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Patent cooperation mechanisms in the Pacific Alliance: An initial assessment of the effectiveness of the Patent Prosecution Highway for intra-regional trade integration

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This working paper provides and overview of the Patent Prosecution Highway (PPH), as the only patent cooperation mechanism established within the framework of the Pacific Alliance (PA). It further explores the current state of trade flows of patent intensive goods among PA member countries (Chile, Colombia, Mexico and Peru). Based on this background, it assesses the impact of the PPH as a vehicle to achieve increased levels of intra-regional trade, innovation and, entrepreneurship.

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I. Introduction

Intellectual Property Rights (IPRs) protection in Free Trade Agreements (FTAs) and regional economic integration mechanisms has developed incrementally over the last decade. IPRs were included in the negotiation of almost every major FTA, including the Trans Pacific Partnership Agreement (TPP), the Transatlantic Trade and Investment Partnership (TTIP), among others. Nonetheless, this trend is still controversial given the content and scope of IPRs provisions, in special with regard to sensitive topics such as public health, education, traditional knowledge, biodiversity, biotechnology, the internet, among others. Yet, while the protection of IPRs has increased at the level of FTAs, there is no sign of achieving harmonization of the substantive aspects of the different types of IPRs, such as patents or trademarks. This scenario has led to develop cooperation activities to facilitate the prosecution some types of IPRs, such as patents.

The Pacific Alliance ("PA" or "Alliance") is a regional integration initiative created within the framework of the Declaration of Lima signed in 2011 among Chile, Colombia, Mexico and Peru. This group has since consolidated as one of the most dynamic integration initiatives among the economies in Latin America and the Caribbean (LAC). The PA group, which brings together most of liberal economies in LAC, represents 38% of the regional GDP and about 50% of regional trade with exports valued in USD 513,046 million[1]. PA member economies are committed to the progressive liberalization of movement of goods, services, resources and people.

The PA Additional Protocol (PAAP) entered in force during the first semester of 2016, consolidating all previous FTAs under the umbrella of a more comprehensive agreement. The PAAP is considered a new generation FTA as it includes both WTO plus and WTO extra provisions in several areas including market access, services, investment, trade facilitation, foreign investment and public procurement.

However, the PAAP does not include -yet- a chapter on IPRs protection. PA members have decided to address IPRs related matters in a parallel mechanism. In October 2015, the IP offices of the PA members signed a Joint Declaration in which they acknowledge that IPRs

[1] This figure turns the PA in the seventh largest exporter in the world: China, United States, Germany, Japan, France and Korea are the only countries whose exports are larger than those of the PA.

are important for innovation and entrepreneurship, and also a key factor for regional economic growth. Thus, as a starting point, the four PA IP offices decided to concentrate efforts on expediting patent prosecution through the signature of an agreement regarding a Patent Prosecution Highway (PPH) Program, harmonizing and simplifying the trademark registration process, and establishing a technological platform that serves as a pilot program for the information dissemination and technology transfer.

Against this backdrop, this paper explores the current state of patent flows of patent intensive goods among the PA member economies and assesses whether the patent cooperation mechanisms set forth in the PA, namely the PPH, is the most effective vehicle to achieve increased levels of intra- regional trade, innovation and entrepreneurship among Chile, Colombia, Peru and Mexico.

Accordingly, this paper is structured as follows. Section II will provide a general context on the relationship between IPRs, trade and innovation by reviewing the existing literature on these subjects. Section III will explain the objectives and characteristics of the PPH as contained in the Joint Declaration of the IP Offices of the PA, the Memorandum of Understanding regarding the functioning of the PA PPH, and the PPH application guides issued by each PA patent office. Section IV will describe the trade flows of patent intensive goods within PA economies and constitutes, along with section III, and important and necessary contextual background for section V, which contains the main findings of this analysis. Thus, section V will present and assessment of the effectiveness of the PA PPH to foster intra–regional trade and local innovation. This assessment will be based on OLS and Panel Data gravity models that will allow to profile the industries that could benefit the most the PPH. Section VI will conclude this paper by presenting the main conclusions.

II. General Background: The relationship among patent protection, international trade and innovation

The relationship between patent protection and international trade forms part of a broader discussion involving IPRs in general. The literature review indicates that there is no consensus as to the effects of increased IPR protection on international trade. On the one hand *Fink and Primo,*[2] *Briggs and Park,*[3] and *Montobbio and Sterzi*,[4] among others, agree that strengthening IPRs policies -including patent protection- has a positive effect on trade, benefiting both exporters and importers regardless of their level of development. On the other hand, there is a group of authors that share as less optimist view about the overall effects on trade of a stronger IPRs protection. From the perspective of *Maskus and Penubarti,*[5] *Akkoyunlu,*[6] and *Auriol, Biancini and Paillacar,*[7] and more recently *Shin, Lee and Park*[8] a stronger IPR protection has a positive impact on trade flows, however, developed economies tend to benefit more from the additional protection than developing countries. The views of these two groups of authors are further discussed in this section.

The group of authors defending the positive impact of IPRs on trade for both developed and developing countries, believe that additional protection will lead to an increase in foreign direct investment, technology transfer and economic growth in developing countries, in particular because such framework would also encourage companies to innovate as it facilitates access to developing markets by reducing costs associated with the technological lost. *Fink and Primo* [2] adduce that a higher IP protection may motivate exporting companies to relocate their operations in markets with less stringent regulations, thus, potentially increasing their exports. The findings of *Briggs and Park* [3] reveal that greater IPRs protection

[2] Carsten Fink and Carlos A Primo, 'How Stronger Protection of Intellectual Property Rights Affects International Trade Flows' (1999) World Bank Policy Research Working Paper

[3] Kristie Briggs and Walter Park, 'There will be exports and licensing: the effects of patent rights and innovation on firm sales' (2013) Journal of International Trade & Economic Development

[4] Fabio Montobbio and Valerio Sterzi, 'The Globalization of Technology in Emerging Markets: A Gravity Model on the Determinants of International Patent Collaborations' (2014) 44 World Development 281–299

[5] Keith Maskus and Mohan Penubarti, 'How Trade-Related are Intellectual Property Rights?' (1995) Journal of International Economics, No. 39, 227- 248

[6] Şule Akkoyunlu, 'The Correlation between the Level of Patent Protection and International Trade' (2013) NCCR Trade Regulation. Working Paper, No. 2013/36.

[7] Emmanuelle Auriol, Sara Biancini and Rodrigo Paillacar, 'Intellectual Property Rights and Trade' (2015) Working Paper. Toulouse School of Economics

[8] Wonkyu Shin, Keun Lee and Walter G Park 'When an Importer's Protection of IPR Interacts with an Exporter's Level of Technology: Comparing the Impacts on the Exports of the North and South'(2015) The World Economy. John Wiley & Sons Ltd.

generates the necessary conditions for the creation of export platforms, not only for local companies. Similarly, *Montobbio and Sterzi* [9] observed a positive sign in the interaction between IPR and trade. According to their results, greater IPR protection in emerging markets stimulates technological collaboration, which favours export to third markets.

The other group of authors including *Maskus and Penubarti,*[10] *Akkoyunlu,*[11] *Auriol, Biancini and Paillacar,* [12] and *Shin, Lee and Park*[13] argue that only developed economies are able to assume the costs related to the implementation of a stronger IPR framework, thus creating a trade barrier for domestic companies in the developing countries. Based on their assessment, a more comprehensive IP protection attracts more imports from innovative countries -in most cases developed markers- to replace uncompliant domestic production. From this point of view, higher IP protection, although may increase trade, is not necessary the best policy for developing economies, in particular those willing to promote their innovation ecosystems.

With regard to patents, *Gnangnon and Moser*[14] obtained evidence that irrespective of the countries being developed or developing, strengthening patents rights protection was conducive to export diversification. However, the impact of such protection in reducing the concentration of their exports baskets was higher in developed countries compared to developing ones. *Maskus and Yang*[15] also found results consistent with the hypothesis that a higher protection of IP increases the exports of products of patent-intensive industries. However, according to their results and contrary to other studies, this effect is especially notable in middle-income countries, even more so than in developed economies.

[9] Fabio Montobbio and Valerio Sterzi, 'The Globalization of Technology in Emerging Markets: A Gravity Model on the Determinants of International Patent Collaborations' (2014) 44 World Development 281–299

[10] Keith Maskus and Mohan Penubarti, 'How Trade-Related are Intellectual Property Rights?' (1995) Journal of International Economics, No. 39, 227- 248

[11] Șule Akkoyunlu, 'The Correlation between the Level of Patent Protection and International Trade' (2013) NCCR Trade Regulation. Working Paper, No. 2013/36.

[12] Emmanuelle Auriol, Sara Biancini and Rodrigo Paillacar, 'Intellectual Property Rights and Trade' (2015) Working Paper. Toulouse School of Economics

[13] Wonkyu Shin, Keun Lee and Walter G Park 'When an Importer's Protection of IPR Interacts with an Exporter's Level of Technology: Comparing the Impacts on the Exports of the North and South'(2015) The World Economy. John Wiley & Sons Ltd.

[14] Kimm Gnangnon and Constance Besse Moser, 'Intellectual Property Rights Protection and Export Diversification: the Application of Utility Model Laws' (2014) World Trade Organization Economic Research and Statistics Division Working paper

[15] Keith E Maskus and Lei Yang, 'The Impacts of Post-TRIPS Patent Reforms on the Structure of Exports' (2013) RIETI Discussion Paper Series 13-E-030

Several authors including *Roffe and Santa Cruz*,[16] *Blyde*,[17] *Diaz*[18] and *Roffe*[19] have studied the relationship between IP and trade within the Latin American context. While *Roffe and Santa Cruz*,[11] *Diaz*[13] and *Roffe*[14] work centred in the analysis of IP provisions in RTAs. Based on their findings, the majority of the countries in LAC have subscribed FTAs including WTO plus (TRIPS plus) provisions on IPR. *Blyde*[12] conducted, to our knowledge, one of the most comprehensive assessments on the impacts on IPRs on the trade flows in Latin America. Several conclusions could be drawn from his assessment: 1) A stronger IP protection was expected to increase bilateral imports of IPR-intensive goods in the majority of the countries in the region, in particular middle income economies; 2) The results show that a higher patent protection has a limited impact on the imports of goods that are difficult to imitate. This was due to the low imitation capacity of regional economies, even the most developed ones. However, to the degree that regional economies are able to generate a good environment for technology transfer, a stronger IPRs might generate potential efficiency gains in the region; and 3) strengthening IPRs will encompass considerable costs to the countries in the region, but in the long-run could have a positive impact on both the imports of high technology goods and the attraction of foreign investment.

