Patent Mapping in Emerging Countries

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Abstract: Perform a technological prospecting permits the Company to understand what in the future may have as economic assets to their own nation and which technologies will be available in terms of innovation. In this paper, we aimed to construct a panorama with technological indicators through patents focusing mainly in emerging countries that make up the BRIC group. It was sought as obtaining results, variables such as: profiles of patent offices, numbers of intellectual protection applications, patent applications by offices in the applicable countries of forms resident and abroad by family of patents, as well as the technological profiles of these patents, of their inventors and of their investors. With this multicase study, reflections were supported through bibliographic references in scientific articles and international reports, and the extraction of technological data in patents were results of one exploratory verification in the Patent Office of the World Intellectual Property Organization. Taking the general understanding that emerging countries are growing index in intellectual protection records in the issue of patents and there is a general effort from their offices by the motivation to innovation, as well as multinational companies stand out in this segment of intellectual assets.

Keywords: innovation; technology; prospection; development; economy.

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Introduction

To measure and know the Intellectual Property - IP - indexes, is the same as seeking to understand the technological forecast that the Society in the future may have as a resource for usufruct. And in focus on developing countries, we can observe the degree of possible patent growth, and the main areas of investment by companies.

In order to illustrate the size of these emerging countries at the world level, authors such as Neil (2001) and Brics Research Group (2012) Report that these savings represent approximately 43% of the population worldwide with a share of 25% of the global Gross Domestic Product - GDP, catching eyes to its participation in world markets.

There are gaps that are questionable in the innovation and economic relationship in these countries, for example: what are the numbers of Applications for Intellectual Protection of Brics’ emerging members, the Intellectual Protection profile of the Resident and Foreign patent offices by family of patents, what are the Technological Profiles of these patents, of their inventors and of their investors.

For the variables described in this study, procedures were carried out for research by means of bibliographic analysis with verification in journals indexed on international bases, as well as exploration in the PatentScope database of the World Intellectual Property Organization - WIPO

In the portals of patent offices of the countries investigated, it was sought to understand what has recently been adopted as a way of developing solutions to improve the services provided by technological protection in patents.

The method of analysis and construction of the assertives researched resulted from hypothetical-deductive logic with the analysis of indicators extracted from spreadsheets, and generated in the form of graphs or figures to better explain the phenomena observed. Taking Microsoft Excel 2019 Student software as a tool. The research is geographically limited to the main emerging countries, known as Brics: Brazil, Russia, India, China and South Africa in the last decade, with a descriptive approach of qualitative and quantitative variables.

As a goal of this multicase study (YIN, 2001), it is hoped that research on technological indicators in patents can make these elements a means of looking at a brief overview that will allow us to generate reflections for impacting on the future of these territories, which are heading towards possibly being examples in cooperation with other developing nations.

Theoretical Reference

Intellectual Property (IP) consists of new ideas, original expressions, distinctive names and appearance that make products exclusive, valuable and often marketed or licensed (LESPERANCE, 1994; WIPO, n.d.). Just like the authors’ view Quintella et al., (2013) that mention intellectual property is actually a type of property or asset as valuable (or more valuable) as physical or real property, even though it may be intangible, such as knowledge. In other words, it is a category of property that covers the intangible creations of the human intellect in such a way that it appears in the form of industrial property and copyright (WORLD INTELLECTUAL PROPERTY ORGANISATION - WIPO, 2016).

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In terms of patents for emerging countries of Brics group, it can now be understood that there is a well aligned understanding among these nations via international treaties adjusted by the World Intellectual Property Organization (DEORSOLA et al., 2017) and seek to conduct summits that discuss among other issues, technology and innovation (BRICS, 2017). And extract the statement from (BUDWAR et al., 2017) that “BRICS exhibit several profiles with trade-offs between intensity, structural change and interaction with the global economy”.

Look at intellectual property - IP - in the world scenario, especially in patents, it is understandable that just in 2018, the amount of this technology reached 3.3 million applications, understanding the potential of protecting in terms of technology.

Method

Subjects or Participants
The participants are emerging nations limited to Brics, with registered patents in public patent database renowned globally answering issues as: applicants names, patents quantities, international classifications, inventors’ names. Which it was possible with PatentScope© Database originated at Intellectual Property Organization – WIPO.

The subjects are patents of each country answering information about technological forecasting like numbers of Applications profile of Resident and Foreign patent offices by family of patents, technological profiles of these patents, of their inventors and of their investors. Which all these information permit to reflect and bringing the matter: in case of emerging countries, what is their landscapes about technologies and their players?

