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## GREEN TECHNOLOGIES AND INTELLECTUAL PROPERTY RIGHTS

### *PATENTES VERDES E DIREITOS DA PROPRIEDADE INTELECTUAL*

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#### ABSTRACT

**Objective:** The intellectual property rights (IPRs) related to green innovation has demanded new legal rationalities and tools to foster the R&D in many countries due to greenhouse effects. The main purpose of this article is to analyze the challenges faced by the Green Patent Program to achieve its purpose of building an innovation environment concerned with sustainability.



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**Methodology:** The deductive approach method is used to observe how the debate involving patents fits into the issue of green patents. Analytical and comparative procedure methods were used to analyze the arguments and strategies used by doctrine, governments and companies on patents and the acceleration of patent granting involving green technologies.

**Results:** The result shows that accelerating the granting of green patents could be useful to stimulate innovation driven by small companies if backlogs are tackled.

**Contributions:** The main contribution of the research refers to the identification of the problem generated by the practices of large companies aimed at delaying the granting of patents, making it difficult to carry out the Green Patent Program that seeks to develop innovative solutions in the environmental area, therefore, it is necessary to face this scenario with appropriate legal instruments.

**Keywords:** Patents; Intellectual Property Rights; Green Patents; Backlog and Patents.

## RESUMO

**Objetivo:** Os direitos da propriedade intelectual concernentes às tecnologias verdes possuem, em diversos países, racionalidades jurídicas próprias e ferramentas jurídicas específicas para fomentar o Desenvolvimento & Pesquisa com o intuito de controlar os impactos trazidos pelo efeito estufa. O objetivo desse artigo é analisar os desafios enfrentados pelo Programa de Patentes Verdes para alcançar a sua finalidade de construir um ambiente de inovação preocupado com a sustentabilidade.

**Metodologia:** O método de abordagem dedutivo foi empregado para se observar como o debate envolvendo as patentes se insere na questão das patentes verdes. Os métodos de procedimento analítico e comparativo foram utilizados para a investigação dos argumentos e das estratégias usadas pela doutrina, governos e empresas sobre as patentes e as acelerações de concessão de patentes envolvendo tecnologias verdes.

**Resultados:** O resultado aponta que a aceleração da concessão de patentes verdes poderá ser útil para estimular a inovação impulsionada por pequenas empresas se os backlogs forem combatidos.

**Contribuições:** A principal contribuição da pesquisa refere-se à identificação do problema gerado pelas práticas de grandes empresas voltadas ao atraso na concessão de patentes, dificultando a realização do Programa de Patentes Verdes



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*que busca o desenvolvimento de soluções inovadoras na área ambiental, logo, é necessário enfrentar esse cenário com instrumentos jurídicos adequados.*

**Palavras-chave:** *Patentes; Direitos da Propriedade Intelectual; Patentes Verdes; Backlog e Patentes.*

## 1 INTRODUCTION

It is important to note that the use of green technologies, especially in the energy field, is an important measure to combat global warming and other emerging environmental issues and balance development and sustainability.

In the face of environmental challenges, intellectual property rights related to green innovation have demanded, in several countries, new legal rationality and new tools to foster Research and Development.

In this context, the importance of studying the main factors involved with the development of green technologies is great, such as i) the role of intellectual property rights, especially in the field of energy and alternatives to economic incentives in R&D, through the use of instruments appropriate legal frameworks; ii) discussions on comprehensive patents, cross-patents, low-quality patents, and third-generation biofuels; and iii) the contribution, from a legal perspective, of the Brazilian pilot program for green patents.

In this way, the article focuses on studying the connection between intellectual property rights (IPR) and improving the development of green technologies, in addition to proposing to show that the market behavior related to innovative technologies and the protection of intellectual property rights is different when we compare with green technologies and intellectual property rights.

