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SUMMARY OF THE STUDY ON THE USE OF THE INTELLECTUAL PROPERTY SYSTEM IN THE MINING SECTOR IN BRAZIL AND CHILE

prepared by the Secretariat

1. The Annex to this document contains a Summary of the Study on the Use of the Intellectual Property System in the Mining Sector in Brazil and Chile undertaken as part of the project on Intellectual Property and Socio Economic Development - Phase II (CDIP/14/7). The Study has been prepared under the coordination of the WIPO Secretariat in collaboration with the Patent Office of Brazil (INPI) and the Patent Office of Chile (INAPI).

2. *The CDIP is invited to take note of the information contained in the Annex to the present document.*

[Annex follows]

Use of the Intellectual Property System in the Mining Sector in Brazil and Chile

In 2017, Brazil and Chile requested the World Intellectual Property Organization (WIPO) to be part of the Project on Intellectual Property and Socioeconomic Development – Phase II (CDIP/14/7) implemented under the Committee on Development and Intellectual Property (CDIP). Their participation represents a follow up on the studies conducted in both countries under the Phase I (CDIP/5/7). Given the relevance of the mining sector for both countries, it was agreed to include the follow-up studies under the on-going economic study work on the global innovation patterns in the mining industries and the role of intellectual property (IP).

The conception of this global study is a direct consequence of the country study work conducted in Chile and Brazil during the first phase, which revealed national stakeholders of the mining industries to be drawing on patents as means of appropriating their innovative efforts. Informal consultations with economists of IP offices – such as IP Australia, the Canadian Intellectual Property Office (CIPO) and the United States Patent and Trademark Office (USPTO) – and experts on the sector confirmed the relevance and interest of the topic. The study analyzes the main global patterns of the mining sector in terms of innovation and use of IP. In particular, it explores countries' patterns of technological specialization, the direction of technological change and the role of IP in protecting and transferring mining-related innovations.

The participation of Brazil and Chile in the second phase contributed to the global study in two main ways. First, it provided input to a first global depiction of the sector in terms of innovation and use of IP. Second, Brazilian and Chilean experts from academia and industry were invited to collaborate with national IP offices in preparing an empirical study to add different perspectives to the understanding of the sector.

This document summarizes the implementation and main outcomes of the participation of Brazil and Chile in this global study as part of the CDIP second phase, which took place from February, 2017 to February, 2019.

OBJECTIVES

Both national studies had as main objective to compile original empirical research on the recent innovation trends of the national mining sector. The studies have the intention to provide a novel and detailed description of the national mining innovation ecosystem, which should inform innovation and IP policymaking in this strategic sector. The studies aspired to provide answers to the following guiding general questions:

- Who are the main stakeholders involved in the mining innovation process?
- What are the different technological specialization patterns in these countries?
- Which are the roles of the key stakeholders? In particular, what is the role of mining companies and the mining equipment, transport and services (METS) ones?

COORDINATION AND EXECUTION

The study implementation required coordination in both countries between national IP offices, local experts and WIPO. Within WIPO, the Innovation Economics Section (IES) was the technical focal point to coordinate the execution and workflow.

The implementation of the study was divided into two main components: (i) the creation of a comprehensive mining IP database for statistical use; and (ii) empirical analysis of the use of IP within the mining sector in each country. WIPO-IES took the lead on the first component in collaboration with the national IP offices of Australia, Brazil, Canada, Chile and the US. Local consultants with the collaboration and guidance from national IP offices and WIPO-IES carried out the second component.

The results of the two studies were reviewed at several stages. WIPO-IES provided guidance and internal reviews of the early drafts, while an external reviewer specialized in mining economics reviewed the final drafts. The authors of the studies presented a mid-study draft to international innovation economics scholars attending the 10th Conference on Model-based Evidence on Innovation and Development (MEIDE) Conference, held in November 2017, Montevideo, Uruguay.¹ This conference provided valuable feedback on the research work and helped improve the statistical and economic analysis.

The final and full versions of the studies are published in the WIPO Economic Research Working Paper Series.² A stylized version of the studies is expected to be published during 2019 as two independent chapters of the book “*Global Challenges for Innovation in the Mining Industries*”, as part of the WIPO-Cambridge University Press Book Series. A summary of the main findings of each study can be found at the end of this document.

METHODOLOGICAL DESIGN AND IMPLEMENTATION

The implementation of the study was divided in two main components: (i) the creation of a comprehensive mining IP database for statistical use; and (ii) empirical analysis of the use of IP within the mining sector in each country.

i. *Creation of a global mining IP unit-record database*

In collaboration with the national IP offices of Australia, Brazil, Canada, Chile and the US, WIPO-IES developed the first global IP database related to mining technologies. The novel statistical database is a compilation of unit-record bibliographical information for patents and utility models with global coverage. It enables in-depth analysis of innovation and use of IP in the mining sector at the global scale.

The creation of the database required compiling a worldwide list of mining and METS firms, particularly the innovative ones. The participating national IP offices provided invaluable inputs for the compilation of such a list. Other sources – such as the Orbis database from Bureau Van Dijk – complemented these national sources.

