations are only radical, since there was no previous knowledge of patents detected. The average number of citations received indicates whether the patents were cited by other patents, being considered economically valuable due to their technological relevance.

As for the indicators (Table 3), it was noticed that the surveyed companies have the following characteristics:

- Aché is the maximum leader, with high patents and products distribution, low market share and average citations (made/received), indicating only radical innovation (for not having used prior knowledge of other patents) but not valuable/relevant (economically/technology), it has not been cited by subsequent patents;
- EMS presents leadership, intermediate patent and product distribution and market share and average citations, indicating low incremental invention (little use of prior knowledge of previous patents, demonstrating higher investment in radical innovation), but without economic value/technological relevance;

- Eurofarma demonstrates leadership, intermediate patent and product distribution and market share and average citations, indicating high incremental invention and without economic value/technological relevance;
- Hypermarcas demonstrates leadership, high patent and product distribution and market share and average citations, indicating low incremental invention and low economic value/technological relevance, however the latter characteristic is self-citation;
- União Química has leadership, low patent and product distribution and market share and average citations, indicating that its patents are radical, however they don't demonstrate economic value/technological relevance.

Based on these characteristics, it was understood that the leading companies in the pharmaceutical industry in the country have 3 distinct strategic behaviors: analytical, defender and prospector.

The prospector strategy has been applied by organizations that seek continuously to research aiming to market opportunities and innovation of their products, demonstrating high leadership capacity to explore and take advantage of opportunities for growth. The companies Aché and Hypermarcas are included in these strategies. Aché has differed from this strategy on market share, with a low index.

The defensive strategy is characterized by narrow fields of products/markets and by a huge emphasis on efficiency. The defensive companies seek niche markets where they can find stability, even in the most dynamic industries. They are very efficient organizations in their area and their technology, structure, and method of operation seldom need major adjustments. The company União Química presented this strategic profile.

The analytical strategy is adopted by companies that try to keep a relatively stable and limited line of products. They represent an intermediate category, providing a combination between the defensive and prospective strategies, with a more stable central business and more dynamic component. It was found that EMS and Eurofarma use this strategy, and the indicators show that the first company prioritizes radical innovations while the second focuses heavily on incremental inventions.

Aside from Eurofarma, most of the companies have presented, according to the average citations, a radical investor profile in innovations, although their new assets are not considered technologically relevant, or economically valuable, because they have not been cited by other patents. It has impressed, however, that although the most companies has adopted strategies that demonstrate certain levels of technological leadership, they have presented an insignificant total number of patent deposits in a trajectory of 26 years.

#### 4. Final Considerations

Although in terms of net sales it has been found that Hypermarcas holds the 1<sup>st</sup> position in the Brazilian ranking of the pharmaceutical companies in relation to the patents deposited in INPI, it has been evident that Aché occupies the leader position. The analyzed deposit patents demonstrated characteristics predominantly of invention patents, showing that the surveyed companies are investing primary in technological development rather than in the functional improvement of the existing products. However, the restricted quantity of applications due to the partnerships with universities and with research support foundation points out that investment in partnerships is not yet a reality experienced by the Brazilian pharmaceutical industry, which could minimize the RD&I process costs and stimulate better results, raising the number of patentable innovations, since universities and research centers are potentially generators of science and technology.

The extremely small number of concessions compared to the quantitative of deposits led us to a reflection about the backlog in the country, which among other things permeates mainly by the imminent need to increase the quantitative of examiners in INPI. The combination of indicators showed that the leader companies are characterized by 03 distinct strategic behaviors: 40% prospector, 40% analytical and 20% defensive. New indicators may be searched for patenting and strategies analysis in the Brazilian pharmaceutical industry, as well as for the analysis of other types of intellectual property that cover the sector, enabling other results for the building of the contemporary panorama of this segment in the country.

For future work, a new application of the life cycle is suggested to analyze whether the industries have entered the maturity phase or not, as well as research to prove or not the migration of patent deposits from Brazilian pharmaceutical companies to foreign countries.

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