NATIONAL PHASES PROCESS: A NEW METHODOLOGY FOR THIS STRATEGICAL PROCESS

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SUMMARY

This study provides a new and easy methodology for determining the patenting protection strategy of firms, entrepreneurs, universities and research centers. Literature on this topic is minimal since it is a factor that generates high competitive advantages over competitors. Overall, our approach uses patent analysis and market research methodologies based on low-cost databases to define technology value and target countries to perform patent fillings for an international technological strategy. We use a patent example to show how this methodology operates and we conclude that this patent should be protected in five different countries in which has comparative advantages and commercial possibilities.

Keywords: patent strategy – market research – national phases – patent analysis – patent valuation

1 INTRODUCTION

Developing a strategy of intellectual property is a costly and time-consuming task, especially patents. Firms around the world face a trade-off between having the best commercialization and protection strategy and simultaneity, cutting costs to maximize the net present value of their R&D ventures. However, there are an important number of possibilities for generating those strategies which do not depend solely of a technological component, but marketing, legal, and financial factors also (Modlin & Glenn, 2006; Fernandez-Rivas, 2010). At the same time, patents can be used not only for protection but also for strategic proposes; patents could generate data about competitors for which information is restricted, or can be used to determine technological paths, or to find possible future allied firms or inventors around the world. The disadvantage of this perspective is that there are some industries in which patent portfolios are wide used, but some others use extensively industrial secrets, trademarks and other types of protection, for those late

industries patent data is not so rich (Ernst, 2003). Given that firms developing high technology products and services are usually cost restricted, the developing of a structured strategy is a fundamental task to reduce the structuration, filling, defense, and renewal costs of intellectual property, but at the same time, firms need to understand the potential value of a patent to develop those strategies and maximize their return.

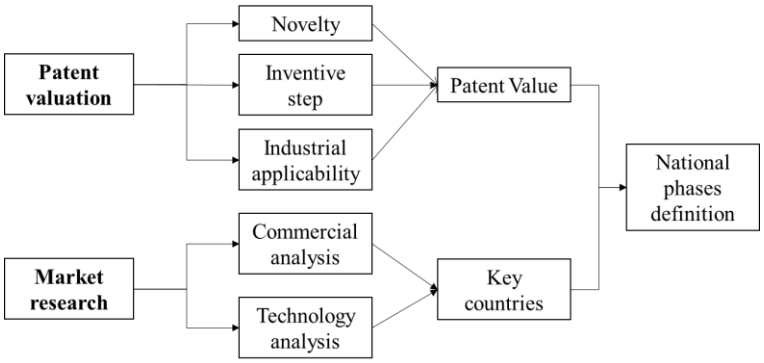
Generally, the scope of patent strategy protection it is not focused only on the origin country of technology or inventor, but it could be based also on a complex range of intellectual protections all around the world. Developing those complex global strategies and protection portfolios could generate disincentives, especially for small, young and cost restricted companies and organizations (Storz, 2011; Manning, 2007). In this regard, it is worth noting the case of firms developing cutting-edge technologies; those firms could be even more cost restricted given the high uncertainty of future revenues or the inexistence of a market for those technologies; an example of those organizations could be universities or high-tech firms (Fernandez-Rivas, 2010; Storz, 2011).

Those restrictions arise given the high complexity of the process surrounding the filling of patents locally or globally. There are different routes to develop the patent process; however, the simplest way of protection begins with a national filing in the applicant country of origin (Modlin & Glenn, 2006). After that, in any time during the next 12 months, the applicant can initiate the process in other countries through a direct applying, this methodology is perhaps the most expensive and it is known as the Paris Convention strategy. Another valid strategy is the use of the Patent Cooperation Treaty (PCT) that allows to seek patent protection simultaneously in a large number of countries. PCT process include the next stages: Filing, international search, international publication, supplementary international search (optional), international preliminary examination (optional) and national phases (WIPO, 2007). The PCT strategy is cheaper than the Paris convention strategy if the applicant is seeking protection in a wide range of countries. In this research, we focus in the last part of the PCT process, i.e. national phases.

Keeping in mind that patents could generate valuable data about competitor behavior, possible alliances, and individual protection technological strategies, it can be understood that the value of information included in patents is higher that it can be expected. in the same way, for companies with important restrictions is crucial the use of this data to consolidate technological portfolios even though collect this information is not an easy task considering the cost and the knowledge intensity required. That is why, it is necessary to use a methodology that systematically allows this activity, in this document we propose a strategy to determine the national phases to be followed by patent owners after a PCT filing, this methodology includes:

- Patent valuation through patent analysis, this valuation includes novelty analysis, inventive step and industrial applicability
- Market research that includes commercial and technology analysis

Figure 1. Framework of national phases definition



Source: own elaboration

The idea behind these analyzes is to define in which countries it is worthwhile to carry out national phase processes; an overview of this process can be seen in Figure 1.