Apparatus
For this research, all technology in terms of equipment and software were generated with their own resources, as well as the analysis and generation of graphs with the help of Microsoft Excel Student and CorelDRAW X7 Student, with support of map extracted from WIPO.

Design
All the statistical variables are discrete for the quantification of the patents of each country studied. This allowed to be traced the behavior of countries independently and acting together, and it was understandable that countries presented themselves as dependent variables. As for the independent variables, the profile of patent applicants, inventors, patent areas (classification) could be highlighted.

Outcomes and Discussions

Brazil
The official office that deals with issues of intellectual property protection is the National Institute of Industrial Property (INPI) - autarchy linked to the Ministry of Economy - and that recognizes intellectual property as the fruit of inventiveness in relation to knowledge, technology and expertise INPI (201-), and comes corroborating what is internationally referenced by the World Intellectual Property Organization (WIPO, 2016).

WIPO in its report highlights in the patent area the position (26) for Brazil and pending in analyses of patents around (196,354), although a reduction of this backlog by (6.8%) was observed in relation to the previous period (WIPO, 2019a). As possible justifications, this can be found in Sobral (2017) that the process of internationalization has evolved the number of international deposits in the country, as well as the technological progress resulting from more complex inventions.

With this metric in the Brazilian backlog, the INPI expanded its staff by 1/4 of its old capacity in human resources for technological analysis, as well as improved electronic systems and internal process flows of its institute (INPI, 2018).

The Ministry of Economy recognized the world competitive scenario and the need to stimulate innovation, reacting with the goal of reducing the average analysis of each patent to 02 years, using the analysis of invention patent applications already made abroad, either for resident or foreign applications; adherence to the Madrid protocol for effectiveness in trademark protection and internationalization; briefness for priority examinations (group of elderly, micro and small businesses, green technology science institutions and participants of Patent Prosecution Highway – PPH) © (VERDÉLIO, 2019).

The INPI Business Program also stands out, broadening the list of INPI services, acting as a facilitating agent in the relations between national and foreign companies, universities, start-ups and research institutes, in order to generate new assets in intellectual protection (SILVA, 2020).

Russia
With entry into the World Intellectual Property Organization in 1970, Russia has Rospatent as the official office for intellectual protection (ROSPATENT, 2018b).

In your office, there is a continuous interest for efficiency in the evaluation of processes, optimizing a reduction in the deadlines from 2018 to 2019 by 30% in protections in general, with the processes to be optimized online (ROSPATENT, 2019a).

In the internationalization of Russian intellectual protection, Rospatent has been holding since 1997 the Rospatent Science and Practice Conference event, with the participation of regional and international organizations such as WIPO, EPO, Eurasian Patent Organization and foreign states (ROSPATENT, 2019b).

As for the profile of innovations registered in Russia internationally via WIPO, data are available in the general intellectual property panel of emerging countries (Table 1,2 and Appendix 2).

India
WIPO participant since November 1973 (WIPO, 2019b), India has a growing patent in recent years, highlighting the increase in the number of applications for patents by origin, particularly in the areas of information and communication technology (CORNELL UNIVERSITY; INSEAD; WIPO, 2019).

1Patent Prosecution Highway (PPH) – projeto entre escritórios nacionais/regionais de patentes no qual um Country aproveita o exame do parceiro para realizar sua análise.
His office, known as the Office of General control of Patents, Designs and trademarks, presents as legal framework the patent law since 1990 (THE PATENT ACT, 1970), amended in order to take account of normative developments.

Above all, we can see India with strong growth in patents since 2016 (WIPO, 2019c), being able to check more details in the results section of this work.

**China**

Member of the World Intellectual Property Organization since 3 June 1980, and being in force at the Paris Convention in 1985, China has the world’s largest index of patent protection. (WIPO, 2018).

The answer to this growth in China can probably be found through Smith e Leydesdorff (2012), when it reveals that the increase in innovation took place after the change of state-owned enterprises (EEs) have been privatised. In addition, there has been an increase in applications for protection in Chinese cities regarding the use of Intellectual Property Rights (IPR) by private sector companies, which are more sensitive to IPR protection than state-owned companies.

Another factor that possibly justifies this growing rate of innovation is the investment in R&D, reaching the figure of 1.55 trillion, representing 2.1% of its GDP, so that part of these investments come from companies that contribute 78% of total spending on Innovation and Development. With this, China reaches 4th place in the world in citations of articles indexed to SCI, according to (BRICS, 2017).