The deductive approach method was employed to carry out the analysis of the debate on IPRs and how this discussion applies in the case of the Green Patent Program. On the other hand, the analytical and comparative procedure method were used to confront the doctrine's arguments on the issue of patents and the strategies



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of protection of IPRs by the countries. The result found was that the acceleration of the granting of patents is not always beneficial to companies, being more useful for startups that need to raise capital to start their businesses. Many companies use strategies to delay the patent granting process and this practice is very harmful to the credibility of patents, encouraging large companies to adopt other protocols for the protection of their trade secrets.

In this sense, the fight against backlogs must be carried out together with the priority concessions of patents so that small companies can benefit from patents and allow the construction of an innovative and sustainable environment. Consequently, this is one of the reasons why Brazil has a Backlog Combat Plan since 2019, and several initiatives are being carried out to reduce the time of analysis of patent applications by the National Institute of Industrial Property (INPI).

## 2 IPR'S PROTECTION AND DEVELOPMENT OF GREEN TECHNOLOGIES

First, it is pertinent to consider the challenges related to innovation: asymmetric information, market power, uncertainty and externalities (LYBECKER, 2014, p.8).

Although the frequent tool to foster innovation is incentives, in the case of the green technologies, **there are two externalities that represent a barrier to the innovative process** (HALL; HELMERS, 2010, p. 34) **and they make necessary the government intervention and policy:** a-) Knowledge spillovers from R&D efforts and b-) these technologies have a public good nature on account of social effects that they bring to society (HALL; HELMERS, 2010, p.37 ; POPP, 2012, p.16).

Thus, it is possible to describe the scenario of the **market of green technologies as a place that is involved by the uncertainty of their adoption**; the impact on markets that provide complementary products; the compliance of legal system that exists in the country that the green technologies are developed; the



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possibility of enforcement of IPR's and the behavior of international markets (HALL; HELMERS, 2010, p. 34).

The problem of uncertainty, that is present in all the parts of the process, is related to costs, to the development of the end-product, to the production of competitors etc:

“Uncertainty about actual costs, uncertainty about the end-product of a research process, uncertainty about the reception by the market, uncertainty about the ability to appropriate the returns to research while competitors try to produce similar results, uncertainty about current and future policy platforms, uncertainty surrounding the pricing of competing as well as complementary goods, and uncertainty about regulatory impacts on the research process and end-result. This is exacerbated by the uncertainty surrounding the rate of innovation itself which complicates any estimate of global climate change, making it difficult to substantiate the reasons for further research funding.” (LYBECKER,2014)

In addition, the **externalities in the context of green technologies are** : a-) The social costs connected with pollution are higher than private costs (JAFFE; NEWELL; STAVINS, 2005) and b-) It is possible to use the knowledge produced by others without paying for the information (GROSSMAN; HELPMAN, 1991), in other words, “*the development of (green) technologies is characterized by **non-excludability***” (HALL;HELMERS, 2010). Furthermore, it is necessary to say that these externalities exist and act on a “*global scale*” (HALL; HELMERS, 2010) and this fact is responsible for the growth of the problem caused by these negative externalities.

On account of these two externalities that are mentioned, two kinds of tools are suitable to face them (externalities): incentives and penalizations. Subsidies are temporarily useful when there is a policy intervention to make the diffusion of the research developed by the subsidies. Thus, it is not enough to make an intervention in order to give subsidies in R&D, because it is necessary to enhance the diffusion of the technology that is developed by this research and it is important to understand the local needs that can be a barrier to the diffusion (HALL; HELMERS, 2010). The



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subsidies are not sufficient to diminish these negatives externalities because the non-green technologies are cheaper and by consequence, the penalization of the use of polluting technologies is necessary.

IPR's are other modality of tool to face the externalities that are associated with innovation and green technologies. Firstly, a feasible and stronger IP protection will assist the transfer of technologies to the host country in a variety of ways "*imports of capital goods, by foreign firms to their subsidiaries and possibly to domestic firms, either via direct investment in the form of partnership or licensing*" (HALL; HELMERS, 2010). Thus, the IP protection must be effective to encourage the transfer of technologies. On the other side, it is not certain that the transfer of technologies will be responsible for the development of human capital. It is difficult to answer if a stronger IP protection brings the development in the host country because it is imposed a barrier to absorb these new technologies by imitation (HALL; HELMERS, 2010).