Now, the relationship between patent protection and innovation is no less controversial than the relationship between IPRs and international trade. According to *Léger*,[20] as the innovation process results in not only a new product or process, but also new information that has public good characteristics (non-rival and non-excludable), it can be difficult for inventors to appropriate the financial gains. Therefore, government intervention should address this market failure, for instance, through the grant of IPRs. By granting temporary exclusive rights (patents) on inventions, right-holders can price their products above marginal cost, and hence recoup their initial research and development (R&D) investments. Moreover, this exclusive right can also stimulate further R&D leading to more innovation. In exchange for the exclusive right granted, the patent applicant is required to disclose the details of his

[16] Pedro Roffe and Maximiliano Santa Cruz, 'Los derechos de propiedad intelectual en los acuerdos de libre comercio celebrados por países de América Latina con países desarrollados' (2006) CEPAL - Serie Comercio Internacional 70

[17] Juan Blyde, 'Assessing the impacts of Intellectual Property Rights on Trade Flows in Latin America' (2006) IADB-INTAL Occasional Paper 34

[18] Alvaro Diaz, 'América Latina y el Caribe: La propiedad intelectual después de los tratados de libre comercio' (2008) CEPAL

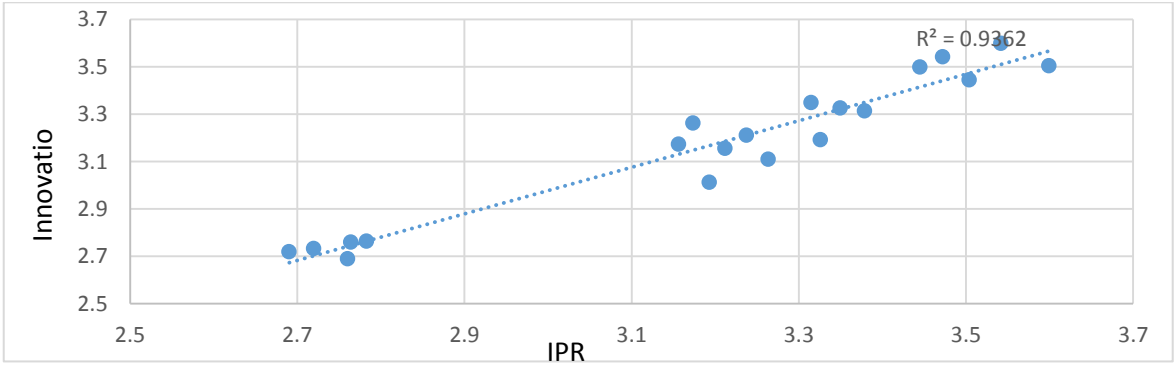
[19] Pedro Roffe, 'Free trade agreements and the Americas' (2013) International Review of Intellectual Property and Competition Law, 44 (8), 932-942

[20] Andréanne Léger, 'The role(s) of intellectual property Rights for innovation: a review of the empirical evidence and implications for developing countries' (2007) DIW Discussion Papers, No. 707, 7-8

invention, so that society can benefit from the knowledge. This is *quid pro quo* is known as the patent social contract.[21]

The interaction of IPRs protection and innovation indicators could further illustrate this relationship. Based on the World Economic Forum Global Competitiveness report indicators on IPR protection and Innovation, this two variables are highly correlated in the context of the PA economies (their r-squared is 94%)[22]. Even though it is not possible to deduce causality from their correlation, IPR protection seems to be one of the driving forces for innovation in this region, thus, providing a positive argument for their relationship.

Figure 1: Correlation between WEF- Global Competitiveness Indicators on Innovation and IPR (2011-2016)



Source: authors based on WEF data (2016)

Nonetheless, it is also worth to remark that the number of patents granted does not automatically indicate if innovation is happening or not. Innovation, in fact, is different from invention. Innovation is defined as the generation of an idea or invention, and the conversion of that invention into a business or other useful application. Or, in simple terms, innovation is equal to invention plus exploitation.[23] That means that while inventions can be granted patent rights, in order to become innovation, those patented inventions have to be commercialized. In fact, in many cases there is a considerable time lag between the moment of invention (and patenting) and innovation.

[21] Fritz Machlup and Edith Penrose, 'The Patent Controversy in the Nineteenth Century' (1950) Journal of Economic History, 1

[22] R-squared measures how much of the percentage of the variations in the dependent variable in a linear regression are explained by the changes independent variables

[23] Edward Roberts, 'What We've Learned: Managing Invention and Innovation' (1988) 31 Research Technology Management, 12-13 <http://secure.com.sg/courses/ICI/Grab/Reading_Articles/L02_A02_Roberts.pdf> accessed 2016

That is why cross-border patenting is a better indicator of the levels of innovation activity as it makes evident the commercial need of a patent holder to secure patent rights in other jurisdictions or markets. In this context, cooperation mechanisms for cross-border patent examination can stimulate innovation to occur. However, the innovation process can also happen in silence. For instance, many companies opt to not patent their inventions but decide to keep them secret. Trade secret protection has special importance for small and medium-size enterprises (SMEs) since it has lower costs as compared to the patent system and do not require registration.[24]

On the contrary, the importance of innovation is undisputable. Innovation influences economic growth and is determinant for global competitiveness. An empirical study carried out by *Fagerberg and Srholec* analysing four factors of economic development (i.e. development of the innovation system, quality of governance, character of the political system, and degree of openness to trade and foreign investment) showcases that "countries that succeed in developing and sustaining strong innovation capabilities (…) do well economically while those that fail tend to fall behind".[25]

Yet, it has to be remark that while patents and other IPRs, to certain extend, can play a role in the innovation process, innovation also depends on many other factors, including R&D expenditure, the number of SMEs in a given country, availability of venture capital funding, high tech exports, among others.[26] It is for this reason that patents by themselves are not likely to overcome the serious problems preventing innovation in developing countries which are related to low levels of technological capacities, imperfect markets for technology, risk and capital, high transaction costs and weak legal systems.[27]Against this backdrop, this paper will analyse the role of patent cooperation mechanisms in the PA and how they can influence intra-regional trade, innovation and entrepreneurship in the PA.

[24] Douglas C Lippoldt and Mark F. Schultz, 'Trade Secrets, Innovation and the WTO' (2014) E15 Initiative, 2 <http://e15initiative.org/wp-content/uploads/2015/09/E15-Innovation-LippoldtSchultz-FINAL.pdf> accessed 28 October 2016

[25] Jan Fagerberg and Martin Srholec, 'National Innovation Systems, Capabilities and Economic Development' (2008) 37 (9) Research Policy, 1427

[26] European Commission, 'Patent Costs and Impact on Innovation: International Comparison and Analysis of the Impact on the Exploitation of R&D Results by SMEs, Universities and Public Research Organizations' (2015) <http://ec.europa.eu/research/innovation-union/pdf/patent_cost_impact_2015.pdf> accessed 14 October 2016

[27] Léger (n 13) 29

III. The Pacific Alliance Framework for Intellectual Property Rights and patent cooperation mechanisms

A. The Pacific Alliance Framework for Intellectual Property Rights

Negotiations regarding IPRs within the PA should be analysed in light of the PA broader objectives and legal framework. On the one hand, the PA main objectives are: first, to form an area of deep integration and move progressively towards the free movement of goods, services, resources and people; second: to drive growth, development and competitiveness of the economies of its members; and third: to become a platform of political articulation, economic and commercial integration and projection to the world, especially towards the Asia-Pacific region.[28] On the other hand, the legal framework that supports the achievement of these objectives is given by the PAAP. The PAAP not only consolidates existing FTAs among the four member countries of the PA, but also tackles aspects of beyond the content of former FTAs, inter alia, e-commerce, trade facilitation among others.

However, PA members have also established different technical working groups as a parallel mechanism to address other trade related issues and internal matters. Those working groups are characterized by having a more practical approach and an evolving agenda.

Against this background, unlike current FTAs, the PAAP does not include a chapter on IPRs. The PA members have decided to address IP aspects, pragmatically, through a technical working group with an evolving agenda. The IP working group has concentrated - until this point - on administrative cooperation initiatives.

B. Patent cooperation mechanisms within the Pacific Alliance

The IP Working Group - established in 2012 during the Cadiz Declaration - was instructed in 2013 to "prepare and implement a work plan with joint and specific cooperative actions between intellectual property offices, in order to share experiences and extend the collaborative and communication links between them, in order to achieve a better use of the IP system for the benefit of its users".[29] In light of these instructions, on 8th October, 2015,

[28] *See*: <https://alianzapacifico.net/en/que-es-la-alianza/> accessed 12 November 2016
[29] 'Declaración de Cali' (23 May 2015) <http://www.sice.oas.org/TPD/Pacific_Alliance/Presidential_Declarations/VII_Summit_Cali_Declaration_s.pdf > accessed 22 October 2016

the Chilean National Industrial Property Institute (INAPI), the Peruvian National Institute for the Defence of Competition and the Protection of Intellectual Property (INDECOPI), the Superintendence of Industry and Commerce of Colombia (SIC), and the Mexican Institute of Industrial Property signed the "Joint Declaration of the IP Offices of the Pacific Alliance".[30]

In the Joint Declaration, the four PA IP offices remark that the protection of IPRs contributes to the generation of innovation and entrepreneurship in the region and is key to regional trade and economic growth. Accordingly, they agree to collaborate on the three main aspects: (i) the facilitation of fast, accessible and high quality patent examination procedures that would reduce patent office's backlogs; (ii) harmonization and simplification of trademark prosecution procedures, (iii) the creation of a platform for information sharing technology transfer.

It is important to remark that the Joint Declaration only puts forward cooperation activities in the areas of patent and trademark protection. Other issues such as copyrights or protection for trade secrets have not been mention at all. Moreover, as *Cusipuma and Ramirez* have pointed out, issues of common importance for the four countries of the PA, such as traditional knowledge have not been addressed so far.[31]

While acknowledging the importance of other aspects of IPRs protection, this paper is limited in scope to the patent cooperation activities. A patent is an exclusive right granted to an inventor that allows him or her to exclude others from making, using or selling the invention during the life time of the patent in the country were the right was granted. Hence, patents are territorial rights. That is why companies doing business in several markets are urged to patent their rights in each jurisdiction that is relevant for their business. In fact, as the expansion of global activities of business entities continues there is an imperative need for the acquisition of high quality simultaneous patent rights in a plurality of countries. Once a patent is granted, patent holders can exclude other competitors from the market (preventing infringement) and/or use the patent granted for licensing purposes.

[30] 'Declaración Conjunta de las Oficinas de Propiedad Intelectual de la Alianza del Pacífico' (8 October 2015) <http://www.gob.mx/cms/uploads/attachment/file/100549/13_-_2015-10-08_AP.pdf> accessed 22 October 2016

[31] John Cusipuma and Gonzalo Ramírez, 'Pacific Alliance: An Opportunity to Establish New Priorities on the Protection of Intellectual Property in Free Trade Agreements' (2016) SECO / WTI Academic Cooperation Project Working Paper, 41 <http://www.wti.org/media/filer_public/15/2a/152ab462-7e33-43ad-b321-745f2b0f5393/working_paper_no_12_2016_cusipuma_and_ramirez.pdf> accessed 3 October 2016

Nonetheless, in order to secure a patent, three requirements shall be met: novelty, inventiveness and industrial applicability.[32] In general terms, novelty requires than an invention shall be new. Thus, a patent can be denied by any evidence that an invention is already known to the public or was disclosed before the patent application date. Inventiveness refers a significant advance over the state of technology at the time the patent application was made. This requirement aims at the preventing the patenting of trivial advances in the state of technology. Industrial applicability, in turn, refers as to whether an invention is capable of use and provides some identifiable benefit.