In short, China seems to explain in large part the worldwide dissemination of scientific and technological innovation activities in the last two decades, although many other countries have contributed to this trend. But many low-income countries are systematically excluded from international innovation.

**South Africa**

The participation of the South African office at WIPO, took place with the agreement signed in 1967 which went into effect in 1975 (WIPO, 1975).

The office of the acronym in English, CIPC - Companies and Intellectual Property Commission, presents itself as the Commission of Companies and Intellectual Property, and comes since 2013 with the adoption of patent applications and other electronic technologies in order to optimize the service of the growing demand for intellectual protection (CIPC, 2013).

It is also found that the services for registration in intellectual protection of CIPC motivated its customers even more, adopting a strategy of reducing fees for the purpose of increasing records, thus demonstrating a greater interest in the increase of its technological indicators (Notice 36 of 2019 - Decrease of co-operative registration fee and amendment of constitution in terms of the amended co-ops act (no.6 of 2013), 2019).

It could be seen that South Africa still strives to make significant progress in the area of intellectual protection in front of the same markets on its continent. (Makhoba & Pouris, 2018), and has adopted a strategic planning with proposed market value, making it potentially available, as can be enumerated with: a) Delivery program and easy access to CIPC; b) Programme to promote innovation and creativity; c) Programme of reputation and business standardization (CIPC, 2017).

2.1. Requests for Intellectual Protection

Looking at the report of the World Intellectual Property Organisation, an increasing number of applications for intellectual protection for the emerging could be found, with the unusual point of the outlier of China potentially superior to the other countries, reaching over 8,15 million units in patents, making him world leader globally and among emerging countries, followed by Russia with (314251), India (212147), Brazil (65835) and South Africa with (20085) patents, as shown more graphically by Figure 1.

**Figure 1.** Accumulated patents in emerging Residents + Foreign and Regional (2009 a 2018)

| Country | Amount of patents (un.) |
|---------|-------------------------|
| China   | 8153514                 |
| Russia  | 288277                  |
| India   | 190556                  |
| Brazil  | 59922                   |
| South Africa | 20085     |

Source: Adapted from (WIPO, 2019a, 2019d, 2019c, 2019b, 2019e).
However, there is a strong characteristic related to these patents over the period when viewed in chronological detail by (Figure 2), when in the year of 2014 Russia presents strong decrease and recovery of growth in 2015 with later fall to the years after 2018. Resuming again strong growth from 2015 to 2018, appearing to be a general problem among patent offices in the matter of technological protections. While China, still being the outlier of this statistic, has not shown to have suffered shake-ups in its indices.

For India, it is worth highlighting the strong growth throughout the period for investment in intellectual protection, demonstrating a great effort of this country by its inventors, as well as an awareness of the importance of protecting its innovations. Moreover, it is worth highlighting the strong market by the population contingent that demands for various technological solutions. In order to compare its initial results with the most recent, according to the data presented, India started with 11,939 patents in 2009 and reached the mark of 30,036 patents in 2018, showing in this contrast an increase of 251.57%.

In the case of Brazil, the protection of innovations remained practically constant, maintaining between 5423 and 7505 patents.

As for South Africa, it presented a quantitative index around 1964 to 2317 patents during all time.

In general terms, there is an increasing number of intellectual protection applications for emerging countries, observing just Brazil, Russia, India and South Africa during this period, when the amount of patents per year is analyzed (adding up your results per year), as can be seen from Figure 3, when it shows a trend line with $R^2=0.99$, demonstrating that together they show a strong trend of technological growth in numbers of millions patents.
2.2. Intellectual Protection of Patent Offices Resident and Abroad by Patent Family

From this international indicator of Intellectual Property, it is worth noting that patents have been widely used as an indicator of innovation activity in recent decades, and that to measure the productivity of these activities in research and development, one must observe the absence of limitations pointed out by Pavitt (1982) and policies towards, technical change, requires better measurement of technical change. No single measure is perfect. Taken together, statistics on R&D and on patenting activities give important clues about the rate and direction of innovative activities, and also show the dangers of too hasty interpretation based on one measure. They both show a heavy concentration of innovative activities in chemicals and engineering (electrical, electronic and non-electrical), and Griliches (1990), when many of the innovations are not patented, while others have several patent protections when applied in different territories, or the number of patents protecting the invention may differ between each country applied for (DECHEZLEPRÊTRE et al., 2017).