Stronger IPR's protection is not the only responsible for innovative technologies, because there are others important factors that impact on the green technologies innovation, such as infrastructure, government policies and regulations focus on the development of new technologies, knowledge institutions, access to credit, possibility of acquiring venture capital, human capital etc (LYBECKER, 2014).

IPR's protection could cause the raise of the costs to guarantee their enforcement and could be a barrier to the access to protected innovations and imitate them. On the other hand, IPR could foster direct investment and the transfer of technologies. Despite all problems related to IPR protection, it is possible to see that a weaker IPR protection limits the transfer of technologies (LYBECKER, 2014), as we can see in a study of World Bank (2010) about renewable energy:

"When enforcement of intellectual property rights (IPR) is perceived to be weak, foreign firms may not be willing to license their most sophisticated technologies, for fear that competitors will use it—which is the situation for wind equipment in China. Weak IPR enforcement also discourages foreign subsidiaries from increasing the scale of their R&D activities and foreign



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venture capitalists from investing in promising domestic enterprises.” (WORLD BANK, 2010, p.309)

According to the World Bank, developing countries, like, Brazil, China, India, and Turkey, have received investments in R&D but there are few patents that were registered and probably on account of their weak IPR protection. In the other side, in this same study of the World Bank, it was possible to verify that low-income countries hosted the transfer of new technologies because they do not represent any risk. Thus, *“in low-income countries, weak IPRs do not appear to be a barrier to deploying sophisticated climate-smart technologies”* (WORLD BANK, 2010).

In this scenario, the conclusion is *“in the cases of more advanced technology, the imitation risk is highest when the host country has the capacity to adopt and develop such technology, which implies that the risk is generally greater in middle income countries than in low-income countries”* (HALL; HELMERS, 2010). In addition, it is relevant to state that in stronger IPR's, foreign firms could preferer to license technologies, but they do not have their presence in the country and by consequence, there is no transfer of knowledge, and the gain of the host country is not enough to justify the stronger IPR protection (HALL; HELMERS, 2010).

Finally, there are some conclusions that are important to remark about the relation between IPR's protection and the development of green technologies: Kanwar and Evenson (2009) tried to study the connection between IPR protection and the investments in R&D but they are not successful in this task.

Hall and Helmers stated that it is not possible to achieve a conclusion about the relation between IPR's protection and the development of the country (HALL; HELMERS, 2010). In addition, they conclude that developing countries, where there is a good absorptive capacity, could have positives results if they have a stronger IPR's protection because direct investments and technological transfer will increase.

In the context of green technologies, it is possible to see that many innovations are in the public domain (HALL; HELMERS, 2010). Furthermore, there is a potential market that will target to improve the existing off-patent technologies and

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will seek to adapt them to the local needs. This market will limit the role of IPR's protection for the development of green technologies (HALL; HELMERS, 2010; JOHNSON; LYBECKER, 2009).

Park and Lippoldt (2008) conclude that there is a positive relation between IPR'S and investments in R&D. They stated also that in developing countries, a stronger IPR's protection could help to their domestic development. Lybecker (2014) concluded that the innovative market for green technologies has externalities, risks and uncertainties. In the case of developing countries, the transfer of technologies has the influences by the externalities which complicate the context. Thus, it is necessary the participation of the governments to provide incentives for green technologies because "*without effective public policy markets alone are not likely to provide sufficient incentives for the development of environmental innovations.*" (LYBECKER, 2014).