The participation of Brazil and Chile in CDIP first phase was instrumental for their contribution to this component. During the first phase, these national offices prepared and standardized their IP unit-record data for statistical use, built internal capacity to analyze such IP data and established long-lasting relations with the national statistical offices granting access to

¹ The LAC Bureau provided support to the participation in this conference.

² See <https://www.wipo.int/publications/en/series/index.jsp?id=138&sort=code>

complementary economic data. Thanks to the fact that these countries have kept updating their data and building their capacity after the conclusion of the first phase, both Brazil and Chile could perform research work mirroring the one performed in the other countries taking part in the global study.

The final database is an output in itself, as it has also been made available to the international academic and expert community to conduct further studies related to innovation in the mining sector. This also includes the sharing of the global database with the local experts conducting the studies in Brazil and Chile.

ii. *Empirical analysis of the use of IP in the mining sector*

Being an extractive activity, the mining sector is often considered less innovative than other sectors, particularly manufacturing. At the same time, policymakers in these two economies face the continuous challenge of promoting innovation in a sector that accounts for a large share of their gross domestic product (GDP). With this challenge in mind, Brazilian and Chilean experts from academia and industry were invited to collaborate with national IP offices in preparing an empirical study to add more economic perspectives to the understanding of the mining sector.

Each national government decided the main direction of their study with the technical support of WIPO. Following this process, WIPO-IES and the national IP offices chose the most suitable experts to carry out the study. The experts prepared the studies with the guidance of the national IP offices and WIPO-IES. In the case of Brazil, the research team of the national IP office also contributed as coauthors to the study.

The base for the empirical analysis in the two studies was sourced from the global database described in the previous section, but complemented with additional evidence to enrich the description of the national mining industry. Given the structural differences in the two mining sectors under consideration, the national offices had the flexibility to enhance this quantitative exercise in the way they felt it would be most appropriate. The Brazil study enriched it with more refined data from the national IP office and a thorough case study of the main Brazilian mining company. The Chile study was enhanced with a survey of Chile-based METS and semi-structured interviews of senior executives from Chilean mining stakeholders.

As a result, these studies provide a first-in-kind statistical description of innovation and use of IP in their respective mining industries, which combines quantitative and qualitative insights.

LESSONS LEARNED

The national studies were generally implemented according to the initial scope and timeline established during their design. However, there were challenges faced during its implementation from which lessons can be extracted for future studies.

The main challenge faced during the creation of the mining IP database concerns the general quality and standardization of IP unit-record data. The differences in data structure slowed the processing and harmonization of the data, but in the end most technical obstacles could be resolved. National IP offices, including the ones of Brazil and Chile, have come a long way in improving their unit-record data, but there is still room for improvement.

The main challenge faced during the empirical analysis concerns the novelty of the study subject, which combines innovation economics, IP use and considerations specific to the mining industry. In consequence, it is hard to find enough expert academics and prior literature, or one

consultant embodying all required expertise. This, in turn, requires working with multiple stakeholders with different institutional settings, which increases the coordination efforts and the need to reconcile different types of inputs.

SUMMARY OF THE ECONOMIC STUDIES

This section summarizes the economic and statistical findings of the Brazil and Chile studies. The findings of the Brazil and Chile study contribute to the other outcomes of the global study aimed at better understanding of how innovation operates in different parts of the world and where attention should be focused to meet the demands of the future.

1. Brazil study: Technology appropriation and transfer in Brazil's mining sector

Brazil is at the center of the policy debate on commodity-exporting, natural resource-intensive emerging economies and on whether natural resource-exploiting economies can generate innovation.

The importance of the role of the mineral sector in Brazil's economy is beyond doubt. Only the mining sector accounted for 21 percent of Brazil's total exports in the first quarter of 2017. Despite the country's size and geological diversity, mining output is concentrated both geographically and in the hands of few producers.

The paper aims to describe patterns and distinctive features of Brazil's mining sector's technological trends. To that end, the study aims to answer the following questions:

- In which technological areas is the patent system being used by the mining sector in Brazil?
- How intensively do the mining equipment, technology and services suppliers (METS) use the patent system?
- How does Brazil's mining sector import technology? What role do the mining firms and METS play in this process?

Methodologically, two approaches were taken in reviewing innovation in Brazil's mining sector. Firstly, patents and technology import contracts involving mining and METS companies in Brazil, were analyzed. Secondly, a case study was conducted on Brazil's largest mining company innovation strategies.

Use of the patent system and technology transfer in Brazil's mining sector

Mining companies and METS in Brazil make use of two main mechanisms to build their technological capabilities, namely technology development and technology acquisition from abroad.

Foreign METS companies account for nearly all of the mining related patents filed in Brazil. Japanese companies accounted for 36 percent of all patents filed by non-resident METS, followed by North American and German companies. METS are more likely to file patents for mining and metallurgy technologies, while mining firms focus on refining and transport technologies. Among mining firms, there is a wide gap between Vale S.A. and the other firms. Vale alone filed 46.8 percent of all patents filed from 2000 to 2015 by resident and non-resident mining firms. Vale has filed for patents mainly in transport and refining technologies. Very few Brazilian applicants in the mining sector engage in co-patenting with academic institutions or

international co-inventorship.