Another relevant point to understand in this indicator of patents residing and abroad by family is that each protection exercised presents its usefulness for quantifying the technological diffusion that is taking place among these countries, and also with the minimization of data duplication. It is also possible to count the relationship of international interests regarding the invention to be protected for exploitation in the respective market of that country, or simply to be applied in use mode (DE RASSENSFOSSE et al., 2013). Thus, depending on the size of the family of patents in which there is representation in the territory, it is possible to observe a mensuration of size market, quantifying the appropriate technological value (HARHOFF et al., 2003).

Analysing the important points raised about these indicators, it is possible to ask: what are the indexes, at least quantitative in a protection matrix among the emerging ones, and what can be evidenced with these numbers? And according to PatentScope (2020), it was possible to condense the quantitative in the period 2009 to 2018 in agree with Figure 5, resulting of Table 4 from Appendix II.

Figure 4. Protected resident/exterior patents per family, among emerging countries.

Source: Database PatentScope(2020)
Looking at the compiled data from the sum of the period of 2009-2018, it turns out that South Africa invests in protecting its technological assets much more internally (1550) to externally, indicating that outside its territory it is much more attractive to protect its innovations in markets. As for requests for protection abroad, this African continent nation has records in Chinese office with (1040) patent units, Indians (609), Brazilians (101) and finally in Russian markets (84).

China’s innovation ecosystem actors presented a superiority in this internal quantitative patent protection (134489), presenting full leadership in these indicators also in the external market. And it places their investments in protections, mainly in the Indian neighbor market (3396), followed by Russia (1402), Brazil (1029) and South Africa (598), demonstrating a hierarchy of interests in these markets.

India visualizes its domestic market with great value (11107) in the protection of its innovations against the external market, but it respects the neighboring market of China (2600), and less investment in the protection of the Russian (181), African (164) and Brazilian (141) markets. It should be noted that all these external markets do not represent or want more than 2% of the quantity of resident patents protected.

Russia invests around 60% more in the protection of its patents within the China market (6436) in relation to its number of domestically protected patents (4145), while in the hierarchical order of investments in protection, it follows the Indian (649), Brazilian (189) and South African (185) markets mainly. The families of patents in Brazil present a statistic of importance in the external market mainly (4338), while internally it also presents a considerable index of this quantitative (2791), so that India is the second external market of greater interest (977), Russia (290), and South Africa (283) finally, and not less important.

Observing the general indicators of protection in this macro-environment of nations, one can possibly identify that the considerations of the factor - geographical proximity to the markets - attract more patent protection in general, except for China, since this huge Chinese market of protection attracts the interest of international patent registrations from the most distant countries, as in the case of Brazil.

From the data obtained, it is possible to illustrate this relationship of interests in Intellectual Protection resident and abroad through Figure 6, identifying the appropriate quantitative proportions.

**Figure 5.** Geography of Intellectual Protections in emerging countries and their resident and foreign holdings (2009 – 2018)

The results achieved on the geographical factor with the vision of Blomkvist; Drogendijk, (2013) when it mentions that physical distance really is a factor explaining the path of internationalization of companies as a form of choice, as well as the flow and selection of markets in emerging countries, widely perceiving the power of patents protected by family on the axis of Russia - China - India.
In the case of China, although its market share in foreign patents is still a fraction of what is applied for in domestic patents, it is noted that there is a significant amount also in foreign countries, which has also been observed in the case of emerging countries (WUNSCH-VINCENT et al., 2015).

The same authors also point out that China's patents are concentrated on specific technologies and on small companies, being mostly in the technological sectors, corroborating what will be seen in the item below in what is presented in Table 1, in the technological profiles of Chinese patents.

It is observed that African general indices are more suppressed compared to all other countries as we have seen, however, is to be emphasized research (Makhoba; Pouris, 2018) that portrays South Africa with a different view, a look at specific areas in nanotechnology, biotechnology, climate change, energy and health, highlighting it in a more competitive environment against Brazil, Russia, India and China, even concluding that South Africa's production is the most prolific on its own continent, although the technologies investigated are not properly aligned with the priority areas of government policy.

Lubango (2020) exposes the international networks of co-inventors among South Africa, Brazil and India for the production and dissemination of green international innovations, highlighting the linear correlations in India, followed by Brazil with the largest network of co-inventors and finally identifying the non-linearity for South Africa, by presenting a smaller network. However, it argues that co-inventor networks accelerate transnational exchanges of human capital and that it is worth adopting national and transnational industrial cluster and innovation policies at global levels to support sustainable production plans.

The Russian Government highlights the bilateral technical-military cooperation with China, aiming at maintaining the agreements on mutual protection of intellectual property, and ensuring their effective implementation in relation to previous agreements (ROSPATENT, 2018a).