While those principles are minimum standards deriving from international treaties (i.e. Agreement on Trade-Related Aspects of Intellectual Property –TRIPS-) there are divergences between each country as, for instance, the norms and administrative procedure to grant a patent.[33] That is why, when seeking patent protection in multiple countries, applicants have to follow different processes according to each country where they wish to patent an invention because different countries have different interpretations of patentability minimum standards. Those differences may lead to different final decisions, if for instance, the same subject matter is regarded as patentable in certain countries but not in other countries (e.g. software patents). Against this background, several efforts to harmonize substantive aspects of patent law beyond those minimum standards have proved unsuccessful.[34] Instead, patent offices have turned to cooperation efforts.[35]

Cooperation efforts are of increased importance given the fact that the number of patent applications worldwide has increased over the last decade and patent offices face growing backlogs.[36] Latin America is no exception to backlogs of unresolved cases and slow

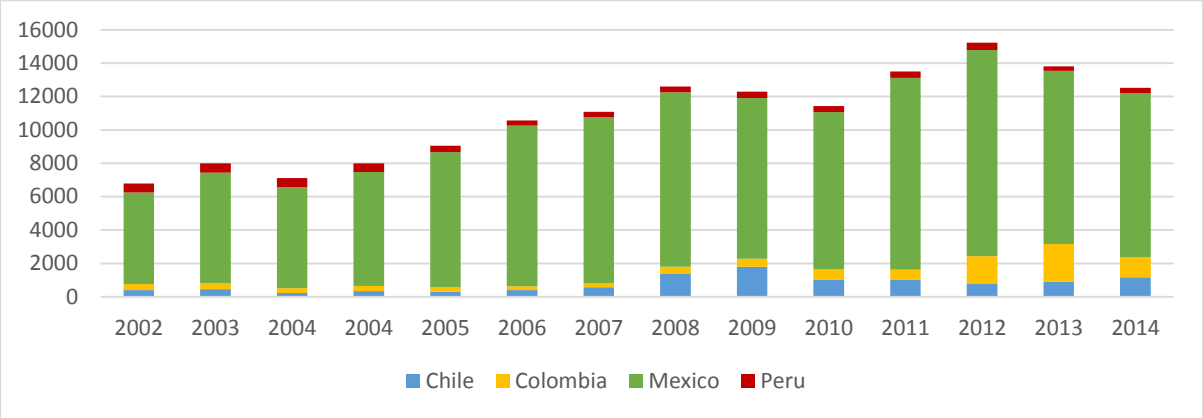
[32] TRIPS Article 27.1
[33] Peter Drahos, *The Global Governance of Knowledge: Patent Offices and their Clients* (Cambridge University Press 2010) 10
[34] Joseph Straus and Nina-Sophie Klunker, 'Harmonisation of International Patent Law' (2007).38 International Review of Intellectual Property and Competition Law, 907- 926
[35] *See*: International Worksharing and Collaborative Activities for Search and Examination of Patent Applications <http://www.wipo.int/patents/en/topics/worksharing/> accessed 04 November 2016
[36] As it was showcased by a 2010 study by London Economics, increases in backlogs translate into longer pendency times (which is the time that it takes for a patent application to be processed from the date of filling to the day of grant). Furthermore, extended pendency time reduces the value of patents to applicants, which in turn reduces incentives for innovation. Likewise, applications that do not meet requirements for patentability may remain unexamined, and hence gain temporary monopoly power for a longer period. Finally, uncertainty over patent applications and the scope of granted patent rights may deter investment and hence slow down, or prevent, valuable innovation. See; 'Economic Study on Patent Backlogs and a System of Mutual Recognition',

procedures. They remain as some of the main obstacles for the protection of IPRs in the region.[37]

On the one hand, backlogs are explained by the increase of patent applications in the countries of the region. Based on data from the WIPO Statistics Database for the period 2011-2015, the number of patent applications has increased in the region, albeit in different proportions. Mexico shows the highest increase of patent applications, from 14,055 in 2011 to 18,071 in 2015. Mexico is followed by Chile, where the number of patent applications has increased from 2,792 in 2011 to 3,274 in 2015. In the case of Colombia, the number has increased from 1,193 in 2011 to 2,242 in 2015. Finally, in the case of Peru, the number of patent applications has maintained relatively stable, with 1,168 patent applications filed in 2011 and 1, 249 filed in 2015.

With regard to the number of patents granted, the most recent data is from 2014 when 12,531 patents were granted (over a 100% increase compare to 2002 figures). However, it is important to mention that over 78% of the patents were granted in Mexico, while only 10% of them in Colombia: 9% in Chile and 3% in Peru. (See figure 2).

Figure 2: PA performance in the WEF- Intellectual Property Protection indicator (2011-2016)



Source: authors based on WIPO data (2016)

On the other hand, the analysis of each patent application can be very complex. For instance, in order to determine whether an invention is novel or not, a patent examiner has to make a

(2010) London Economics, x <https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/328678/p-backlog-report.pdf> accessed 13 October 2016

[37] Ellen McDermott, 'The Latin American Patent Challenge', (2009) No. 188 Managing Intellectual Property, 48-53

search of the relevant prior art. This can take a long time and consume many resources. Therefore, it is not surprising that obtaining a patent in PA member countries, as in other Latin American countries, can take five to eight years on average.[38] Delays in the patent granting process create uncertainty which affect business decisions, such as whether or not enter a market and reduce incentives for innovation.[39]

Those are the reason behind the PPH and why countries have agreed on different types of cooperation mechanisms, as reflected for instance in the Patent Cooperation Treaty or other PPH around the world. But not all cooperation mechanisms can be compared or have the same structure. The following chart is useful in understanding the differences among (i) deep patent law harmonization, (ii) procedural harmonization, and (iii) work sharing mechanisms.

Figure 3: Types of procedural and substantive patent harmonization.

<table>
<tr><td>Procedural</td><td colspan="2">Procedural Harmonization
PCT, PLT Unification of forms</td></tr>
<tr><td>Substantive</td><td>Deep Harmonization
TRIPS, SLPT</td><td>Work Sharing
PPH, SHARE, Triway</td></tr>
<tr><td></td><td>Legislative
(Legal)</td><td>Administrative
(Practical)</td></tr>
</table>

Source: *Dongwook Chun, Patent law harmonization in the age of globalization: The necessity and strategy for a pragmatic outcome (2011) Cornell Law School Inter-University Graduate Student Conference Papers, Paper 45.*

As it can be observed from the figure above, the PPH is only a work-sharing mechanism. It does not harmonize substantive aspects of patent law. The details about the functioning of the PPH will be reviewed in the next section.

[38] Ibid.
[39] European Commission (n 19) 8

1. The Patent Prosecution Highway: A work-sharing administrative mechanism for patent accelerated examination

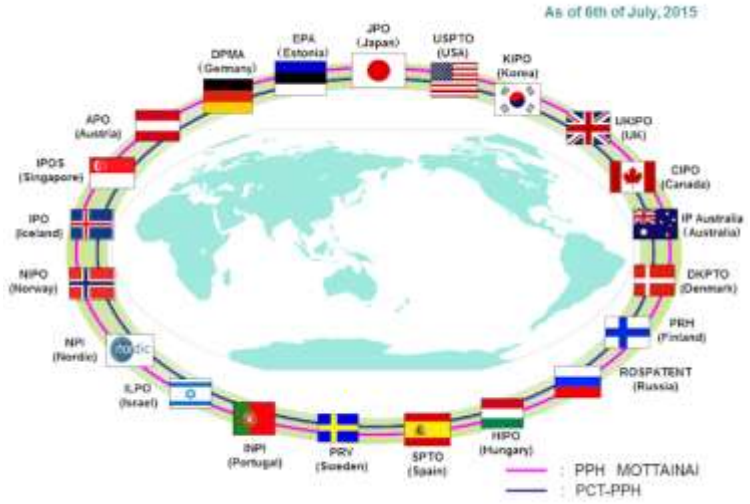
PPHs, in general, allow patent offices to benefit from work previously done by an earlier patent office. This refers to (i) prior art search results and/or (ii) examination results. Therefore, they help to reduce examination workloads and allow applicants to obtain patents in less time and more efficiently. In this sense, a PPH scheme facilitates cross-border patenting. It is important to remark that the PHH does not grant any substantive right to the patent applicant. In fact, a patent office can deny the granting of a patent even if an earlier patent office has already granted one. This is the reason why the PPH does not constitute a substitute for harmonization of patentability standards. Instead, it is just a framework that allows participating PPH patent offices to utilize previous search and/or examination results. Moreover, under the PPH, each national patent office has the obligation to conduct its examination in accordance with its own sovereign national patentability law and standards.[40]

Yet, as mentioned earlier, work sharing amongst the major patent offices has become an attractive patent cooperation policy. In fact, while in 2006 the first PPH agreement was established between Japan Patent Office (JPO) and United States Patent and Trademark Office (USPTO), in 2016 there were more than 40 patent offices involved in PPH programs, as it can be seen from below.[41]

[40] John Tessensohn, 'The Scylla of accelerated examination and Charybdis of competitor coverage - prospering from the Patent Prosecution Highway' (2011) 33 (6) European Intellectual Property Review, 357-367

[41] Data as of 1st July 2016. *See*: 'PPH portal index', <http://www.jpo.go.jp/ppph-portal/index.htm> accessed 13 October 2016

Figure 4: PPH network as of July 2015



Source: Patent Prosecution Highway Portal Site

Many argue that making use of information collected by previous patent offices can improve the quality of the examination procedure as the scope of the prior art is expanded or refined.[42] Nonetheless, this also depends on the degree of the similarity of the scope of claims presented for the same patent application in different patent offices. For this reason, one of the requirements of PPH cooperation schemes is that the claims of the patent application presented in subsequent patent offices must be substantially similar to the claims presented in previous patent offices.

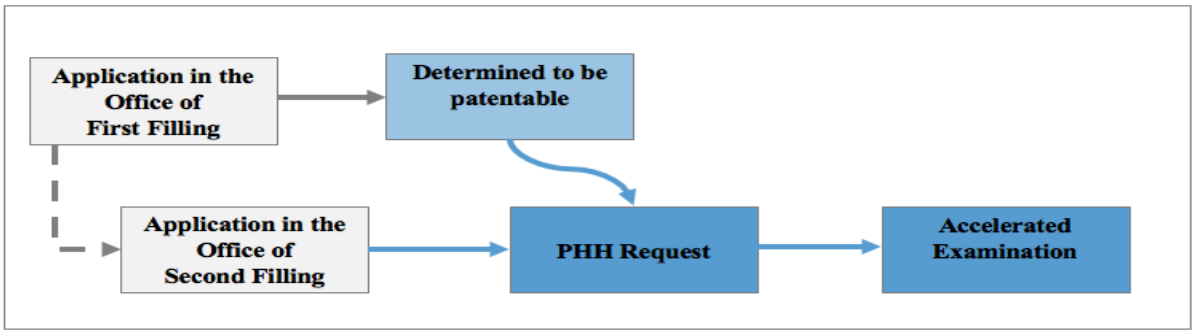
2. Patent Prosecution Highway models

PPHs have evolved since they were first use in bilateral agreements among patent offices. Therefore, we can talk about a *traditional PPH model*, the *Patent Cooperation Treaty (PCT) - PPH model*, and an enhanced version: *the Mottainai model*.

