

Processes proposal for the technology search, reception and analysis for the Intellectual Property management in a Technology Licensing Office from a Brazilian Scientific and Technological Institution

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Abstract—In a Technology Licensing Office (TLO), which deals with issues considered to be complex, decision-making is a relevant factor and should be aligned with the Scientific and Technological Institution (STI) institutional and innovation strategy. To meet this need, the objective of this work is to present a process model for the admission of technologies based on Intellectual Property (IP) to a TLO, as a way to subsidize the elaboration of strategies and the decision making regarding the processes of protection and commercialization of technologies, and thus leverage the transfer of the technologies invented or developed by an STI to a receiving organization, and, finally, to promote innovation. The process is called Admit Technology and is comprised of sub-processes Search Technology, Receive Technology, and Analyze Technology. This developed organizational process is composed of activities and tools with capabilities to make TLO more proactive and dynamic, both to seek new technologies developed in the STI Research and Development (R&D) units that can be appropriated through IP as well as to receive such technologies And to proceed with an in-depth analysis of its technical and commercial aspects and to indicate its main applications and markets where this technology should be protected and the marketing effort should be applied.

Keywords—intellectual property, technological innovation, technology admission, technology evaluation, technology search, technology reception, technology licensing office.

I. INTRODUCTION

Santos (2011) describes Intellectual Property (IP) as a topic that has gradually been growing in importance in private organizations that seek both to use it for commercial purposes and to guarantee a competitive position in the globalized economy and also in public organizations, Especially in Scientific and Technological Institution (STI), which increasingly face a new reality, composed of processes of technology transfer and innovation.

For Amadei and Torkomian (2009), the strengthening of IP related policies in a Scientific and Technological Institution (STI) has a direct impact on technology protection activities, while facilitating the commercialization and, finally, transfer of technologies to the productive sector. However, Buchele et al. (2015) and Dias and Porto (2013) describe that the activities of the Technological Licensing Office (TLO) take place in a constantly changing environment and that stimulating and supporting the innovation process is still a challenge. In turn, the application of good management practices, with the effective use of methods, techniques and tools is fundamental to support the process of managing innovation, efficiently and effectively.

In this way, the objective of this work is to present a process model for the admission of technologies, based on IP, for a TLO, as a way to support and/or subsidize the processes of protection and commercialization of technologies, and thus to leverage Technologies developed or developed by an STI for a recipient organization, and, finally, to promote innovation.

To achieve this objective, an action research was carried out in a TLO of a Brazilian STI, aerospace and defense sector. Observing and carrying out the activities of this TLO, it was possible to understand that it was a set of activities of a bureaucratic nature, without the capacity to elaborate strategies or to make decisions about the diverse options to protect or to commercialize a technology. This justified the proposal of the model of processes presented in this article.

In a department such as a TLO, which deals with issues considered to be complex, decision-making is a relevant factor and should be aligned with STI institutional and innovation strategy. Specifically in relation to the protection and commercialization of technologies, these decisions must take into account the potential of each technology, individually, to become an innovation and the markets where this technology will be more attractive, only to define the best format for its Protection and the necessary actions for its commercialization, and, thus, make the protection add value to the technology and facilitate its commercialization and transference.

This article is structured in four parts. The second concerns a review of the literature that deals with the concepts of admission of technologies, based on IP. The third presents the proposed technology protection process, and finally the fourth part presents the final considerations of this study.

II. ADMISSION OF TECHNOLOGY BASED ON PI IN A TLO

The PI, according to WIPO (2015) and INPI (2014), refers to the legal branch dealing with legal protection granted to all creations of the human mind, such as inventions, literary and artistic works, symbols, names and images used with Purpose. In Brazil it is divided, based on Jungmann e Bonetti (2010), into three categories: author protection, industrial property and sui generis protection, as presented in below:

- Intellectual Property
 - Author Protection
 - Copyright
 - Related Rights
 - Computer Program
 - Industrial Property
 - Trademark
 - Patent
 - Industrial Design
 - Geographical Indication
 - Industrial Secret & Unfair Competition Repression
 - Sui Generis Protection
 - Topography of Integrated Circuit

- Plant Varieties
- Traditional Knowledge

For Lichtenthaler (2011a), IP management processes should not be simplified. On the contrary, to be successful, you need to create active and strategic processes. Such processes must have vision turned in and out of the STI. This is important, given the dynamics and complexity involved in processes related to IP management. Thus, for Conley, Bican and Ernest (2013), Shahraki (2012), Germeraad (2010), Jannuzi et al. (2008), O'Hearn (2008), Chesbrough (2007), Jain and Sharma (2006), Vives I Gràcia (2005) and Feldman et al. (2002), one of the challenges for TLO is to use multiple mechanisms to delineate strategic decisions for IP management, especially in relation to the protection and commercialization of technologies, considering the STI innovation strategy.