2 LITERATURE BACKGROUND:

On a highly cited research paper, Reitzig (2004) uses what he called, first, second and third generation data of individual patents to calculate their economic value, he concludes that information related with the claims and full text of the patent is correlated with their economic value. As Reitzig defines, first generation data can be classified in country of origin, date, forward citations, family size or ownership. Second generation data could be average number of International Patent Classifications (IPC), international filing strategy and legal contend of backward citations (Reitzig, 2004, pág. 941). Third generation data unlike the first two, uses data of legal requirements of patents, this is, information not contained on patents' first page, this information could be, number of claims of the patent draft, inventive step and state of the art included in the draft; an example for the use of this indicators can be found in Betancur et al (2016). Following the same logic of economic patent value, Harhoff & Reitzig (2004) uses the number and characteristics of patent oppositions in the case of biotechnology and pharmaceutics industry and concludes that there is a correlation between the number of oppositions and economic value of a patent. What can be learned about this type of research papers is that it is possible to use aggregated patent data to determinate the potential value and scope of firm's patents and therefore firms can use this information to elaborate their intellectual property strategy.

At the same time, inventors will not apply for a patent if they do not expect any profit for this process. According to Storz (2011), gain is one of the most important reasons to pursuit a patent in a given country, the fact that patent provide a monopoly, allows to develop the full potential of the economic value of the patent. In this regard, any applicant looking to protect its inventions needs to develop a commercial analysis to ensure that its strategy is aligned with market characteristics. Similarly, an adequate intellectual property strategy should address the patent concentration and the effective presence of competitors around the world (Fernandez-Rivas, 2010). The reason behind this is that this information can point the regions of the world in which competitors pretend to deploy their technologies and therefore, regions in which patent protection is needed; this is, and

applicant should have at least an idea of the technology characteristics and competitor's behavior in order to draw its strategic path.

Even when the development of an adequate strategy of patenting is fundamental for high technology firms, there is no much research about this topic; this could be due to the strategic value of this kind of methodologies; the disclosure of this information can benefit competitors affecting competitive advantage and firms' benefits. One of the few documents addressing this topic and giving useful punctual advices for small firms to pursue an international intellectual property strategy is the GAO Report (U.S. Government Accountability Office, 2003); this document presents advices around the complete patenting process; however, it does not develop a formal methodology but a set of general advices for firms.

In the next sections, we present a specific methodology to determinate in which countries to pursue patent national phases. As it was posted before, this process is important for high technology firms and knowledge generating institutions with cost restrictions.

3 DATA & METHODOLOGY

All data used in this research was obtained on free or affordable data bases like Thomson Innovation[1] or Passport[2]. Technology analyzed in this study was the patent US2017130213. For this technology, we tried to know the technology value, the market potential and finally the aim countries to protect the technology.

The patent US2017130213 that we analyze in this research has the next characteristics:

> "This invention refers to the obtainment of a modified lipolytic enzyme that was isolated, expressed and purified from the heterologous expression. The gene sequence that codifies for the basal enzyme was obtained based on a thermophilic acidophilus organism of the acidobacteraceae family. This basal enzyme that comes from a thermo acidophilus organism, it is able to hydrolyze lipid substrates (triacylglycerols) united to middle chain fatty acids (C6-C10) such as tributyrine and tricapryln, among others. It also can carry out other inverse reactions to the hydrolysis such as synthesis reactions. On the other hand, this enzyme has enantioselective preference on (S) substrates of profens esters such as ibuprofen, naproxen and others. The enantioselective lipolytic basal enzyme was modified in its terminal C end to add an amino acid histidine tail that gives a higher efficiency in its purification process. The invention therefore refers to a method for making a pure, active polypeptide, which is called lipolytic enzyme 499EST obtained through the host E. coli BL 21 (DE3)" (USPTO Patent No. US2017130213, 2017)

In Figure 1, an overview of the methodology used to operationalize this methodology can be seen. This methodology was divided in two major steps named i) patent valuation and ii) market research.