The *traditional PPH model* is usually found in bilateral agreements between individual patent offices. It sets eligibility requirements and often includes a limitation on country of priority filing, which typically must be in same country as the Office of First Filing (OFF). Only if this requirement is met, the work of the OFF may be used in the Office of Second Filing (OSF) to expedite examination in the OSF. This is a limitation for patent applicants. The traditional model could be better explained by the following figure:

[42] It shall be noticed that different offices have access to different information databases.

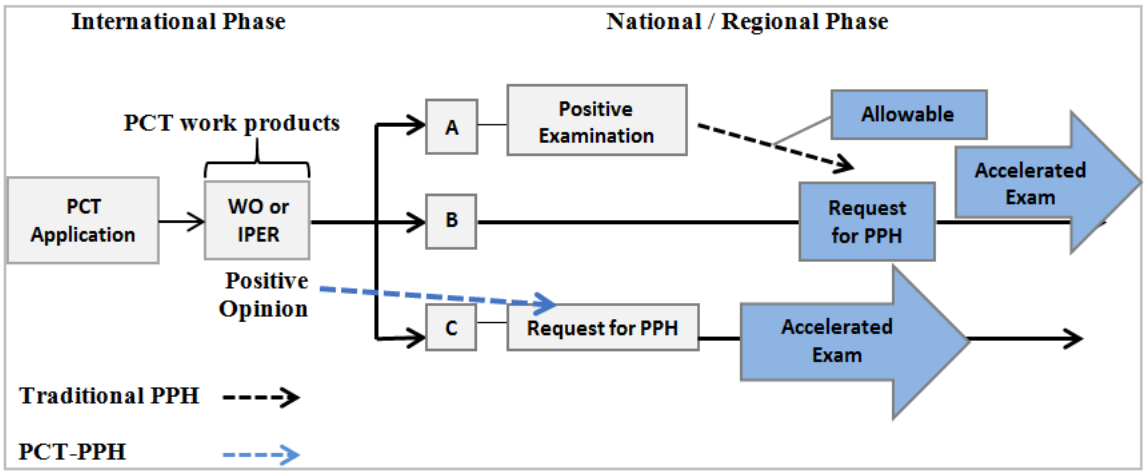
Figure 5: Traditional PPH model



Source: Patent Prosecution Highway Portal Site

In contrast, under the *Patent Cooperation Treaty (PCT)-PPH model*, applicants requesting accelerated examination are allowed to make use of a written opinion established by certain International Searching Authorities (WO/ISA), a written opinion established by certain International Preliminary Examining Authorities (WO/IPEA) or an international preliminary examination report (IPER) established by certain International Preliminary Examining Authorities.[43] Those are called PCT work products and can be issued by designated PCT offices.

Figure 6: PCT - PPH model



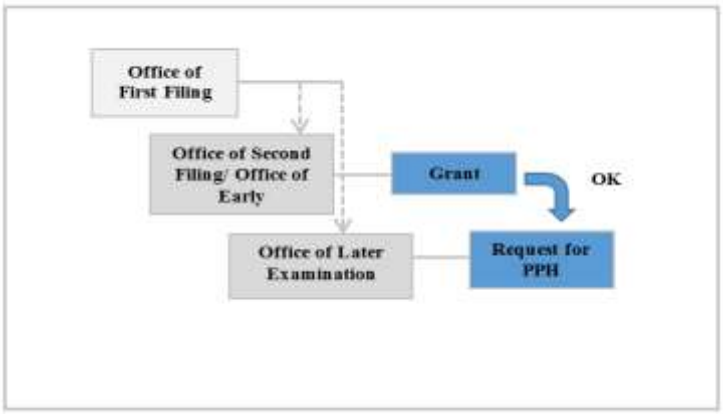
Source: Patent Prosecution Highway Portal Site

Finally, under the *Mottainai model* the terminology changes. Instead of having an OFF and OSF, there is an "Office of Earlier Examination (OEE)" and "Office of Later Examination

[43] See: PPH Portal Site: Patent Prosecution Highway using PCT international work products <https://www.jpo.go.jp/torikumi_e/t_torikumi_e/pph_pct/pct_e.htm> accessed 01 December 2016.

(OLE)". The reason for this change is that an applicant is allowed to make use of any positive examination report issued by an OEE -not just one from the office of first filing (OFF)- in their request under the PPH framework. The Mottainai model is considered to be an improved version of previous PPH programs as it makes the most use of prior resources for patent examination. Indeed, "Mottainai" is a Japanese word meaning "a sense of regret concerning waste when the intrinsic value of an object or resource is not properly utilized".[44] This model can be better represented in the following way:

Figure 7: PPH-Mottainai model



Source: Patent Prosecution Highway Portal Site

3. Characteristics of the Patent Prosecution Highway under the Pacific Alliance patent cooperation activities framework.

In the context of the PA, the first milestone of patent cooperation mechanisms is the PPH. This mechanism was established in 2015 for a trial period of three years (starting in July 1, 2016) and it is renewable for 1 year. The PA offices may terminate the PA PPH pilot program early if the volume of participation exceeds a manageable level.[45]

[44] *See*: PPH Portal Site: PPH Mottainani Pilot Set to Launch (Easing of PPH Requirements) <https://www.jpo.go.jp/ppph-portal/mottainai.htm> accessed 01 December 2016

[45] *See*: Memorandum de entendimiento sobre el programa piloto del procedimiento acelerado de patentes (December 2015) <https://www.indecopi.gob.pe/documents/20791/368017/MOU+PPH,+Alianza+del+Pacifico.pdf/e1fe3cc7-c8c9-4543-b688-4f5231dbcb83> accessed 25 November 2016

According to the memorandum of understanding, the PA PPH will follow the Mottainai model, as previously described.[46] Therefore, where the request for participation in the PA PPH programme is granted, the application will be advanced and will be processed in an accelerated manner.

While the memorandum of understanding provides for general grounds for the functioning of the PA PPH, each PA patent office have established guidelines on how to access the program. In general terms, the request for accelerated examination can be based on:

> (a) Patent examination results from an earlier PA patent office, where the PA patent office results contains one or more claims determined to be patentable or allowable;
> (b) A PCT work product (written opinion of the ISA (WO-ISA) or international preliminary examination report (IPER)) issued by Chile´s INAPI

When the request for benefiting from the PA PPH is based on a positive examination result from a PA patent office, both the OLE application on which PPH is requested and the OEE application forming the basis of the PPH request shall have the same earliest date (whether this be a priority date or a filing date). Additionally, claims presented before the OLE have to be the substantially the same than the ones presented under the OEE. For this reason, the applicant is requested to fill in a table where the claims presented before the OEE and OLE have to show correspondence. Yet, not all claims have to be presented as part of the PA PPH. Finally, the OLE should have not begun substantive examination of the application yet.

On the other hand, in case of a PA PPH application based on a PCT work product issued by Chile´s INAPI, the guidelines set out similar requirements as the ones described above. Additionally, the PA PPH application must suffice at least one of the conditions set out in the guidelines regarding the PA PPH application relationship to the international application under the PCT.

[46] In the 11th Summit of the PA in Puerto Varas, Chile, the presidents of the four PA member countries instructed the working group on IP to continue with the implementation of the PPH at the national level. Accordingly, each national IP office has issued guidelines on the implementation of the PPH. Those guidelines follow the Mottainai model and can be found in <https://alianzapacifico.net/en/temas-de-trabajo/> accessed 05 December 2016

An interesting aspect to remark is that the PA PPH does not cover applications for utility models as well as industrial designs. However, utility models are within the scope of the PROSUR - PROSUL PPH scheme, which is a recent cooperation project between the National Institute of Industrial Property (INPI) of Argentina, the National Institute of Industrial Property (INPI) of the Federative Republic of Brazil, the Ecuadorian Institute of Intellectual Property (IEPI), the National Directorate of Intellectual Property (DINAPI) of the Republic of Paraguay, the National Institute and the National Directorate of Industrial Property (NCPA) of the Republic of Uruguay, along with the patent offices of Chile, Colombia and Peru.[47]

Utility models are often called "petty patents" or "innovation patents". Their scope of protection is significantly lower than the one provided by the patent system. For instance, the term of protection varies between 7 to 10 years, and in some countries utility model protection is not available for processes.[48] However, utility models are much easier to obtain and have been considered an option to incentivize minor and incremental innovation. Furthermore, they have been mainly used by resident applicants rather than non-resident applicants.[49] This is why, the PPH under PROSUR – PROSUL might represent a more attractive option for SMEs than the PPH under the PA scheme.

Having explained the main objectives and characteristics of the PPH programs and how this scheme will function in the context of the PA, the next section will review the trade flows of patent intensive-goods in the PA.

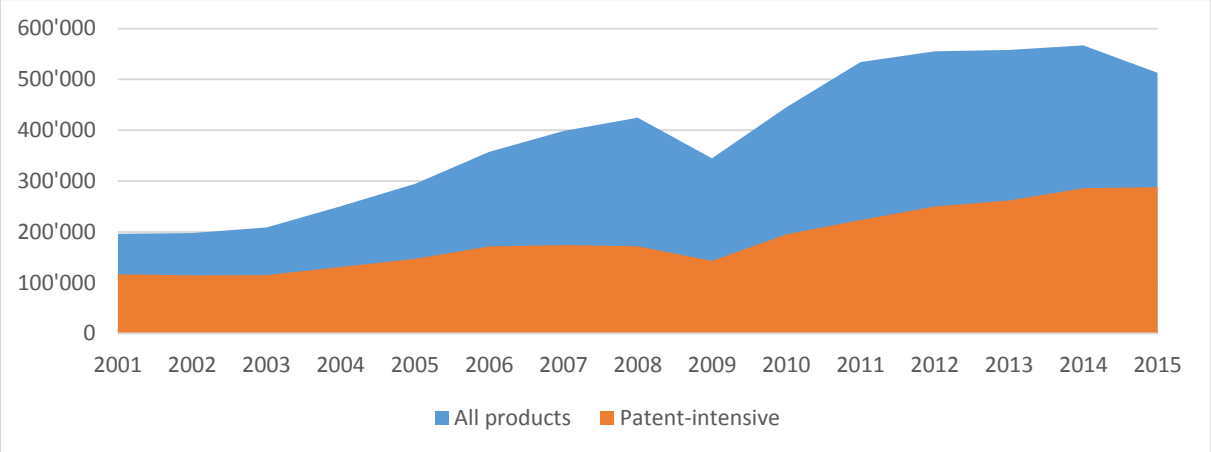
[47] *See*: Guía PPH INAPI – Prosur, < http://www.inapi.cl/portal/publicaciones/608/articles-9464_recurso_1.pdf> accessed 04 December 2016.
[48] *See*: WIPO: Protecting Innovations by Utility Models,
< http://www.wipo.int/sme/en/ip_business/utility_models/utility_models.htm> accessed 04 December 2016.
[49] Henning Grosse Ruse – Khan, 'The International Legal Framework for the Protection of Utility Models' (2012) 12-10 Max Planck Institute for Intellectual Property & Competition Law Research Paper, 13 < https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2160229> accessed 02 December 2016.