### **3 BROAD PATENTS, CROSS PATENTS, LOW QUALITY PATENTS AND BIOFUELS OF THIRD GENERATION**

Patents could have a positive role in the market of innovative technologies, for example, they could represent an incentive to innovator that could receive a part of the economic exploitation of his innovation. Also, government needs to develop a legal structure that enables an efficient exploitation of innovations by companies:

Economists have estimated that social rates of return from innovation can be 30% or more. Although innovators should be able to capture some of this return through mechanisms such as head start advantages and trade secrecy, patents also represent a powerful mechanism. (REICHMAN; RAI; NEWELL; WIENER, 2008).

Furthermore, patents could foster venture capital to small firms that develop innovative technologies and in the sector of biotechnologies this is more evident. The





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economic analysis appoints that the presence of small and large companies stimulate innovation more than environments dominated by large ones:

A system of industrial organization that includes small firms and markets is likely to yield more innovation (particularly cumulative innovation) than a system that comprises only large, vertically integrated firms, patents' role in promoting the former type of industrial organization is important. (REICHMAN; RAI; NEWELL; WIENER, 2008).

In the other side, it is possible to verify that patents could be a barrier for innovation on account of the costs of a licensing that is *conditio sine qua non* to continue the development of a innovative technologies. Consequently, broad patents are an obstacle for innovative technologies and this problem could be seen in the case of foundational research or in a research platform that needs some parts that are protected by patents. Thus, many innovations are made unfeasible due to the cost arising from patents on certain parts necessary for the development of new technology:

it bears mention that a 2003 IP survey of IP managers found that 23% said that competitor patents played an important role in decisions to abandon development of otherwise promising technologies. Currently, these problems appear to be most salient in the area of information and communications (ICT) technology (REICHMAN; RAI; NEWELL; WIENER, 2008).

The broad patents in the foundational research could bring many kinds of disputes and in order to avoid the costs of a litigation, it is possible to see many cases of cross-licensing that represents sometimes a risk of violation to antitrust law. There is other problem concerning cross-licensing: when there are many overlapping patents and a cross-licensing agreement it is difficult and an expensive litigation can not be avoided, for example, the microarray technology that represented a paradigmatic case in the field of cross-licenses, because after years of lawsuits, the technology monopoly did not stay with any company that disputed the patent:



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*Microarrays are a powerful genomic research platform that involves depositing short DNA sequences on a support medium as a mechanism to test for gene expression. Over the past decade, multiple firms (including Affymetrix, Hyseq, Incyte, and Oxford Gene Technologies) that raced to dominate the platform have tangled in court with respect to patents they hold on to this platform. Although many of these suits have resulted in settlements involving cross-licensing, with the result that no firm is currently a monopoly provider, it is unclear whether microarray patents have, on balance, been beneficial.” (REICHMAN; RAI; NEWELL; WIENER, 2008).*

These problems that are connected to patents could increase when it is related to low quality patents. They can protect innovative technologies that are obvious. Thus, it is possible to say that low quality patents are the result of an easily combination of known information and on account of this, the Supreme Court of United States in 2007 decided in the case *KRS v. Teleflex* that the requirement to be object of the protection of a patent is the *non-obviousness*, so this decision aims to avoid the protection by law of low-quality patents.

The examination of patents is other problem because there are a lot of application and few days to analysis the solicitations. The consequence is the delay in patent examination, the error in the analysis, low quality patents and arbitrary decisions. In addition, the delay in patent examination is responsible for negative consequences for small firms that depend on venture capital. Thus, a backlog impacts the development of an innovation environment, as it produces negative impacts mainly on small companies and startups:

[...]in both the U.S. and Europe, there are very serious concerns about increasing time delays in patent examination. In the U.S., total pendency for a first application rose from 25.9 months in 2003 to 31.9 months in 2007. Overall, the U.S. has a backlog of over 750.000 patent applications. The delays caused by this backlog have particularly severe implications for small firms that may use patents to attract venture capital.” (REICHMAN; RAI; NEWELL; WIENER, 2008).

In the area of green technologies, there are many questions about patents in innovative technologies related to third generation of biofuels. The third generation of biofuels is the result of a combination of parts of DNA in order to design an organism

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that is capable to produce fuel by taking cellulosic feedstock. The synthetic biology has a lot of problems and discussions about the possibility of the commercial use of its synthetic organisms and this is an obstacle to patents and their legal system of protection.