3.1 PATENT VALUATION

To evaluate the patent value, we obtained the information of all the patents that are similar to our technology. To do this we searched in Thomson Innovation Database with the next keyword search:

[1] http://info.thomsoninnovation.com/
[2] https://www.portal.euromonitor.com/

AIC= (C12N9/20 OR C12N9/16) AND use=(enantiose*)

This search equation means that we were looking for the patents with international classifications C12N9/20 or C12N9/16 and at the same time for patents with the root word *enantiose.*

Three indicators were used to determine patent value. The first indicator was novelty that was obtained using the methodology developed for Betancur et al (2016) that compare the publication year of our technology, with the median of all the backward citations (scientific papers or patents). The second indicator used in this study was the inventive step. To define it, the number of claims of the technology were compared with the median of claims of similar technologies. In addition, like the proposal of Harhoff & Reitzig, (2004) we identified the inventive step using the number of words of the technical problem, in this case, we used the field Abstract Advantage of the Thomson Innovation patents database to determine it. The third indicator used was the Industrial Applicability of technology. To define it, we used the number of Cooperative Patent Classification (CPC) of our technology against the median of the similar technologies.

3.2 MARKET RESEARCH

3.2.1 TECHNOLOGY ANALYSIS

In this study, we evaluate the industry with different perspectives. The technological dimension of the industry was analyzed with patent information. We used the next query to obtain the data.

AIC=(C12N000920 OR C12N000916) AND DP>=(20070101) AND DP<=(20170326);

With this search, we were looking for the patents with international classifications C12N9/20 or C12N9/16 and at the same time for filings with priority years between January 1st 2007 and March 26rd 2017. With this search, we found the inventions in lipases or esterases that is the main technology industry of the invention used. We identified the main countries for inventions generated for applicants of the country and for patent presentations in the jurisdiction. At the same time, we identified the main applicants for forward citations and number of inventions.

3.2.2 COMMERCIAL ANALYSIS

Commercial data was recovered in LinkedIn[3] and Passport[4] databases. LinkedIn was utilized for analyzing the enterprises that are competing in the industry (developing products or services). The search equation for LinkedIn was:

(enzyme OR lipase OR esterase OR sulfatase OR sulphatase OR hidrolase OR transferase OR hydrolase OR lyase OR Isomerase OR protease OR amylase OR Xylanase OR celullase OR ligninase OR betaglucanase OR Pullulanase OR Amyloglucosidase OR pectinase)

We search for all type of enzymes because the market data for lipase or esterase are limited. Customer data was obtained from Passport database. We search in this query for ingredients and especially enzymes.

3.2.3 NATIONAL PHASES DEFINITION

The data obtained for national phases was used to define the most important countries to protect the technology. We used the clustering method K- means (Jain, 2010) to generate different groups of countries with similar characteristics. We used the patent country data that we described in patent

[3] https://www.linkedin.com/
[4] http://go.euromonitor.com/passport.html

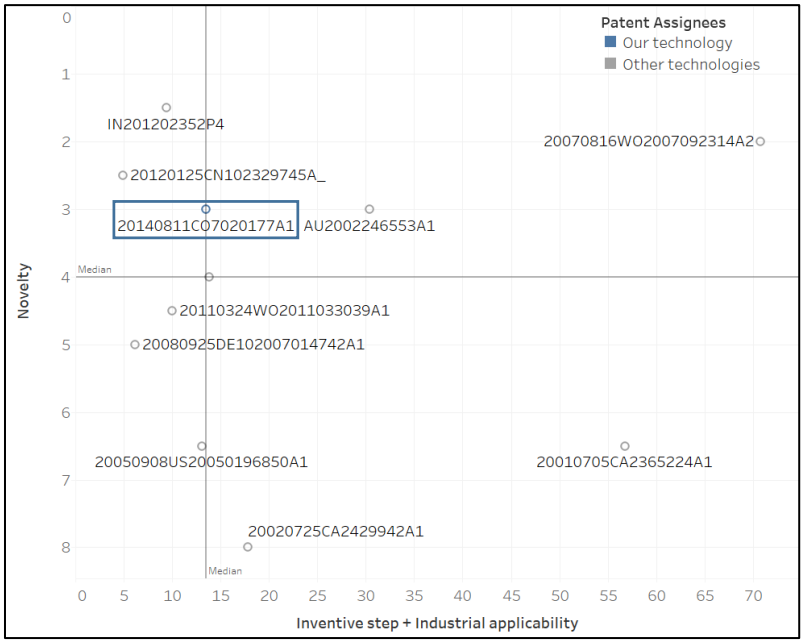
valuation section. We also used the number of companies per country from the LinkedIn social network and the data of countries enzyme consume of Passport database to define the most important countries for commercial indicators. Finally, we generated a scale based on the statistics of patent applications of similar inventions to define the range of countries presentations in the industry. With this data, we presented our candidate countries.