IV. Trade flows of patent intensive-goods in the Pacific Alliance

This section describes the trade flows of patent-intensive products among PA economies. The patent-intensive industries were determined based on the USPTO[50] classification. The USPTO determined that most patent-intensive industries are: computer equipment, communication equipment, electronic components, basic chemicals, pharmaceutical, industrial machinery, semiconductors, resins and synthetic rubber, and other equipment (mostly comprised of navigational and medical equipment). As such, trade figures for their corresponding tariff-lines were accounted. Other sectors despite a lower patent-intensiveness such as plastics and rubber products, motor vehicles and aerospace and non-mineral manufactures were also included in the assessment due to their importance for PA economies, in both the value of their exports and employment.

The value of PA's patent-intensive exports experienced a steady increase during the period 2001-2015, reaching a record value of USD 288,085 million in 2015, representing 56% of regional exports to the world. During the 2011-2015 period PA total exports increased by 3.3% per year, while patent-intensive exports expanded by 8.2% per year. Moreover, while total exports experienced a 9.5% drop in 2015, the value of exports of patent-intensive goods increased by 0.8% bringing good news to regional economies (see figure 8).

Figure 8: PA export performance (2001-2015). USD millions



Source: author estimates based on UN Comtrade (2016)

[50] For additional information on the patent-intensive industry classification and the corresponding tariff-lines (NAICS system) for each industry, please refer to: U.S. Patent and Trademark Office (USPTO) and Economics and Statistics Administration (ESA). Intellectual Property and the U.S. Economy: Industries in Focus. (2012).

Data at a country-level reveals significant differences in the export patterns of PA members. The country with most patent-intensive exports is Mexico, while Chile, Colombia and Peru have limited participation. Based on the five-year average, Mexico exported USD 251,750 million, about 96.2% of the PA patent-intensive exports. The second exporter was Colombia with a significantly smaller average value of USD 4,508 million, Chile USD 4,014 million; and Peru USD 1,527 million.

Patent-intensive goods represented over 67% of the Mexican exports to the world, but were not significant for other PA economies. Based on the five-year average, patent-intensive exports were 8% of Colombian exports to the world; 5% of the Chilean exports and 4% of the Peruvian exports to the world. The fastest expansion of patent-intensive exports occurred in Mexico with 8.5%, while the other countries experienced growth below the average. For Peru, 6.1%; Colombia 2.1%; and Chile 2% (See table 1).

Table 1: Country distribution of PA patent-intensive exports (2011-2015) USD million

	2011	2012	2013	2014	2015	Average (2011-2015)
Pacific Alliance	**223,273**	**249,966**	**261,835**	**285,838**	**288,085**	**261,799**
Chile	**4,095**	**4,061**	**3,952**	**4,409**	**3,553**	**4,014**
Share	1.8%	1.6%	1.5%	1.5%	1.2%	1.5%
Colombia	**4,582**	**4,551**	**4,836**	**4,472**	**4,101**	**4,508**
Share	2.1%	1.8%	1.8%	1.6%	1.4%	1.7%
Mexico	**213,118**	**239,794**	**251,491**	**275,373**	**278,972**	**251,750**
Share	95.5%	95.9%	96.0%	96.3%	96.8%	96.2%
Peru	**1,478**	**1,561**	**1,557**	**1,584**	**1,458**	**1,527**
Share	0.7%	0.6%	0.6%	0.6%	0.5%	0.6%

Source: author estimates based on UN Comtrade (2016)

The most important markets for patent-intensive goods exported by the PA economies were: United States, Canada, Brazil, Germany, and China. The value patent-intensive exports to United States market averaged USD 261,799 million (80% of PA patent-intensive exports). The second was Canada with a value of USD 7,838 million; Brazil USD 5,350 million; Germany USD 3,664 million; and China USD 3,061 million. Among the markets that expanded the most for PA patent-intensive exports were: Italy 52%; France 37%; Korea 16%; China 14%; Spain 14%; and United Kingdom 10%; to mention a few. The intra-PA trade that increased by 9.4% during this period. (See table 2).

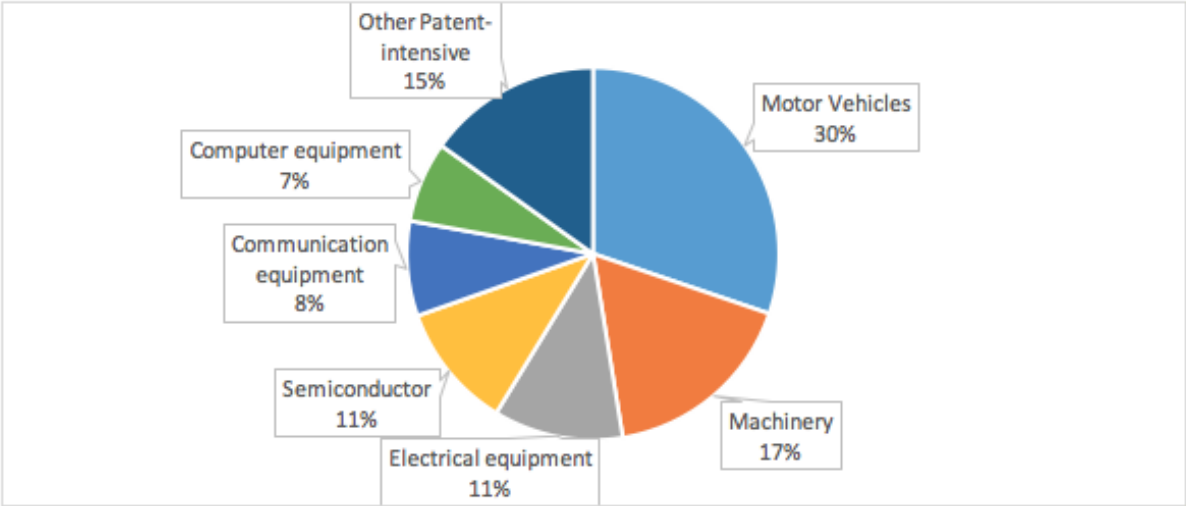
Table 2: Most important markers for PA patent-intensive exports (2011-2015) USD million

Importers	2011	2012	2013	2014	2015	Average (2011-2015)	Share of world
World	223,273	249,966	261,835	285,838	288,085	261,799	
Intra- PA	6,079	6,705	6,552	6,599	5,659	6,762	2.6%
Colombia	3,770	3,433	2,845	3,286	2,319	3,131	1.2%
Peru	1,603	1,715	1,803	1,822	1,682	1,725	0.7%
Chile	1,499	1,468	1,400	1,277	1,284	1,386	0.5%
Mexico	333	554	631	528	553	520	0.2%
Main markets							
1. United States	173,434	195,376	208,499	232,527	237,742	209,516	80.0%
2. Canada	7,366	7,498	7,460	8,089	8,775	7,838	3.0%
3. Brazil	5,479	6,028	5,881	5,404	3,956	5,350	2.0%
4.Germany	4,121	4,192	3,510	3,220	3,275	3,664	1.4%
5. China	2,034	2,872	3,473	3,826	3,103	3,061	1.2%
6.Argentina	2,129	2,064	2,232	1,490	1,576	1,898	0.7%
7. Ecuador	1,584	1,690	1,686	1,639	1,189	1,558	0.6%
8.Venezuela	1,686	2,109	1,584	1,343	986	1,542	0.6%
9. Netherlands	1,872	1,632	1,430	1,231	1,344	1,502	0.6%
10. Japan	1,028	1,400	1,164	1,439	1,246	1,255	0.5%
11.France	554	1,152	1,333	1,452	1,660	1,230	0.5%
12. UK	1,043	873	953	1,264	1,524	1,131	0.4%
13. Bolivia	1,038	1,147	1,132	1,234	970	1,104	0.4%
14. Italy	997	978	646	617	705	789	0.3%
15. Guatemala	793	792	761	770	827	788	0.3%

Source: author estimates based on UN Comtrade (2016)

The industry-level analysis reveals that motor vehicles, industrial machinery, and electrical equipment were the industries in the PA with the largest patent-intensive exports. Based on a five-year average (2011-2015), the motor vehicles industry in the PA economies exported a total of USD 79,095 million, 30% of PA's patent-intensive exports to the world. The second industry was the industrial machinery with an average value USD 45,096 million, 17% of PA's patent-intensive exports; and the electrical equipment accounting for USD 24,484 million, 1% of PA's patent-intensive exports. Based on this five-year average, other industries with significant exports of patent-intensive goods include the semiconductors 11%; communication equipment 8%; and computer equipment 7%. (See figure 9)

Figure 9: Largest patent-intensive industries in PA (average 2011-2015). USD millions



Source: author estimates based on UN Comtrade (2016)

The industries with the largest increases in the most recent years (2011-2015) were the motor vehicles with average growth of 12% per year; industrial machinery with average growth of 11% per year; other equipment with average growth of 10% per year; semiconductors with average growth of 9% per year; and plastics and rubber products with average growth of 9% per year. Other industries like computer equipment and basic chemicals experienced a negative trend during the period as their exports decreased up to 1%.

Intra-PA export of patent-intensive goods is low compared to the value exports of these goods to other international markets. The value of intra-PA exports of patent-intensive products averaged USD 6,762 million, which is only 2.6% of PA exports of patent-intensive exports to the world. The largest market among PA members for patent-intensive goods produced within the region was Colombia, whose purchases averaged USD 3,131 million or 1.2% of PA exports of patent-intensive goods; followed by Peru USD 1,725 million, Chile USD 1,386 million, while for Mexico the value was only USD 520 million.

During the period 2011-2015, the value of intra-PA patent-intensive exports increased by an average of 9.4%. This value is higher than growth of exports of this same group of products to the rest of the world. This trend suggests that even though intra-PA exports of patent-intensive goods are low, they are increasing faster than the total trade. The value of Colombian imports of this products from other PA markets increased by 3.5% per year during the last five years. The value for Peru was 6.6%; Chile 2.5%; and Mexico 17.2%. Furthermore, the analysis of intra-PA exports reveals other interesting insights. Based on

their total value, the industry with largest intra-PA exports was also motor vehicles USD 2,195 million equivalent to a share of 32.5%; followed by machinery USD 778 million or 11.5%; and electrical equipment USD 713 million or 10.5%. These three industries were also predominant at the global level, however, other industries such as plastic and rubber accounting for USD 646 million or 9.6%; resin and synthetic rubber USD 578 million or 8.6%; and the pharmaceutical products USD 393 million or 5.8%, had more importance at the intra-regional level than they do at the global level.

This trend is also reflected on the proportion of intra-PA exports as share of exports to the world. The industries were intra-PA trade has the highest proportion were resin and synthetic rubber, with over 14.9% of PA exports of these products going to other PA markets; followed by pharmaceutical products with 11.8%; and basic chemicals with 8.9% (See table 3).