In the proposed study of Russia as the cooperation in the Brics relating to Science, Technology and Innovation, the authors have compiled indexes in priority areas, and realized that issues such as the advanced manufacturing and robotics, space systems and astronomical observations are fields of high importance and which require a lot of research and development - R&D, while areas of information communication technology - ICT - have a great importance and an average capacity for investments in R&D (SOKOLOV et al., 2019).

Another important topic regarding this collaboration network among the emerging focus on Russia, is present: a) the focus for cooperation in the fields of nanotechnology and new materials; b) mutual benefit for win-win cooperation in ICT and advanced robotics and industrialization; c) and the leading role in space research and robotics (SOKOLOV et al., 2019).

**Patents: Technology profiles, inventors and investors (2010-2019)**

Knowing the profiles of protection in patents with the highest rate of each nation, is possible to extract evidence that China holds the largest amount of intellectual protection with more than 19.8 million units, being outlier compared to other countries. And following in descending order, there is the participation of Russia with (1,197,097) patents, Brazil (788,878), India (538,465) and South Africa with (151,921) protections.

Taken from the whole period (2010-2019), the highest rate of protection for each country, was the year 2011, and a description of its results is worth noting. Note that in the general classification profile of the International Patent Code there is a clear evidence and predominance of the category (G06F) which is associated with - section G - Physics, subsection 06 - Computation; calculation; count; F - Electrical processing of digital data - dominated by the high quantitative degree of Chinese patents. Taking in general that all the productive potential in patents stands out for progress in the areas of Informational Technology and processing. While all other countries: Brazil, Russia, India and South Africa, looking for intellectual property protection in the code (A61K) which is associated with the area of - Human Needs, Health, Rescue, Recreation (A), highlighting the subclass Medical or veterinary science; Hygiene (A61) and specifically for the purpose for medical preparations, dental or hygiene (A61K) - leading to understand that companies with the profile in the health field in general, drugs or hospital have greater framework that quantitative when They present the companies Bayer AG (4497) in Brazil and Unilever PLC (3247) of South Africa.

With this, it could be seen in a general way that, in this time space of 2011 among these countries, 3/4 of patents were focused on the areas of information and processing - “cold, machine technology” - well highlighted by China, compared to 1/4 of patents for human and health issues to the rest of the countries.

Associated enterprises in the informational area are highlighted by the company's inventor Oleg Kyasenkov of Russia to (3481) patents, Qualcomm Incorporated in India (17381) and State Grid Corporation (63285) in China, in ascending order.

The countries of India, China and South Africa did not have the profile of its inventors their names, while Brazil stands out with inventions of the German Focke Heinz with 334 protections and Russian Oleg Kyasenkov with (33416) Patent units in Russia.

In the same period in 2011, stands out in ascending order of the quantitative South Africa (5108), Brazil (22,878), India (49,904), Russia (72,158) and China (839189).
Table 1. Technological Profile patents by countries for the highest rate achieved by each emerging

| Country    | Applicants                   | Inventors                     | Code IPC    | Year of publication |
|------------|------------------------------|-------------------------------|-------------|---------------------|
|            | Name Quant.                  | Name Quant.                  | Name Quant. | Name Quant.        |
| Brazil     | 788878                       | BAYER AG 4497                | FOCKE HEINZ 334 | A61K 64793 2011 22878 |
| Russia     | 1197097                      | Oleg Kvasenkov (RU) 3481     | Oleg Kvasenkov (RU) 33416 | A61K 79637 2011 72158 |
| India      | 538465                       | QUALCOMM INCORPORATED 17381  | NA          | 497 A61K 74789 2011 49904 |
| China      | 19888802                     | STATE GRID CORPORATION OF CHINA 63285 | THE INVENTOR HAS WAIVED THE RIGHT TO BE MENTIONED 75662 | G06F 783458 2011 839189 |
| South Africa | 151921                       | UNILEVER PLC 3247            | 22915       | A61K 36202 2011 5108 |

Fonte: PatentScope (2020)

Evaluating the general technological profiles of the countries as the applicants, inventors and protected areas, it can be understood at a glance according to Appendix III, the following data (Table 2).