4 RESULTS

4.1 TECHNOLOGY VALUATION

In Figure 2, we show the 12 most similar technologies founded for our technology. In comparison with the similar technologies, the analyzed patent has an important novelty degree. A technology has a high novelty degree when this value is close to zero that indicates that between the priority year of the technology and the priority year of the backwards citations, there is a small distance.

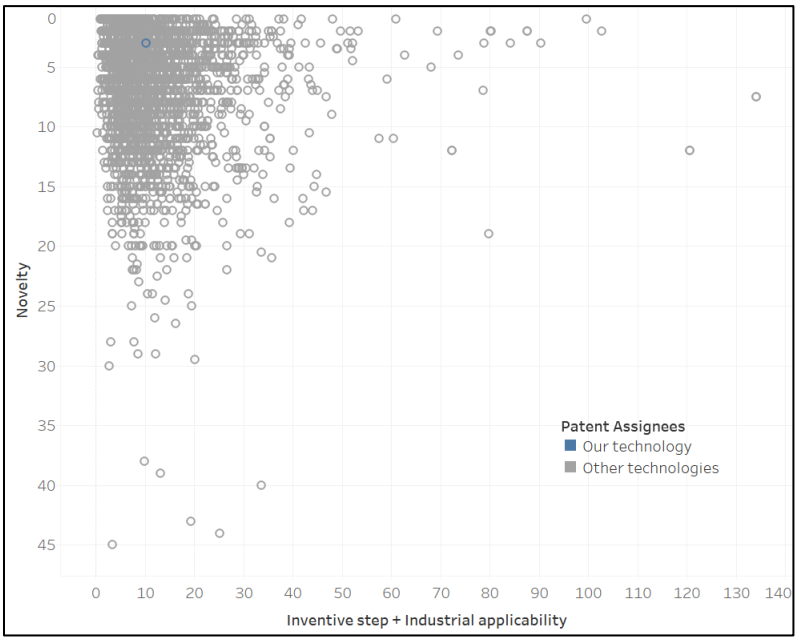
Figure 2: Patent quality compared our technology with similar inventions



Source: Own elaboration with Thomson Innovation data

We also perform the comparison between our technology and all the patents in lipase or esterase, because although our technology has a restricted use in the claims, the researchers have found other possible use of the technology in other areas. Also, is important to know the index of our technology in comparison with all the technologies. We found that our technology has a higher novelty degree, and in the inventive step, and industrial application, our technology is above of the median. This quantitative analysis showed us that our technology has a high patent value and high technology quality (Figure 3).

Figure 3: Patent quality our technology compared with all the inventions of the industry