Therefore, in the field of biotechnology, the difficulties are high and multiple, as business secrecy is relevant for these companies:

*At the moment, synthetic biology is sufficiently removed from commercial application that current patent applications on items like microbial chassis (Craig Venter's firm Synthetic Genomics has applications pending on several such chassis) are not likely to cover the inventions that will ultimately become the standard. But to the extent standardization is achieved in the future, the prospect of patents on synthetic biology standards raises the same concerns as existing patents on various ICT standards. Perhaps most notably, secret infringement, which (as discussed earlier) is currently one prominent strategy for avoiding patent thickets in the context of biotechnology, may be less feasible when relevant platforms are standardized." (REICHMAN; RAI; NEWELL; WIENER, 2008).*

Finally, it is possible to notice that on one hand, patents could bring positive consequences in the area of green technologies because the protection of patents fosters investment to R&D and venture capital to small firms that develop innovative technologies. On the other hand, there are many problems and obstacles concerned with patents in innovative technologies like broad patents, cross-licensing, low quality patents and patents related to synthetic organisms.

#### 4 PILOT PROGRAM OF GREEN PATENTS

Firstly, it is important to notice that Brazil was the first developing country that launches the Pilot Program of Green Patent, in April 2012 (DECHEZLEPRÊTRE, 2013), which would last until April 16, 2015, or until the registration of 500



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applications, but was extended to the third phase, until April 2016, when became a permanent program from December 2016.

This pilot green patent program focuses on accelerating the process for examining patent applications, the completion of which could not be more than two years. In Brazil, the examination of a patent application lasts, on average, four to five years (KAFRUNI, 2020). Also, according to Article 14 of the Resolution n. 75/2013 of the National Institute of Industrial Property (INPI), the first pilot program was limited to the first 500 requests submitted. The categories of eligible green technologies were: alternative energy, energy conservation, waste management, agriculture, and transportation. The cost of submitting a patent application for examination is approximately \$ 500.

The requirements to patent apply are: 1-) patent applications and utility model that were not submitted to technical examination; 2-) applications that have a maximum of 15 claims or three independent claims; 3-) it is necessary to request an examination; 4-) annual fees must be paid; 5-) it must be requested the strategic priority examination (there are official fees and specific format); 6-) when the application is related to access Brazilian Genetic Heritage or the negative statement, it must be brought to INPI (National Institute of Industrial Property's) and 7-) if the application has not already been published, it must be requested publication.

There are other pilot programs of green patents in other countries to accelerate the process of patent examination, like: United States (USPTO); United Kingdom (UKIPO); Canada (CIPO); Israel (IPO); Japan (JPO); South Korea (KIPO); China (SIPO) etc. (SANTOS; OLIVEIRA, 2014, p. 301). The American Office responsible for the patent examination (USPTO) concluded that the program was efficient with 300 applications that were approved and decided to reduce the limitations to apply in May 21, 2010. The reduction of limitation resulted in the application of 1000 petitions in green patents (USPTO, 2010).

The results that were expected by Brazilian Government in 2014 are (REIS et al., 2013): a-) the development of a *data basis* concerning documents related to



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green patents; b-) the foment of the government to provide incentives for the products that were registered; c-) the development of an agenda of public policies in order to encourage innovative green technologies and d-) incentives for investments in R&D in the area of green technologies.

The Brazilian pilot program for green patents accelerated the examination process and some processes were approved in just 9 months. In the 2012-2013 biennium, the results of the program showed inequality in the different regions of Brazil (SOUZA DA SILVA, 2016, p.82), as a richer region represents 46.2% of national orders (southeast region) and the poorest represent only 3.8% of national orders (North region).