Table 2. General Profile of Inventions in Patent in Emerging (2010 – 2019)

| Country    | Companies   | Inventors | Patents Section |
|------------|-------------|-----------|-----------------|
| Brazil     | Multinational | 1 resident 9 foreign (Chinese, Americans and Russians) | A, B, C, G |
| Russia     | Multinational | 10 residents | A, B, C, E, G |
| India      | Multinational | 1 confidential and 9 foreigns (Chinese, americans) | A, C, G, H |
| China      | Multinational | 2 under secrecy and 8 residents | A, B, C, F, G, H |
| South Africa | Multinational | Foreigners | A, B, C |

The metrics of larger holdings, among the ten most, it has the following highlights: the profiles of companies that reveal, stand out by presenting profiles of multinational Productions. As for inventors, it can be extracted in a general way that Brazil for the most part is foreign; India and South Africa, all inventions are the result of external inventors, while for Russia and China the participation of inventors from their own country is observed.

For more detailed analysis and assessment is recommended to observe the Table 6 in Appendix 4.

Final Considerations

It can be seen in the survey, an increasing index in the records of intellectual property protection for patents from emerging countries and an effort to improve the quality of services of the regional offices of those countries in order to maintain a equated availability to their demands.

In patent indexes, it stands out as patent outlier, Chinese intellectual production with the highest index to the global, followed by Russia, India, Brazil and South Africa respectively. However, there is a need to verify the amplitude of India’s innovation, which in terms of patents requests, represents the second biggest rate between the countries, showing strong technological growth in the last decade. And that, the countries together accounted for an accumulation of patents with a very strong metric, recorded with a line of $R^2$ trend above 0.99, indicating a promising future for these countries when worked more cooperatively to innovation.

It is noteworthy that protected by patent family abroad, Russia and Brazil invest more in protection with its technological assets in China that within their own countries, while South Africa, India and China seek to protect more internally, as well as the flow of investments in intellectual property protection appears more strongly in countries that are closer geographically.

The highest patent rates in the period (2010 - 2019) represent technologically the holding of applications by multinational companies, with the profile of foreign inventors in the innovations of Brazil, India and South Africa, checking the areas of human needs (A), Processing/Transport Operations (B), Chemistry and Metallurgy (C), Physics (G) for most emerging nations.

It is hoped that with these considerations and reflections, nations can expand cooperative efforts in technology and research, developing collaborative actions between companies and inventors, universities and researchers, intellectual property protection offices and analysts in order to effectively contribute in the economies of societies.
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### APPENDIX I - Indicators of patent applications (2009-2018)

**Table 3. Applications for Intellectual Property (Resident + Exterior, Including Regional)**

| Countries/Period | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|------------------|------|------|------|------|------|------|------|------|------|------|
| Brazil           | 5423 | 5737 | 6362 | 6603 | 6848 | 6712 | 6570 | 7216 | 7505 | 6859 |
| Russia           | 2886 | 3283 | 3146 | 3437 | 3406 | 2851 | 3379 | 3183 | 2780 | 3069 |
| India            | 11939| 14871| 15897| 18201| 20907| 22444| 23990| 25853| 28009| 30036|
| China            | 241435| 308327| 436168| 561404| 734093| 837814| 1010524| 1257425| 1306080| 1460244|
| South Africa     | 1964 | 1996 | 1764 | 1688 | 2211 | 2317 | 2077 | 2018 | 2189 | 1861 |

Source: (WIPO, 2019a, 2019d, 2019c, 2019b, 2019e)