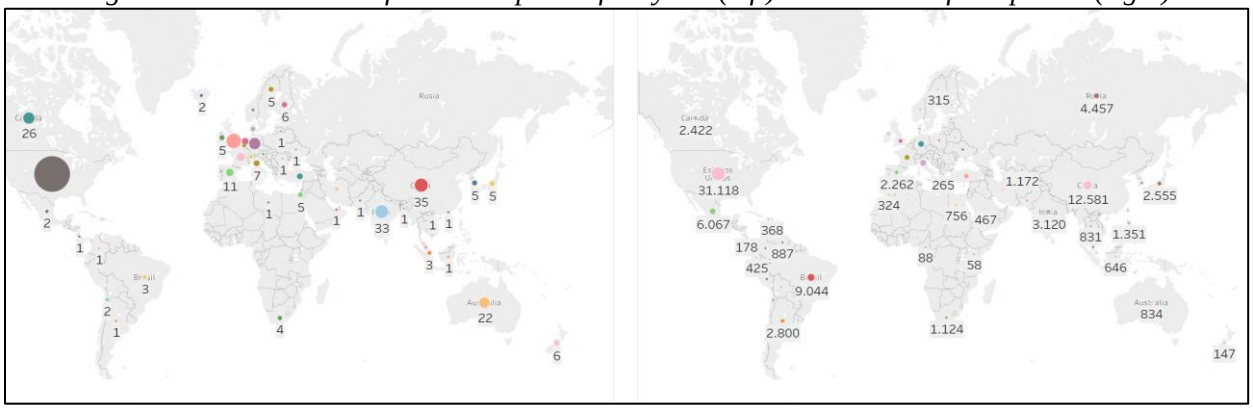


Source: Own elaboration with Thomson Innovation data

3.2 COMMERCIAL ANALYSIS

The main objective behind this analysis was to define the potential customers for our technology. The technology transfer strategy to put this technology into the market was a license. For this reason, the main customers are the companies that develop the same or similar products; therefore, we decided to start analyzing all the industry. We found 710 companies that produce, sell or are suppliers of enzymes Figure 4. The most important country for the number of companies was the United States with the 44% of firms of the world. Other three important countries for these indicators were the United Kingdom, China and Australia. We used the median to define the countries with bigger companies. We found that South Korea, France, India, Denmark and Italy were the most important for this index (Figure 4).

Figure 4: Main countries for consumption of enzymes (left) and number of companies (right)



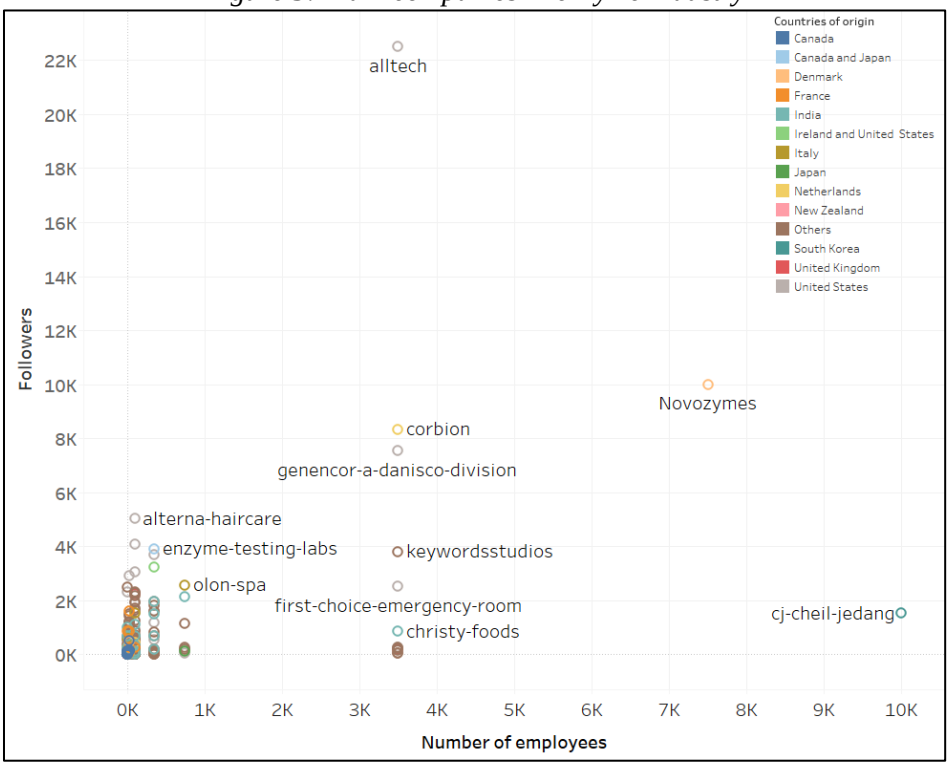
Source: Own elaboration with Passport data

In Figure 4, it can be seen the consumption for the country in enzymes all over the world. The United States had the higher consumption in 2016 with 24% of share. China is the second country

with 10%, and Brazil and Mexico were countries with a 9% of consumption. This is interesting because these countries did not have high number of producer companies.

At the same time, we defined the most important companies in the industry and their geographic location. To identify the most important companies we used two indicators, first, the number of employees, this indicator showed the bigger companies in each region, and second, the followers shows the popularity of the companies between LinkedIn users. We found that an attractive market for a number of important companies is United States (Alltech, Genencor, Alterna). We identified other important companies like Novozymes from Denmark, Corbion from Netherlands and CJ (Cheil Jedang) from South Korea (Figure 5).

Figure 5: Main companies in enzyme industry



Source: Own elaboration with LinkedIn data

3.2.1 TECHNOLOGY ANALYSIS

We analyzed 5,502 families of patents (inventions) about technologies with esterases or lipases. The main goal of this analysis was to identify the principal countries and applicants in this technology. We analyzed from different perspectives this data. First, we defined the countries with more applicants. The United States was the most important country with 33% of the total. China and Japan had 32% of the applicants and South Korea had 4%. In Europe, the most attractive country was France with the 4% of applicants. Africa and South America were not attractive markets for the number of patent applicants (Figure 6).