Resident mining firms also acquired technologies from non-resident METS through technical assistance, know-how agreements and technological licenses. In the national IP office registry of technology import contracts, 40 resident mining and METS firms appear as technology contractors for almost 300 contracts. Vale S.A. is the leading contractor, accounting for more than half of the contracts. Most METS contracts involved a foreign parent company and its resident subsidiary. Resident METS subsidiaries likely acted as intermediaries between non-resident METS and resident mining firms in order to operationalize technology transfers. Most suppliers of technologies are from United States, Canada, Chile, Australia and Germany.

Vale S.A. Case Study

Vale S.A. is now a multinational company active on six continents and one of the largest iron ore producing companies in the world. Vale produces coal, copper, fertilizers, manganese and ferroalloys.

Like any big mining company, Vale faces major technology and innovation challenges. Vale's operations include complex logistics and increasingly advanced energy-intensive prospecting, exploration and mineral-processing technologies. In taking up these technological challenges, Vale has established several internal R&D facilities. In 2009, Vale launched a broader science, technology and innovation (STI) strategy designed to take up technological challenges over the long term. Since then, Vale has been in closer contact with external partners – such as universities and funding agencies – to put in place an open-innovation approach.

The two models – closed and open innovation – are complementary and coexistent within the company. Historically, Vale has made use of the internal R&D facilities for incremental solutions, dealing with short-term results linked to operational demands and focusing on greater efficiency and lower costs. The intention of broadening the R&D portfolio through partnerships to deal with long-term challenges was part of the motivation to include an open innovation approach.

Vale's IP strategy is a recent development. Before 2009, Vale did not have a structured and coordinated IP process. During that period, Vale's patent application practice focused on minor operational improvements without any licensing strategy. In 2006, Vale acquired a substantial technological mining patent portfolio through the acquisition of INCO. As a result, IP activities began to be more structured within the firm, which was consistent with the new STI strategy. The establishment of the IP and Technological Intelligence Management department and the search for trained IP professionals were fundamental to leveraging and consolidating Vale's IP portfolio.

2. Chile study: Innovation and IP rights in the Chilean copper mining sector: The role of METS

The relevance of the copper mining sector in Chile is unquestioned. This sector is however facing important challenges: deeper mines, scarcity of key inputs, lower ore grades and concern for neighbor communities and respect for the environment. Innovation appears to be key to tackle these issues.

This study presents the results of an online survey sent to resident METS that are part of a public private program of open innovation in the mining sector. The survey aimed to collect information about the factors explaining the decisions regarding IP protection. A series of semi-structured interviews to senior executives of a sample of thirteen entities – four mining companies, seven METS and two universities – complement this survey.

In Chile, the mining sector is one of the main contributors to patenting, along with chemicals and pharmaceuticals. Codelco and its related technological division (Codelco TECH) explain the bulk of the domestic patenting activity. During 2009-2017, mining related patent activity increased by 58 percent.

Analysis of the survey and semi-structured interviews

Survey results confirm in a large extent the innovative capabilities of Chilean METS companies. However, the survey also reveals that only a minority of METS firms rely on IP rights to protect their innovations. The majority of these firms have not filed IP applications, neither domestically nor internationally. However, almost 90 percent of METS have indicated they consider IP when analyzing new business opportunities.

While aware of the patent system, innovators mentioned the relative high cost of patenting and the perceived complexity of the registration process as barriers to file for patent protection. Some METS companies choose alternative forms of protection, such as trade secrets and trademarks. The fact that resident METS in Chile tend to be small and medium enterprises (SMEs) might explain these results. By contrast, patent protection is the standard practice among large mining companies, as confirmed in the interviews.

Interest in IP protection might also differ among firms depending on whether they are exporters or not. The majority of METS firms with the intention of exporting is interested in filing a patent internationally. The same METS are interested as well in other IP protection mechanisms such as trademarks (58 percent) and industrial designs (33 percent). The importance of trademarks is also consistent with the fact that the majority of the METS surveyed invest in product innovation.

The interviewees indicated that there is enough expertise in Chile to give the proper IP legal and technical advice. However, some of the interviewees have said that the country lacks the required capabilities to develop business models that take full advantage of the economic potential of IP assets.

The study also presents four case studies describing product and process innovation efforts of four mining providers (one university among them), the partners these organizations have engaged with, the difficulties they have encountered and the IP protection strategies each of them followed. Some of these firms have established cooperation agreements with researchers based in universities or research centers, whereas one firm relied mainly on its own research expertise. The form of IP protection chosen and the intention of selling or licensing it are largely related to aspects such as the type of innovation and the market it serves.

This study represents a first attempt to analyze these questions empirically in a less-developed country. New research efforts should expand the scope of analysis by relying on better data. INAPI has created a rich database, which would allow the analysis to be extended to all forms of IP rights in the near future.

[End of Annex and of document]