### APPENDIX II - Indicators of patents resident and abroad by family of patents (2009 – 2018)

**Table 5. Patent family oriented to foreigners by office of origin and destination**

| Countries Origem | Escritório | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Total |
|------------------|-----------|------|------|------|------|------|------|------|------|------|------|-------|
| Brazil Brazil    | 329       | 307  | 362  | 391  | 331  | 330  | 362  | 278  | 99   | 2    | 2791 |
| Brazil China     | 587       | 636  | 496  | 470  | 423  | 752  | 738  | 199  | 37   | 4338 |
| Brazil India     | 127       | 189  | 168  | 103  | 115  | 92   | 132  | 37   | 14   | 977  |
| Brazil Russia    | 34        | 57   | 45   | 36   | 28   | 55   | 27   | 7    | 1    | 290  |
| Brazil South Africa | 43     | 48   | 62   | 34   | 20   | 31   | 36   | 9    | 2791 |
| China Brazil     | 131       | 126  | 143  | 151  | 115  | 122  | 122  | 77   | 40   | 1029 |
| China China      | 9566      | 10419| 12582| 15367| 16817| 18667| 22398| 20266| 7913 | 494  | 134489|
| China India      | 439       | 607  | 631  | 508  | 300  | 291  | 311  | 222  | 85   | 2    | 3396 |
| China Russia     | 150       | 203  | 199  | 195  | 169  | 187  | 179  | 102  | 18   | 1402 |
| China South Africa | 94     | 114  | 94   | 83   | 62   | 70   | 58   | 21   | 2    | 598  |
| India Brazil     | 63        | 25   | 11   | 35   | 7    | 1    | 1    | 1    | 1    | 1    | 141  |
| India China      | 1192      | 628  | 209  | 380  | 126  | 21   | 22   | 18   | 4    | 2600 |
| India India      | 1071      | 1269 | 1416 | 1310 | 1405 | 1365 | 1514 | 1248 | 502  | 7    | 11107|
| India Russia     | 5426      | 34   | 28   | 27   | 17   | 20   | 21   | 9    | 189  |
| Russia Brazil    | 34        | 33   | 28   | 27   | 17   | 20   | 21   | 9    | 189  |
| Russia China     | 558       | 614  | 478  | 741  | 799  | 1062 | 1168 | 766  | 134  | 6    | 6326 |
| Russia India     | 89        | 113  | 114  | 119  | 61   | 51   | 47   | 49   | 6    | 649  |
| Russia Russia    | 422       | 551  | 578  | 536  | 460  | 548  | 486  | 458  | 106  | 4145 |
| Russia South Africa | 33     | 34   | 36   | 19   | 13   | 19   | 19   | 12   | 185  |
| South Africa Brazil | 21      | 15   | 25   | 24   | 8    | 6    | 2    | 101  |
| South Africa China | 121     | 153  | 176  | 305  | 180  | 58   | 15   | 11   | 21   | 1040 |
| South Africa India | 132    | 108  | 116  | 100  | 88   | 43   | 18   | 4    | 609  |
| South Africa Russia | 22     | 19   | 9    | 14   | 15   | 4    | 1    | 84   |
| South Africa South Africa | 199    | 221  | 213  | 239  | 191  | 200  | 161  | 110  | 16   | 1550 |

Source: WIPO Statistics Database. Last update: October 2019
## APPENDIX III - Technology Profile in patents by emerging countries
analysed separately by office (2010-2019)

### BRAZIL

| Country | Applicants | Inventors | Code | IPC | Year of publication | Applications | Inventors |
|---------|------------|-----------|------|-----|---------------------|--------------|-----------|
| Brazil  | 788878     | BAYER AG  | 4497 | FUKUI TEIKU | 2011 22878 | BRAZIL 788878 | BAYER AG  |
|         | 3286       | PROCTOR & GAMBLE | 3292 | KRISIN CHE | 2012 7713 |
|         | 2063       | UNILEVER NY | 3465 | PIETER GAAL | 2013 11384 |
|         | 2841       | QUALCOMM INCORPORATED | 2865 | FREDERIKS E. SHELTON N | 2014 15871 |
|         | 2601       | HEIDRICH AG | 2651 | RAMMANN | 2015 20845 |
|         | 2466       | BASF AG | 2466 | HAO XU | 2016 50445 |
|         | 2221       | GEN ELECTRIC | 2221 | STRATHMANN SIGFREID | 2016 43496 |
|         | 2160       | SIEMENS AG | 2160 | VENEZIANI JOSE CARLOS | 2017 74996 |
|         | 1934       | CIBA GEIGY AG | 1934 | MARTA KARCZEWICZ | 2017 60116 |

### RUSSIA

| Country | Applicants | Inventors | Code | IPC | Year of publication | Applications | Inventors |
|---------|------------|-----------|------|-----|---------------------|--------------|-----------|
| Russia  | 1197097    | Oleg Kvasevski (RU) | 3481 | Oleg Kvasevski (RU) | 2011 72158 |
|         | 17322      | KONINIKLUK PHILIPS N.V. | 17322 | KONINIKLUK PHILIPS N.V. | 2012 80702 |
|         | 12965      | KONINIKLUK PHILIPS ELECTRONICS N.V. | 12965 | Chen Wanshi | 2013 77638 |
|         | 2517       | KONINIKLUK PHILIPS ELECTRONICS N.V | 2517 | Chen Wanshi | 2014 77638 |
|         | 242       | Oleg Kochetov (RU) | 242 | Yuliya Shchepochkina (RU) | 2014 77638 |
|         | 2841       | SIEMENS AKTIENGESELLSCHAFT | 2841 | SIEMENS AKTIENGESELLSCHAFT | 2015 77638 |
|         | 1976       | FORD GLOBAL TECHNOLOGIES (EUA) | 1976 | Kvasenkov O.I. | 2016 77638 |
|         | 1612       | SIEMENS AKTIENGESELLSCHAFT (DE) | 1612 | Kvasenkov O.I. | 2017 77638 |
|         | 1308       | KUELLCOMM INCORPORATED (EUA) | 1308 | Kvasenkov O.I. | 2018 77638 |