Table 3: Intra PA patent-intensive exports (average 2011-2015). USD millions

	Value in USD million	Share of Intra-regional	Intra-regional as % industry exports to world	Growth of intra-regional
Total	6,762			9.4%
Motor vehicles	2,195	32.5%	2.9%	17.2%
Machinery	778	11.5%	1.7%	3.0%
Electrical equipment	713	10.5%	2.4%	5.6%
Plastic and rubber	646	9.6%	7.3%	4.4%
Resin and synthetic rubber	578	8.6%	14.9%	1.2%
Pharmaceuticals	393	5.8%	11.8%	4.4%
Non-metal manufactures.	365	5.4%	7.6%	1.6%
Basic Chemicals	307	4.5%	8.9%	3.1%
Semiconductors	267	3.9%	0.9%	13.0%
Communication equipment	253	3.7%	1.2%	-12.5%
Computer equipment	200	3.0%	1.1%	-4.2%
Other equipment	50	0.7%	0.4%	9.3%
Aerospace	15	0.2%	0.5%	15.0%

Source: author estimations based on UN Comtrade (2016)

Some of the industries were intra-PA exports grew faster than those to the rest of the world include the motor vehicles, where intra-PA exports increased by 17.2%; aerospace industry with an average increase of 15%, semiconductors 13%; and basic chemicals 3.1%. The

exports of the remaining patent-intensive industries experienced lower intra-PA growth than did their values to the rest of the world. This situation was particularly negative for the computer equipment as intra-PA exports contracted by an average of -4.2%, while intra-PA exports of telecommunication equipment contracted by an average of -12.5%. More information about these trends in available in annex 1.

The overall assessment reflects that there is a nascent patent-intensive industry in the PA, with exports expanding faster than the rest of the products these countries trade with the world. Moreover, the figures revealed that patent-intensive exports constituted a significant share of PA exports to the world. However, further analysis indicated most of regional patent-intensive exports are concentrated in Mexico while only a very small proportion in other PA economies (no more than 8% of their total exports). The value of Mexican exports of patent-intensive exports to NAFTA[51] markets overshadowed the actual dimension of the value of regional patent-intensive exports, which is still limited compared to total trade. Because of this reason, the intra-PA patent-intensive exports provided with a better snapshot of the current situation. The most important patent-intensive industries in the region were the motor vehicles, industrial machinery, electrical equipment, while industries such as resin and synthetic rubber, pharmaceutical products and basic chemicals, while not the largest in overall terms, are very intra-PA oriented (most of their exports are to other PA economies).

The identification of the largest exporters of this products at a company level revealed that the majority of the companies exporting patent-intensive products from a PA country, are multinational companies from developed countries, while only a small percentage of them are actual multilatinas (Latin American multinationals).[52] This results suggests that foreign multinational are still the dominant actors in patent-intensive industries PA, and therefore are the most likely to benefit from the improvements in the regional IPR protection ecosystem.

The following section introduces an empirical model that aims to describe the factors that influence trade on patent-intensive exports among the PA and their most important trading partners around the world, as well as those of an increase in the resident patent applications.

[51] The North American Free Trade Agreement is composed by Canada, Mexico and U.S. Most of Mexican exports are orientated to NAFTA's markets, and patent-intensive exports are not the exception.
[52] Data at the company level was found using Legiscomex (available for Chile, Colombia, Mexico and Peru).

V. Assessment of the Pacific Alliance intra-regional trade on patent-intensive goods and the effectiveness of the Patent Prosecution Highway as an instrument for trade integration

A. Gravity Model for Trade: factors that influence patent-intensive exports of the Pacific Alliance economies

This sub-section introduces and describes the results of an empirical model established in order understand the factors that influence intra-regional trade on patent-intensive goods among PA economies. After an exhaustive literature review, the Gravity Model for trade was found to be the most appropriate tool for this purpose. Diverse authors such as *Fink & Primo Braga,*[53] *Folfas & Kuznar*[54]*, Sheets,*[55] have used the Gravity Model to assess the impacts of IPRs on trade. There are a number of variables that are inherent to the Gravity Model: *Trade Flows* are dependent variable (for the purpose of our model this are the export of patent-intensive goods), *Gross Domestic Product* (GDP) and *Distance* are the basic independent variables. Other independent variables included in the model are based on *Wang, Wei, & Liu,*[56] : *Relative Factor Endowments* as a proxy for transaction and transportation costs and *Residents Patent Application* as a proxy for innovation. A binary variable for *Free Trade Agreement* was also tested to assess their impact on patent-intensive exports.

The empirical works of *Stay & Kulkarni*[57] endorse a more simplify the model and do not consider the effects of the variables across time. Other authors like *Egger & Pfaffermayr* [58] and *Nuroglu & Kunst* [59] use a dynamic gravity model with time varying panel data because of its wider power to describe trade flows. Because of this, our model was tested using linear regressions (OLS) and panel data, to reflect both theoretical approaches.

[53] Carsten Fink and Carlos A Primo, 'How Stronger Protection of Intellectual Property Rights Affects International Trade Flows' (1999) World Bank Policy Research Working Paper
[54] Pawel Folfas and Andzelika Kuznar, 'International trade in intellectual property-intensive goods' (2013)
[55] Darren Sheets, 'How Intellectual Property Regimes Influence Trade with the United States: An Empirical Approach for 2000 – 2008' (2013) 3(2) Journal of Applied Economics and Business Research, 67-80
[56] Chengang Wang and others, 'Determinants of bilateral trade flows in OECD countries: evidence from gravity panel data models' (2010) 33(7) World Economy, 894-915
[57] Kevin Stay and Kishore G. Kulkarni, 'The Gravity Model of International Trade, a Case Study: The United Kingdom and Her Trading Partners' (2016) Amity Global Business Review, 28-39
[58] Peter Egger and Michael Pfaffermayr, 'The Proper Panel Econometric Specification of the Gravity Equation: A Three-Way Model with Bilateral Interaction Effects' (2003) 28 (3) Empirical Economics, 571-580
[59] Elif Nuroglu and Robert M. Kunst, 'Competing Specifications of the Gravity Equation: A Three-Way Model, Bilateral Interaction Effects, or a Dynamic Gravity Model with Time-Varying Country Effects?' (2014) 46 (2) Empirical Economics, 733-741

We consider the following econometric specifications for the OLS:

$$(1)\quad lnRealExports_i = \beta 0 + \beta 1 dist_{ij} + \beta 2 GDP_i + \beta 3 GDP_j + \beta 4 RLFAC_{ij} + \beta 5 Patentap_i$$

$$(2)\quad lnRealExports_i = \beta 0 + \beta 1 dist_{ij} + \beta 2 GDP_i + \beta 3 GDP_j + \beta 4 RLFAC_{ij} + \beta 5 Patentap_i + \beta 6 FTA_{ij}$$

Where:

Variable	Description	Data source
$LnRealExports_i$	Patent-intensive exports of PA countries to their top 30 trading partners (in natural logarithm)[60].	UN Comtrade
$Dist_{ij}$	Weighted distance between the exporting country(i) and the destination (j)	CEPII distance database
GDP_i	Expenditure-side real Gross Domestic Product (PPPs in USD millions 2011) of the exporting country (i)	Penn World Table 9.0
GDP_j	Expenditure-side real Gross Domestic Product (PPPs in USD millions 2011) of the importing country (j).	Penn World Table 9.0
$RLFAC_{ij}$	Difference of the Relative Factor Endowment between both countries.[61]	Penn World Table 9.0
$Patentap_i$	Patent applications in country (i)	WIPO
FTA_{ij}	Binary variable that indicates whether there is a Free Trade Agreement between the exporting country (i) and trade partner (j).	SICE-OAS

For the three-way dynamic Gravity Model then we take into consideration the effects of time so the model specification results as following:

$$(3)\quad lnRealExports_{it} = \beta 0 + \beta 1 dist_{ij} + \beta 2 GDP_{it} + \beta 3 GDP_{jt} + \beta 4 RLFAC_{ijt} + \beta 5 Patentap_{it}$$

$$(4)\quad lnRealExports_{it} = \beta 0 + \beta 1 dist_{ij} + \beta 2 GDP_{it} + \beta 3 GDP_{jt} + \beta 4 RLFAC_{ijt} + \beta 5 Patentap_{it} + \beta 6 FTA_{ijt}$$

[60] The exports are measured in USD thousands for each particular year were deflected using the Wholesale Price Index in the US to eliminate nominal effects.

[61] Where RLFACij = |ln(Kj/Lj) – ln(Ki/Li)| with K and L denoting capital stock and labor force, respectively. Capital stock at current PPPs (in mil. 2011US$) and labor is the number of persons engaged in the labor force in millions of persons.

The results of the linear OLS regression are presented in table 4

Table 4: OLS regressions

OLS	1	2
Weighted distance ij	-0.0002***	-0.0002***
GDPi	1.96E-6***	1.97E-6***
GDPj	1-10E-7***	1.12E-7***
RLFACij	0.3563***	0.3338***
Resident Patent Application i	0.0023***	0.0021***
FTAij		0.3572**
R^2	0.7035	0.7092

** ,**,*** mean statistical significance at the alpha levels of 0.1, 0,5 y 0,01.*

Based on the OLS model, the effect of the distance on the real exports of patent-intensive goods is negative in both scenarios. For every additional kilometre between the exporter country and its trading partner there is a reduction in patent-intensive exports of 0.02%. The case of GDPi and GDPj are also relatively constant across the two regressions. Any additional USD million in the exporting country means a 0.0002% increase in patent-intensive exports. For the trade partner, an additional USD million in its GDP can raise patent-intensive exports around 0.00001%. For the associated coefficient of RLFAC, the effect of an additional 1% in the difference of the capital intensity of the trade partner over the exporting country means an expected increment between 0.3338% and 0.3563% of the value in patent-intensive exports. More importantly, the results for the Resident Patent Application were also significant and their value suggests that for every additional resident patent application in the exporting country, patent-intensive exports are expected increase in a value ranging from 0.21 to 0.23%.

In the first regression the R-squared[62] was 0.7035. That means that from the 100% of the variations in the real exports of patent-intensive goods 70.35% of them are due to the changes in the exogenous variables (Distance, GDP, RLFAC, Patent Application). The second linear regression includes the FTA binary variable increased the R-squared to 0.7092. The coefficient associated with the FTA variable is 0.3572. This suggests than when there is a FTA between the exporter and its trading partner there will be an expected increase in exports of patent-intensive goods of 35.72% in comparison to the scenario without FTA.

[62] R-squared measures how much of the percentage of the variations in the dependent variable in a linear regression are explained by the changes independent variables, i.e, the linear model specified.

The results for the panel data model are presented in table 5.

Table 5: Panel Data Random Effects

Data Panel Random Effects	3	4
Weighted distance	-0.0002***	-0.0002***
GDPi	3.89E-6***	3.59E-6***
GDPj	5.88E-8***	4.56E-8**
RLFAC	0.5394***	0.5218***
Resident Patent Application	-0.00004**	-0.0002
FTA		0.4128***
R^2 within	0.4542	0.4669
R^2 between	0.7015	0.7125
R^2 overall	0.6615	0.6741

,,*** mean statistical significance at the alpha levels of 0.1, 0,5 y 0,01.*

The panel data regression using random effects offers some additional insights. These results are important because they not only capture the effects of fluctuations in the values of variables, but also those of changes in time over the trade flows of patent-intensive goods. Based on the results in Table 5, patent-intensive exports are expected to reduce about 0.02% per every additional kilometre between the exporter country and its trade partner. GDP changes of both the exporting country and is trading partner seem to have a more limited impact on patent-intensive exports when random effects are applied. An additional USD million causes an increase on patent-intensive exports of around 0.0003 % in the two models. While an additional million in the GDP of importing country causes an expected increase of about 0.000005% to the exported value of patent-intensive goods.