Figure 6: Number of applicants per country

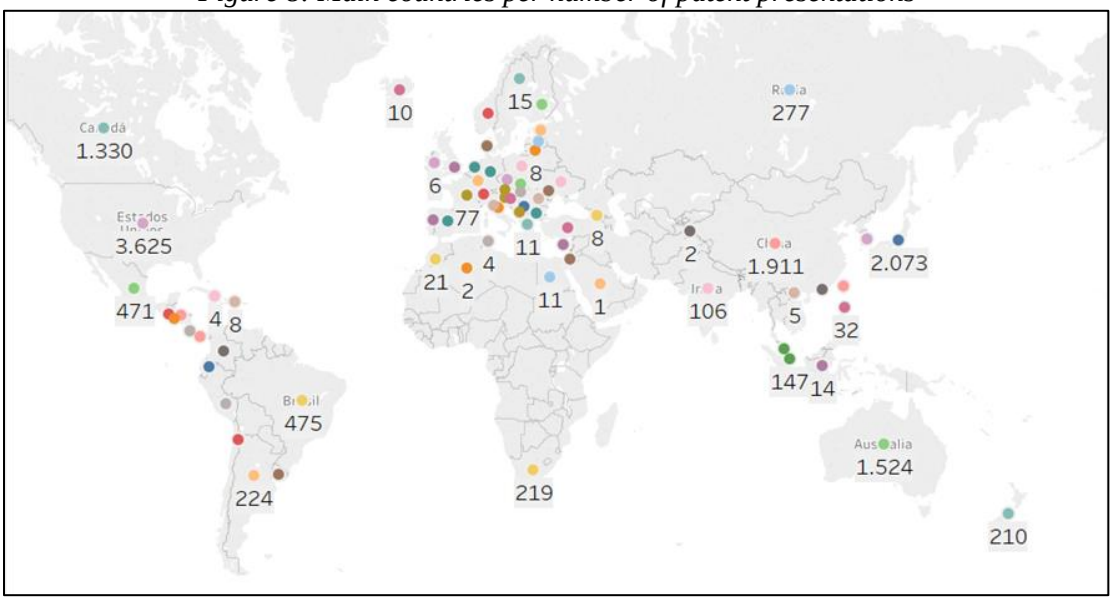
Source: Own elaboration with Thomson Innovation data

Second, the same analysis was done with countries with more inventions and countries with more patent applications in the national phases process. In Figure 7, countries whit more patent applications can be seen and in Figure 8 countries per number of patent presentations, we found that in the two analysis the result was similar; United States, China and Japan were the leaders for this type of technologies. Australia was not important for the origin of the applicant but it was relevant for the number of inventions that are filed in this country.

Figure 7:Main countries per number of applications

Source: Own elaboration with Thomson Innovation data

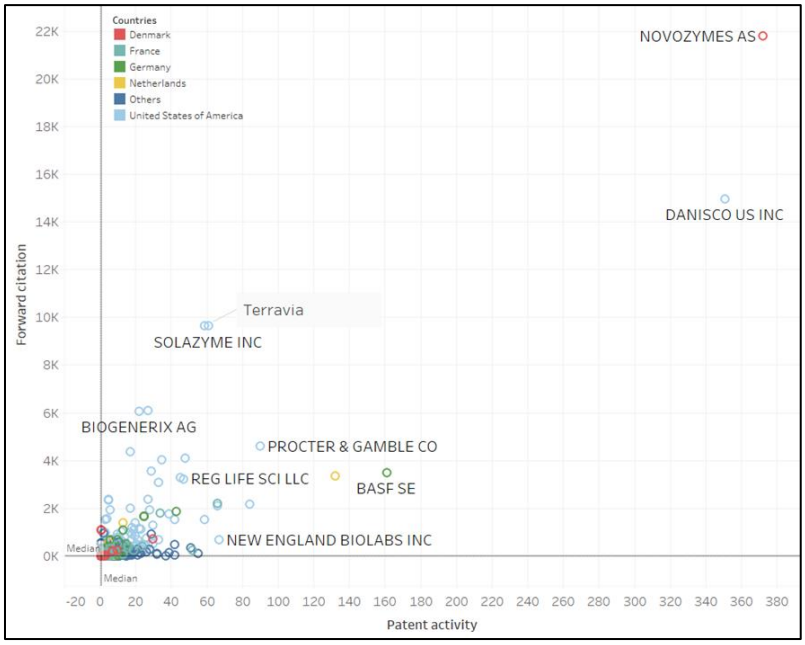
Figure 8: Main countries per number of patent presentations