After the conclusion of the 3rd Phase, as mentioned, the Green Patents Program was suspended to evaluate the results, and shortly afterward, INPI, through Resolution 175, of November 5, 2016, decided to make the service permanent due to good results achieved. In addition, since 2016, the international applications under the Patent Cooperation Treaty (PCT) have no difference with the national applicants in Brazil (MOREIRA, 2021).

Of the 480 requests submitted during the duration of the pilot program, 325 were considered suitable, of which 112 were granted and 115 rejected, until September 2016. The maximum time for these decisions was about two years (RODRIGUES SILVA, 2021, p. 45).

Finally, despite some suspensions of the priority patent examination process, between January 2020 and March 2021, there were 118 requests for priority examination of green technology. The average response time to these requests was 8 months (BÚSSULA, 2021). Furthermore, until 2021, the category with the highest number of green patent applications was waste management (47.1%) (SOUZA DA SILVA, 2021, p. 89), reflecting the number of green patent applications coming from the richest cities in the country that have several difficulties and costs in waste management.



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#### 4.1 THE PROBLEMS FACED BY THE GREEN PATENT PILOT PROGRAM

Although the number of green patent applications has increased from an average of 80 to 225 per year after the Green Patent Pilot Program, many companies prefer to submit the application outside the priority process of the Green Patent Programs, having an average patent approval wait of 6 years old (VIANA DA SILVA, 2019, p. 292). The main reasons for not preferring *Fast Tracking* of green patents are (DECHEZLEPRÊTRE, 2013, p. 07): 1) additional costs; 2-) there is no long period of secrecy and 3-) no testing prior to product launch.

The first problem related to the increase in costs to participate in the Green Patent Program does not exist in Brazil, in other words, an accelerated examination of patents is not more expensive. However, it is possible to verify in other countries, such as Japan, where additional fees are charged and a research report on the prior art is required (DECHEZLEPRÊTRE, 2013, p. 07).

Though there are no additional costs in Brazil for those who participate requesting the accelerated examination of green patents, it should be noted that, for large companies, a longer period of analysis of the patent is interesting to verify the commercial viability before affording the costs associated with granting the patent (DECHEZLEPRÊTRE, 2013, p. 08). Thus, the Green Patent Program is not interesting and beneficial in all situations, as it depends on the characteristics of the company, competitors, commercial testing period in the market, etc.

The second issue is related to the secrecy disclosure when the green patent is granted because a quick patent grant can increase the risk of competitors developing competitive technologies, as they understand the details of the research developed with the opening of the patent (DECHEZLEPRÊTRE, 2013, p. 08). Thus, a delay in granting the patent is useful to explore the technology that is protected by reason of the patent application without the secrecy disclosure before the patent grant.



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The third problem refers to benefits from patent exam delay because companies could verify which inventions and in which areas the results of patentable technology are applicable. Thus, for many companies, the application of a broad patent is interesting, which will take time to be analyzed and the company will be able to test enough to choose the divisional filing (LONDON ECONOMICS, 2010, p.40). Consequently, as it is not possible to change the legal scope when the patent is granted, patent backlogs are beneficial and facilitate the elimination of small competitors from the market (LONDON ECONOMICS, 2010, p.40). Furthermore, the invention may not be mature yet and the final version may be very different from the original version, so a longer period of patent examination allows additional modifications to the invention, avoiding discrepancies between the initial version of the invention and the final version after tests on the market (DECHEZLEPRÊTRE, 2013, p. 08).

Due to the difference in strategies depending on the type of company, the business model, or the country where the patent application is submitted, the accelerated examination of patents may or may not be beneficial. For small companies, the Green Patent Program is interesting to facilitate the funding raising and to prevent the leakage of technological secrets (DECHEZLEPRÊTRE, 2013, p. 07). On the other hand, for large companies, mainly in the field of computing and biotechnology (LONDON ECONOMICS, 2010, p.41), delays in granting a patent are advantageous for the invention to be explored before defining its legal scope and for eliminating small competitors.