The first important change in the results is related to expected effect of an additional resident patent application in the exporting country. Based on the results for the first panel data regression the expected effect of additional resident patent application in the exporting country is a reduction in patent-intensive exports of about 0.004%. When considering the existence of a FTA, the expected reduction of patent-intensive exports due to an additional resident patent application is 0.02%, however, the coefficient of this second regression was not statistically significant. The RLFAC results are similar in both regressions. An increase in 1% in the difference of the capital intensity of the importing country in comparison to the exporting country has an expected increase in patent-intensive exports ranging from 0.5218% to 0.5394%. When an importing country has more capital relative to labour force than the exporting country, trade of patent-intensive goods is expected to be higher. The results

suggest the existence of a FTA between the exporting country and the destination could increase patent-intensive exports by 41.28% compared to cases where a FTA does not exist between the PA member and its trading partner.

Based on the assessment of both OLS and panel data results, most variables included in this model such as the GDP exporting country, the GDP of the destination market, distance, relative factor endowment, resident patent applications in the exporting country and the existence of FTAs among the pair countries have an impact on the exports of patent-intensive products. Variables such as the GDP of both the exporting country and the market always had a positive impact on this trade flow. Variables for relative factor endowment and FTAs provided as well with positive impacts across the different exercises. Based on the OLS model, Patent application variable had positive effects, however when tested using panel data, its results were either negative or not statistically significant. Distance as expected under the Gravity model, always had a negative impact on the evaluated trade flows.

Some of these variables are not susceptible to changes in public policy (for instance distance and GDP), however, there is room for policy recommendation on the remaining areas, in particular those of resident patent applications, FTAs and relative factor endowments.

With regard to resident patent applications in the exporting country, if the OLS model is consider, the results put forward the idea that an increase in the number of them would have a positive impact on patent-intensive exports. These results justify current efforts to promote innovation across the PA, as well, as the initiatives to promote IPRs cooperation activities and the establishment of a fast-track patent system as discussed earlier on this paper.

Now, with regard to the negotiation of FTAs, the results suggest that the existence of this type of agreements is an influential variable to exports of patent-intensive goods. Based on this, trade of patent-intensive goods among PA economies and the world could benefit from further liberalization, however, the decision of negotiating a FTA should also take into consideration other economic and political factors and the potential impacts to other industries and the scope of its IPR clauses. Moreover, the model suggests that an improvement of regional competitiveness in areas related to transactional and transportation costs (i.e. trade facilitation, infrastructure and connectivity), could benefit the expansion of export-orientated patent-intensive industries.

B. Profile of Industries that could benefit from the Pacific Alliance Patent Prosecution Highway

Based on WIPO statistics for the period of 2011 to 2015, most of the patent applications and patents granted in PA members correspond to non-resident applicants (see section III of this paper). With regard to the patents granted, for example, during the year 2015 most of patents were granted to non-residents, In the case of Peru, out of 362 patent granted in 2015, 343 were granted to non-residents while only nineteen were granted to residents. In the case of Chile, 1,058 patents were granted to non-residents while 150 were granted to residents. In the case of Colombia, 921 patents were granted to non-residents while 82 were granted to residents. Finally, in the case of Mexico, 8, 928 patents were granted to non-residents while 410 were granted to residents. The gap between these two groups, resident and non-resident inventors, cannot be more clear.

This means that nationals or residents in PA member countries make a limited use of the patent system. Then, the question is to what extent, they can benefit from a complementary PPH framework and whether the PPH is the ideal cooperation mechanism to enhance intra-regional trade and entrepreneurship in the region, as it seems that local applicants do not file patent applications as much as non-residents.

According to data (as the end of June 2016) from the PPH Web Portal administered by JPO, the main users of current PPH schemes existing in Colombia and Mexico are inventors from Japan, United States and Europe. For instance, under the PPH schemes available in Colombia, the main PPH applicants are: United States with 121 PPH applications; Japan with 12 PPH applications; and Spain with 2 PHH applications. Inventors from Chile have filed zero applications under the PPHs offered by Colombia. In the case of Mexico, the main user is Japan with 226 PPH applications. Other users include: the European Patent Office with 48 PPH applications; Spain with 41 PPH applications; Korea with 13 PPH applications; Canada with 9 PPH applications; United States with 6 PPH applications; China with 4 PPH applications; and Singapore with 2 PPH applications.[63] In this context, the extent to which the

[63] PPH Portal Site: Statistics, <https://www.jpo.go.jp/ppph-portal/statistics.htm> accessed 27 November 2016

PPH could increase the levels of intra-regional trade of patent-intensive goods seems to be limited.

Furthermore, as provided in the reviewed guidelines, the PPH permits the applicant accelerated examination and protection on the condition that the claims presented in the second patent application are the sufficiently similar or correspond to the ones presented in the application presented before the first patent office.[64] This means that the applicant gives up the chance to more carefully craft claim language before the second patent office. This trade-off should be of particular interest to companies that need to secure patent rights quasi simultaneously in several jurisdictions. This could be the case of companies producing fast-moving technologies, such as the computer and electronic industries[65]. Indeed, in the case of patent applications under the JPO, one of the industries that benefited the most from the PPH was the American electronics and software industry.[66] Likewise, in the context of the USPTO, the PPH user profile consist mostly of Japanese and Korean companies applying for patents for communication, semiconductors, electrical and optical systems and components.[67]

Additionally, companies involved in licensing activities, particularly agreements involving large numbers of patents, would benefit from the PPH. This is in line with the findings of WIPO regarding the patenting trends in 2014. According to the 2015 WIPO Indicators, the decision to seek patent rights beyond domestic borders depends on various factors, such as the business strategy of the applicant and market size, to name a few. However, in any case it is costly for an applicant to seek protection in a large number of jurisdictions.[68] This will also indicate that SMEs and start-ups do not fulfil the typical profile of a PPH applicant.

In fact, all the above mentioned characteristics indicate that typical PPH users are transnational corporations. They would benefit the most out of the PHH framework as they are aware that earlier patent allowance permits earlier exclusivity in a given market. As *Chun*

[64] However, it is not necessary that the PPH application contains all the claims that are part of the patent application presented at the office of early examination.
[65] World Intellectual Property Indicators (2015) reveal that Information and Communication Technologies (ICT) are in fact an area in which the number of patent applications has grown substantially over the years. According to data up to 2014, the ICT sector accounts for the largest share of patent applications worldwide. The reasons that explain the situation above are the fast pace evolution of the industry and the benefits of securing patent rights in order to engage in licensing activities.
[66] Tessensohn (n 33)
[67] Ibid 14
[68] Ibid 14

remarks, there is overwhelming evidence (e.g. statistical data regarding the use of Microsoft and IBM of the PPH at the JPO) that proves that international applicants such as multinational corporations can enjoy quicker and reliable patentability determination in multiple jurisdictions through the PPH.[69]

From the above comparative experience of other PPH mechanism, it can be inferred that the industries that will use the PPH system intensively are industries in a fast moving environment that need to secure patents in several jurisdictions and industries that are engaged licensing businesses. Now, the question is whether or not, such industries exist in the four member countries of the PA. This can only be explained based on the economic data provided in the previous sections.

According to the industry-level analysis undertook in the economic section of this study, it was showcased that motor vehicles (30%), machinery (17%), and electrical equipment (11%) were the industries with the largest patent-intensive exports. Other industries with significant exports of patent-intensive goods include the semiconductors (11%); communication equipment (8%); and computer equipment (7%).

Table 6: Industries' share on patent-intensive exports

	Total	Chile	Colombia	Mexico	Peru
Share of total exports					
Patent-intensive	48%	5%	8%	67%	4%
Share of patent-intensive					
Airspace	1%	1%	3%	1%	1%
Basic Chemicals	1%	6%	5%	1%	12%
Communication equipment	8%	4%	1%	8%	2%
Computer equipment	7%	1%	0%	7%	0%
Electrical equipment	11%	9%	10%	11%	6%
Industrial Machinery	17%	24%	8%	17%	14%
Motor vehicles	30%	18%	12%	31%	3%
Non-metal mineral manuf.	2%	4%	10%	2%	15%
Other equipment	5%	1%	2%	5%	1%
Pharmaceutical	1%	7%	11%	1%	4%

[69] Dongwook Chun, 'Patent Law Harmonization in the Age of Globalization: The Necessity and Strategy for a Pragmatic Outcome' (2011) 45 Cornell Law School Inter-University Graduate Student Conference Paper <http://scholarship.law.cornell.edu/cgi/viewcontent.cgi?article=1074&context=lps_clacp > accessed 21 October 2016.

Plastic and rubber	3%	20%	14%	3%	35%
Resins and rubber	1%	3%	21%	1%	6%
Semiconductors	11%	3%	2%	11%	1%

Source: author estimates based on UN Comtrade (2016)

As previously mentioned, the most dynamic sectors are the most interested in streamlining the patent application process as they are the most likely to benefit from PPH. The industry-level analysis reveals that such industries (e.g. ICT-related industries such as semiconductors, communication and computer equipment) while not the most import industries in the PA based on the size of their exports, still have a significant share in regional patent-intensive exports (their sum makes for over 25% of PA's patent-intensive exports). Yet, there is a notable gap between these statistical results when Mexico is excluded from the analysis.

C. Additional aspects to consider for future patent cooperation activities

The PPH has other aspects of importance to remark. The PPH as incorporated in the framework of the PA does not mandate extra fees to request examination. This means that prosecution costs will be reduced for patent applicants within the PA PPH. Thus, in view of the zero financial cost, universities, SMEs and start-up companies with little budget for patent prosecution could take advantage of this opportunity. However, they will have to be educated about the benefits of cross-border patenting and the attractive payoffs of accelerated patent examination. As the Inter-American Development Bank has recently pointed out, SMEs in Chile, Colombia and Mexico are not aware or have misconceptions regarding the IP framework in their home countries. This leads them to operate in an "informal" environment where simply the registration of their IP rights is not part of their commercial strategy.[70]

Further cooperation activities in the area of patents could include not only the absence of fees to access the PPH but also a reasonable reduction of fees to make the registration of patents more attractive. However, this is an idea that has to be carefully explored. At the level of the European Union it has been studied how the costs of filing and maintaining a patent influence the number of filings and the lifespan of patents.[71] While low fees reduce the costs incurred by inventors, they are likely to lead to higher numbers of patent applications and may

[70] Ignacio L. De León and Jose Fernandez Donoso, 'El costo de uso de los sistemas de propiedad intelectual para pequeñas empresas innovadoras: El caso de Chile, Colombia y México' (2015) Banco Interamericano de Desarrollo 2 <http://www.oepm.es/export/sites/oepm/comun/documentos_relacionados/Publicaciones/Estudios-Articulos/2015_02_10_Costo_de_uso_de_sistemas_de_PI.pdf> accesed 03 December 2016

[71] European Commission (n 19) 10

contribute to the initial problem of higher backlogs or less exhaustive examination processes if the number of examiners does not increase accordingly.[72]

The reduction of fees could be of especial relevance to SMEs and for intra-regional trade. According to the OECD; SMEs account for approximately 99% of businesses and 67% of employment in PA countries.[73] As such, policies oriented towards the internationalization of SMEs should consider the IP aspects of their business strategies.