Source: Own elaboration with Thomson Innovation data

The most important applicants were identified using two quality patent indicators. The forward citations and the R&D investment that was obtained using the number of inventions of each applicant. An interesting result was that the main companies for this analysis were from United States, Denmark, Germany and the Netherlands. Applicants from Japan and China was not relevant in this analysis. In Figure 9, the technological position of these companies can be seen; Novozymes (Denmark) was the most important company in the world for the patent indicator that we analyzed, other relevant enterprises were Danisco (United States) and Basf (Germany).

Figure 9: Main applicants for number of inventions and for number of forward citations



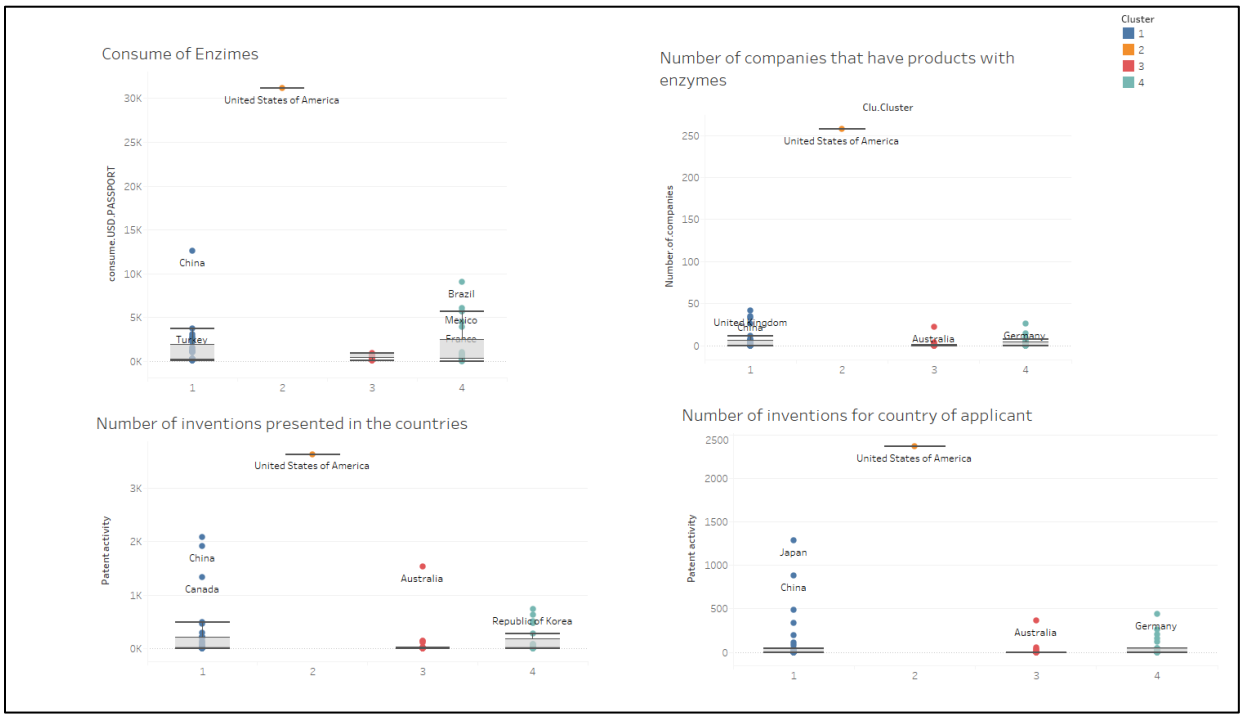
Source: Own elaboration with Thomson Innovation data

3.3 NATIONAL PHASES DEFINITION

The last part of our analysis was the definition of countries of protection using data of patent valuation and data obtained in the countries statistics. With K-means methodology (Jain, 2010), we identified the different countries' clusters with similar values. We used four indicators: consumption of enzymes, number of companies, number of inventions for the country of the applicant, and number of inventions in each country (Figure 10).

We found four clusters of countries that can be seen in the horizontal axis of Figure 10. The first and most important (cluster 2), was formed only by The United States and had the higher indicators for all variables. The cluster 1 was the second most important; this cluster is composed by countries with high patent activity, high patent presentation and high consumption of enzymes. The next cluster in importance was the number 4; it had countries with high consumption, but lower values in other indicators. Finally, cluster 3 had lower values in all indicators.