Regardless of the business strategy, it should be remembered that the patent backlog interferes with the development of innovations, as there is a long time for secrecy disclosure, becoming an obstacle for the development of new competitive technologies and for the dissemination of knowledge (LONDON ECONOMICS, 2010, p.42). In addition, the delay in granting patents reduces the quality of patents, as *“senior staff decreases, and those staff spend more time training the new hires”* (PINKOS, 2005). Finally, by harming competition due to backlogs, the price of the



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product remains high due to the absence of competition and the costs of the long patent process are “*imposed on the consumers*” (VAN ZEEBROEK, 2009).

In this way, countries that have a program to accelerate the examination of green patents are, at the same time, fighting backlogs to carry out the objective of developing sustainable technologies in a competitive and innovative environment. In Brazil, Resolution INPI/PR 175, of November 5, 2016, and Resolution INPI/PR 239/2019 encourage the acceleration of the green patent application examination and Resolution INPI/PR 241/2019 combats backlogs. In the same way, the INPI DIRPA Ordinance n. 1/2021 was enacted to specifically combat patent backlogs. Consequently, if the INPI Backlog Combat Plan (INPI, 2021) is successful, the Green Patent Program will have better results in the coming years.

## 5 CONCLUSIONS

As we have seen, uncertainties and externalities create barriers to the development and adoption of green technologies. The main uncertainties are related to the difficulty of calculating real costs, the reception of the market, the ability to appropriate financial returns, the framework of public policies related to green technologies, regulatory impacts, among others.

As for externalities, these are mainly related to the overflow of knowledge produced by R&D efforts; the nature of public goods in green technologies, which benefit those who do not pay for them; and the greater difficulty in socializing the costs of adopting green technologies compared to the natural sharing of the social costs of not adopting these technologies.

In other words, companies are not encouraged to adopt green technologies, as the costs of non-adoption are mainly borne by society, while the costs of investments in green technologies are not shared with society, despite benefiting it.





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The challenges to green innovation, such as externalities and uncertainties, demonstrate the need for government interventions and other tools to mitigate them, such as i) incentives for them to share their costs with society; ii) penalties for those companies that choose non-green technologies; iii) reinforcement of IPR protection; iv) better infrastructure, public policies, research centers, facilities for obtaining credit, the formation of human capital, etc.

Among the main tools exposed, the focus of the analysis was on intellectual property rights. The studies brought up to indicate that the reinforcement in IPR can contribute to increasing the transfer of technology and investments in the host country, however, it cannot be said with certainty that this reinforcement contributes to its further development or that it is, in fact, an incentive to innovation green.

This uncertainty occurs, among other reasons, because patents can also act as barriers to innovation when the licensing of technologies becomes a condition for the continued development of an innovation, especially if such licenses refer to broad patents.

One way out of this problem is the use of cross-licensing, but which poses a great risk of violating antitrust laws, and the overlapping of several patents can lead to costly litigation, problems that are enhanced when dealing with low-quality patents.

Thus, greater protection of intellectual property rights can have positive and negative consequences, as, on the one hand, it contributes to greater investments in R&D and in attracting investments for small companies; on the other hand, it can impose obstacles, such as the need for expensive licenses that hinder the continuity of innovations.

However, the implementation of green patent acceleration programs may enable greater investments in R&D in these technologies, since, at least, it will be able to reveal a new technology, mainly by small companies, since the facilitation of issuing patents in this niche has been able to produce more innovation than in systems that include only large companies.



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It is in this context that, in the wake of developed countries, the Green Patent Pilot Program emerged in Brazil, which came to foster the need to accelerate the issuance of patents to stimulate the creation of these technologies that are so necessary and urgent for environmental preservation and recovery, and in 2016 it became a permanent program of the National Institute of Intellectual Property due to the positive result of the Pilot Program.

Finally, promoting the development of new environmental solutions through the encouragement of green technologies is a global need. Thus, developed and developing countries will have to fight backlogs in the coming years to fulfill the goals of the Green Patent Program and build an innovative and sustainable environment.

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