[72] Ibid 8

[73] OECD, 'How to Foster the Internationalisation of SMEs through the Pacific Alliance Integration Process' (2016) OECD Publishing, 11 <http://www.oecd.org/latin-america/how-to-foster-the-internationalisation-of-smes-through-the-pacific-alliance-integration-process.pdf> accessed 04 December 2016

VI. Conclusions

Securing international patent protection requires significant investments in time and effort. A patent application must be filed in each individual country where patent protection is sought. Albeit international minimum standards, the requirements for patentability vary across jurisdictions. In light of the difficult task to harmonize substantive patent law, patent offices have turned to cooperation activities. For instance, in the context of the PA, there is no obligation for member states to harmonize substantive aspects of IP protection. The PA only provides, until this point, for cooperation initiatives. One specific type of cooperation initiative that the PA has undertaken with regard to patent protection is the PPH.

The PPH is a work-sharing mechanism that is used for many patent offices to accelerate patent examination procedures and reduce backlogs. In the context of the PA, the PPH has a further objective: to promote regional economic growth, which is affected at the same time by increased levels of intra-regional trade and innovation.

However, based on economic data and comparative experiences regarding the use of PPH systems, it was found that the main beneficiaries of this scheme would be multinational companies holding large patent portfolios, and that are already engaged in cross border patenting and licensing activities. The patent-intensive industries in the PA with the largest exports to the world are: motor vehicles, industrial machinery, electrical equipment, and ICT-related industries (semiconductors, communication and computer equipment). Within PA markets, multinationals dominate the majority of these industries.

In light of this, it seems possible that the PPH will become a platform for large business, perhaps in line with the objective of the PA to become a platform and reinforce ties with the Asia Pacific region. However, the PA PPH would have limited effect over SMEs, as they are not yet fully aware of the benefits of cross-border patenting. Thus, cooperation efforts shall also increase in spreading the benefits of IP protection region-wide, especially towards SMEs, universities and start-ups.

The analysis of trade flows among PA economies and their most important trading partners across the world also revealed another limitation. The results indicate an overall increase in

the value of regional patent-intensive exports, however, when closely examined, data also revealed that most of these exports originated in Mexico, while are still very limited in other PA economies. When observed at the intra-PA level, Colombia is the country with the largest patent-intensive exports, but export values for the other members were minimum.

Moreover, the results obtained from the empirical model put forward the idea that an increase in resident patent applications would have a positive impact on exports on patent-intensive goods. The effect of an increase in the resident patent application was significant in most of models, however, their results changed. Based on the simplest OLS model, every additional resident-patent application could increase patent-intensive exports up to 0.23% more. However, the results obtained using panel data regressions that take into account the changes in time, suggested that an additional resident patent-application could actually reduce exports by 0.004%. These results are consistent with the fact that most of the patents in the PA countries are granted to non-residents instead of residents.

However, the results obtained in the other variables included in the empirical model, in particular the relative factor endowments justify current efforts to promote innovation across the PA, as well, as the initiatives to enhance IPRs cooperation activities and the establishment of a PPH. These results are also a sign that in order to promote patent-intensive exports, protection is necessary and should come in form of IPR protection and the establishment of a regional innovation system across the PA.

One of the suggestions of this paper is to develop evidence-based monitoring regarding the evolution of the PPH. In this context, a monitoring system should place emphasis on the actors making use of the PPH system (e.g. type of applicant, industry, weather is resident or non-resident, number of SMEs and multinationals, among others). This will allow the assessment of the effectiveness of the PPH as a patent cooperation scheme.

Annex 1. Intra Pacific Alliance patent-intensive exports (per industry)

Aerospace industry

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 3,145 million
Average growth 2011-2015	6%
Distribution	1. Mexico USD 3,015 million (93.5%)
	2. Colombia USD 142 million (4.7%)
	3. Chile USD 34 million (1.1%)
	4. Peru USD 23 million (0.7%)
Most important markets	United States (65.2%) Ecuador (3.2%) Brazil (3%) Canada (2.9%) Netherlands (2.1%)

Intra- PA exports USD 15.1 million (0.5% to PA aerospace industry exports) and experienced and average growth of (15%).

Basic chemicals

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 3,456 million
Average growth 2011-2015	-1%
Distribution	1. Mexico USD 2,815 million (81.2%)
	2. Colombia USD 243 million (7%)
	3. Chile USD 231 million (6.7%)
	4. Peru USD 177 million (5.1%)
Most important markers	United States (22.1%) Brazil (17.5%) Belgium (6.8%) Colombia (5.2%) Venezuela (4.6%)

Intra- PA exports USD 307 million (8.9% of PA basic chemical industry exports) and experienced an average growth of (3.1%)

Communication equipment

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 21,587 million
Average growth 2011-2015	-0.1%
Distribution	1. Mexico USD 21,338 million (98.8%)
	2. Chile USD 171 million (0.8%)
	3. Colombia USD 50 million (0.2%)

	4. Peru USD 28 million (0.1%)
Most important markers	United States (76.8%) Canada (3.3%) Netherlands (2.5%) China (1.8%) France (1.8%)

Intra-PA exports of USD 253.3 million (1.2% of PA communication equipment exports) and experienced an average growth of (-12.5%)

Computer equipment

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 18,360 million
Average growth 2011-2015	7.4%
Distribution	1. Mexico USD 18.292 million (99.6%)
	2. Chile USD 53 million (0.3%)
	3. Colombia USD 8 million (0.1%)
	4. Peru USD 7 million (0.1%)
Most important markers	United States (89.9%) Canada (0.9%) Germany (0.9%) Netherlands (0.9%) Hong Kong (0.8%)

Intra-PA exports of USD 200.5 million (1.1% of PA computer equipment exports) and experienced an average growth of (-4.2%)

Electrical equipment

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 29,484 million
Average growth 2011-2015	6.1%
Distribution	1. Mexico USD 28.580 million (96.9%)
	2. Colombia USD 458 million (1.6%)
	3. Chile USD 349 million (1.2%)
	4. Peru USD 96 million (0.3%)
Most important markers	United States (86.1%) Canada (2.2%) Colombia (1%) Venezuela (0.9%) Peru (0.8%)

Intra-PA exports of USD 712.9 million (2.4% of PA electrical equipment exports) and experienced an average growth of (5.6%)

Industrial Machinery

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 45,096 million
Average growth 2011-2015	10.5%
Distribution	1. Mexico USD 43,569 million (96.6%)
	2. Chile USD 964 million (2.1%)
	3. Colombia USD 354 million (0.8%)
	4. Peru USD 209 million (0.5%)
Most important markers	United States (84.4%) Canada (3.4%) Brazil (1.3%) China (0.8%) United Kingdom (0.8%)

Intra-PA exports of USD 778.1 million (1.7% of PA machinery exports) and experienced an average growth of (3%)

Motor vehicles

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 75,095 million
Average growth 2011-2015	11.8%
Distribution	1. Mexico USD 77,791 million (98.4%)
	2. Chile USD 713 million (0.9%)
	3. Colombia USD 545 million (0.7%)
	4. Peru USD 47 million (0.1%)
Most important markers	United States (79.2%) Canada (4.6%) Germany (3%) Brazil (2.9%) China (1.8%)

Intra-PA exports of USD 2,195 million (2.9% of PA motor vehicles exports) and experienced an average growth of (17.2%)

Non-metal mineral manufactures

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 4,826 million
Average growth 2011-2015	4.4%
Distribution	1. Mexico USD 4,014 million (83.2%)
	2. Colombia USD 444 million (0.9%)
	3. Peru USD 227 million (4.7%)
	4. Chile USD 140 million (2.9%)
Most important markers	United States (68.3%)

	Brazil (3.6%) Chile (2.6%) Colombia (2.5%) Ecuador (2.5%)

Intra-PA exports of USD 364.9 million (7.6% of PA non-metal mineral manufacture exports) and experienced an average growth of (1.6%)

Other equipment- navigational and medical devises

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 12,246 million
Average growth 2011-2015	10.2%
Distribution	1. Mexico USD 12,107 million (98.9%)
	2. Colombia USD 71 million (0.6%)
	3. Chile USD 48 million (0.4%)
	4. Peru USD 20 million (0.2%)
Most important markers	United States (89.9%) Canada (1.7%) Germany (1.2%) Brazil (1.1%) Netherlands (1%)

Intra-PA exports of USD 50.3 million (0.4% of PA other equipment exports) and experienced an average growth of (9.3%)

Pharmaceuticals

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 3,341 million
Average growth 2011-2015	6.3%
Distribution	1. Mexico USD 2,518 million (75.4%)
	2. Colombia USD 503 million (15.1%)
	3. Chile USD 265 million (7.9%)
	4. Peru USD 54 million (1.6%)
Most important markers	United States (17.4%) Venezuela (12.2%) Ecuador (7.6%) Panama (7.5%) Brazil (5.4%)

Intra-PA exports of USD 393.4 million (11.8% of PA pharmaceutical exports) and experienced an average growth of (4.4 %)

Plastic and rubber

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 8.832 million
Average growth 2011-2015	9.5%
Distribution	1. Mexico USD 6,831 million (77.3%)
	2. Chile USD 819 million (9.3 %)
	3. Colombia USD 653 million (7.4%)
	4. Peru USD 529 million (6%)
Most important markers	United States (69.1%) Colombia (2.9%) Brazil (2.7%) Ecuador (2.2%) Bolivia (1.9%)

Intra-PA exports of USD 646.1 million (7.3% of PA plastic and rubber exports) and experienced an average growth of (4.4%)

Resin and synthetic rubber

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 3,886 million
Average growth 2011-2015	2%
Distribution	1. Mexico USD 2,732 million (70.3%)
	2. Colombia USD 950 million (24.5 %)
	3. Chile USD 114 million (2.9%)
	4. Peru USD 89 million (2.3%)
Most important markers	United States (33.1%) Brazil (11.3%) Colombia (6.3%) Peru (4.6%) Venezuela (4.6%)

Intra-PA exports of USD 578.3 million (14.8% of PA resin and synthetic rubber exports) and experienced an average growth of (1.2%)

Semiconductors

Value of Pacific Alliance exports 2011-2015 (five-year average)	USD 28,532 million
Average growth 2011-2015	8.6%
Distribution	1. Mexico USD 28,311million (99.2%)
	2. Chile USD 112 million (0.4 %)
	3. Colombia USD 89 million (0.3%)
	4. Peru USD 21 million (0.1%)
Most important markers	United States (87.2%)

	Netherlands (1.5%) Canada (1.4%) China (1.2%) France (0.9%)

Intra-PA exports of USD 266.7 million (0.9% of PA semiconductor exports) and experienced an average growth of (13%)