Figure 10: Countries clusters for different indicators

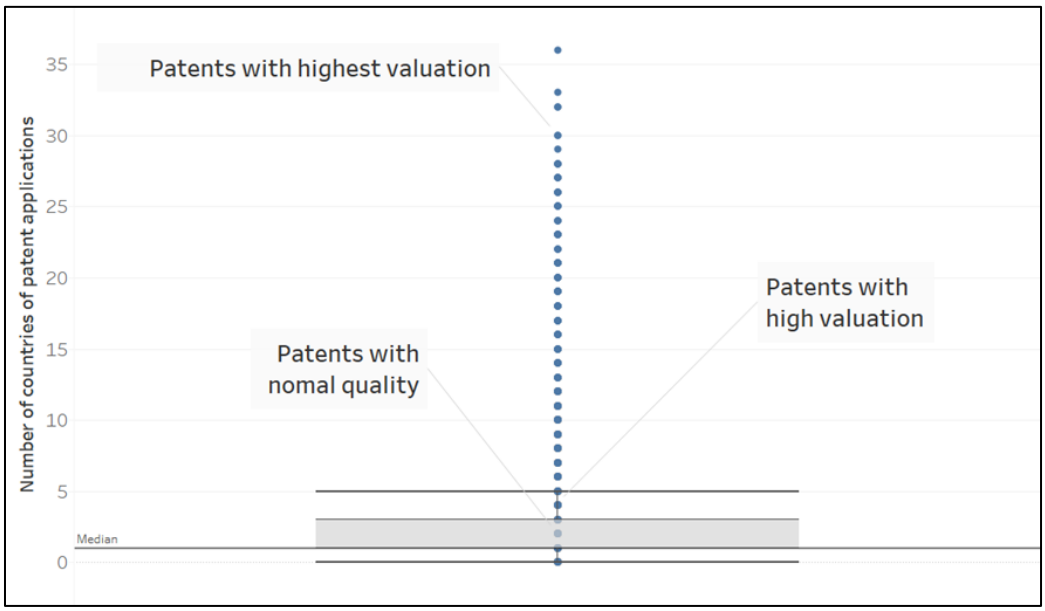


Source: Own elaboration with Thomson Innovation data and LinkedIn

We created a scale to define patent' protection behavior in this industry. For doing this, we took all patents analyzed and then identified the number of countries of application of each invention. We identified that the trend is to protect in only one country (median of countries of protection), in the higher percentile we found a range of three and five countries and some outliers with high levels of country phases. We saw that patents that had high quality (high novelty degree and high inventive step and industrial applicability) have been the patents that were protected in most countries, around 5 in average. With this information, we developed a scale; we defined that the patents with low or normal quality should be presented in 1 or 2 countries and patents with high quality should be presented in 3 to 5 countries. Given this, and based on previous analysis seen in past sections, it was decided that country candidates for this application should be United States,

China, Japan, United Kingdom and Canada. This decision allows applicants of this patent to cover key countries to commercialize this technology and at the same time, optimize available resources for its protection.

Figure 11: Scale to define the number of countries of protection



Source: Own elaboration with Thomson Innovation data

5 CONCLUSIONS AND OUTLOOK ON FUTURE RESEARCH

This study developed a new method to define national phases of protection in a patenting process. In literature, this process has been overlooked given its strategic value. Expenditures associated with patent applications in foreign countries are high. This methodology shows an easy approach for technology managers of firms, universities and entrepreneurs to take decisions in a short time with secondary low-cost data. This is important given that those institutions have restricted cash flows to develop this process.

The use of patent bibliometric indicators for technology valuation facilitates this process because the information is public, of easy access and updated. The fact that patents with high quality have been protected in more countries than their counterparts, shows that there is a relationship between the quality and the number of countries of filed as its suggested in literature (Dechezleprêtre et al, 2017). This methodology can be applied to analyze not only biotechnology patents but all type of industries. Furthermore, data used in country analysis can be changed for other data such as exportation or importation data, patent novelty indicators (Verhoeven, Bakker, & Veugelers, 2016) or another type of data such as trademark information. The method used to define countries with more potential permits not only to identify the national phases candidates; information of market size, competitors and new players can be used also to another strategic approach such as the search of alliances of license candidates. We encourage firms, entrepreneurs, research centers and universities to use and diffuse this methodology in order to optimize the use of their resources, and to promote the use of intellectual protection mechanisms.

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