### INDIA

| Country | Applicants | Inventors | Code | IPC | Year of publication | Applications | Inventors |
|---------|------------|-----------|------|-----|---------------------|--------------|-----------|
| India   | 538405     | QUALCOMM INCORPORATED | 538405 | NA | 2011 49904 |
|         | 210887     | KONINIKLUK PHILIPS ELECTRONICS N.V. | 210887 | Chen Wanshi | 2012 77638 |
|         | 3247       | SIEMENS AKTIENGESELLSCHAFT | 3247 | GAAL Peter | 2013 77638 |
|         | 22915      | TELEFONAKTISSUEISAM (EUA) | 22915 | Li Junyi | 2013 77638 |
|         | 43856      | SIMENS AKGNTENGESELLSCHAFT (DE) | 43856 | Kvasenkov O.I. | 2014 77638 |
|         | 30220      | MICROSCTC CORPORATION | 30220 | KARCZEWICZ Maria | 2015 77638 |
|         | 371        | SONY CORPORATION | 371 | Ting Tingting | 2016 77638 |

### CHINA

| Country | Applicants | Inventors | Code | IPC | Year of publication | Applications | Inventors |
|---------|------------|-----------|------|-----|---------------------|--------------|-----------|
| China   | 16888082   | STATE GRID CORPORATION OF CHINA | 16888082 | NA | 2011 839189 |
|         | 871747     | Samsung Electronics Co. Ltd. | 871747 | WANG WEI | 2012 1106380 |
|         | 22127     | GREE ELECTRIC APPLIANCES INC. OF ZHUHAI | 22127 | ZHANG WEI | 2013 1311729 |
|         | 27026     | Midea Group Co. Ltd. | 27026 | Limin | 2014 448007 |
|         | 2047       | HUAWEI TECHNOLOGIES CO. LTD. | 2047 | WANG LEI | 2015 1609697 |
|         | 19559      | CHINA PETROLEUM & CHEMICAL CORPORATION | 19559 | LIU WEI | 2016 1932340 |
|         | 18871      | HUAWEI TECHNOLOGIES CO. LTD. | 18871 | ZHANG LEI | 2017 2181819 |
|         | 7911       | BOE TECHNOLOGIES GROUP CO. LTD. | 7911 | WANG JUN | 2018 3178904 |
|         | 16518      | ZTE CORPORATION | 16518 | INVENTOR DOB SIGLO | 2019 3178904 |
|         | 16719      | KONINIKLUK PHILIPS ELECTRONICS N.V. | 16719 | LI JIN | 2020 57704 |

### SOUTH AFRICA

| Country | Applicants | Inventors | Code | IPC | Year of publication | Applications | Inventors |
|---------|------------|-----------|------|-----|---------------------|--------------|-----------|
| South Africa | 151921 | UNILEVER PLC | 151921 | NA | 2011 5108 |
|         | 3258       | NOVARTIS AG | 3258 | ADAMS & ADAMSADAMS & ADAMS | 2012 6186 |
|         | 1391       | ASTRazeneca-AB | 1391 | SPOOR & FISHER & FISHER | 2013 10615 |
|         | 1289       | BAYER AKTIENGESELLSCHAFT | 1289 | D.M. KISCH INC & M. KISCH INC | 2014 10615 |
|         | 772        | MERCK PATENT GMBH | 772 | HAHN & HAHNHAHN & HAHN | 2015 1841 |
|         | 467        | THE PROCTOR & GAMBLE COMPANY | 467 | DR GERMHOLTZ INCOR DR GERMHOLTZ INC | 2016 0 |
|         | 567        | BAYER AKTIENGESELLSCHAFT | 567 | DR GERMHOLTZ INCOR DR GERMHOLTZ INC | 2017 2 |
|         | 657        | ELI LILLY AND COMPANY | 657 | DR BOWMAN GLFILLAN (JOHN & KER- NICK) | 2018 5204 |
|         | 651        | HINDUSTRY LEVIER LIMITED | 651 | ERASMUS TEINSELARMS TEINSEL | 2019 4373 |
|         | 631        | NOKIA CORPORATION | 631 | DR M KISCH INC KISCH INC | 2020 3499 |

Fonte: PatentScope (2020)