Considering Spivey, Munson and Wurth (2014), Gonzalez-Gelvez (2013), Pine (2012) and Chen and Wang (2010), to protect the created technologies is a key action for STI, inclusive, is one of the basic assumptions to ensure the marketing and transfer rights. Ritter Junior (2015) and Kelm et al. (2014) indicate that the technologies created must be protected in the way that is most appropriate for STI without ignoring issues related to the promotion of innovation. Thus, to make the protection it is necessary that the managers of the TLO devote time to the formulation of strategies to make the best decision about the format the most suitable protection for each technology.

The commercialization of the technology, according to Bandarian (2007) and Shane (2002), involves a set of skills to negotiate the transfer of technology of STI to another organization, and also considering Lichtenthaler (2011b), Haeussler (2008), Chesbrough (2007) and Teece, Pisano, and Shuen (2000), to commercialize a technology is a strategic issue that is linked to the competitive forces of an STI.

Thus, strategies for protection and commercialization must be integrated in order to transform the opportunity offered by a new technology into a competitive advantage. According to Arora and Ceccagnoli (2006), a strong protection strategy translates into greater reward in the commercialization of technology and considering Bezerra (2010), the protection and commercialization of technologies, based on IP, is presented as a way to facilitate technological innovation, among other possibilities.

In this context, considering the indications of Najmaei (2014), the strategic management of IP requires a careful and comprehensive interpretation of the environment in which the organization and technology will operate. Also, Canongia, Santos and Zackiewicz (2004) and

Wheelwright and Clark (1992) indicate that decisions about innovation strategies need adequate tools to deal with issues that arise from the very essence of innovation processes: focus, uncertainty, The time to market, the ability to analyze alternative routes, the mobilization of skills, the valuation of knowledge or technology, among others. Still, Archila (2015), Markman, Gianiodis and Phan (2009), Dechenaux et al. (2008), Andrade (2007) and Lin and Kulatilaka (2006) describe that in order to promote innovation, speed is important to analyze and consider the various economic variables, among them the market trends and behavior in which the technology will be inserted. Also, for Aparecido Dias and Silveira Porto (2013) the technology must be understood in detail, including its purpose or the problems it aims to solve, the possible applications, the identification of its differential in relation to other existing technologies, among other issues.

According to Jungmann and Bonetti (2010) and Rocha, Sluszz and Campos (2009), from an analysis of information on technologies, and also on the interests of STI, it is possible to define the format of protection and the most suitable form of provision for technology.

Altuntas and Dereli (2012), Rocha, Sluszz and Campos (2009) and Rahal and Rabelo (2006) present some of the points that should be considered in the analysis: the technology itself; the scope of technology; the stage of development of technology; the availability of a prototype; technical feasibility; the inherent risks; ease of copying by third parties; the time needed to finalize the development of technology for the market; the nature and sophistication of technology; compatibility with other technologies; the points where the technology is more fragile or higher than the others in the market; the qualitative and quantitative advantages or benefits perceived by the potential user; the legislation applicable to the technology and investments to finalize or place the product on the market; the type of innovation (radical or incremental); the diffusion speed of innovation; market needs for technology; the demand and type of market; the size and rate of growth of the potential market; barriers to entry; the short time for technology to penetrate the market; the short-term return on investment; and the developer organization.

Based on the previous paragraphs and considering Archila (2015), Kotha, George and Srikanth (2013), Mohan (2012) and Dong-Hyun et al. (2007), it is possible to conclude that the intellectual property management process requires a reliable method of evaluating the technical and commercial potential of the incoming technology in TLO. Closs et al. (2012) indicate that the TLO is the organization that has as attribution carry out this evaluation.

Thus, it is important that the TLO has a structured process for the admission of the technologies created by the R&D units of the STI, in order to give the appropriate treatment for each of the technologies that are forwarded to the TLO, or even for those technologies that Were in the R&D units and the researcher did not envisage potential for transfer.

III. PROPOSAL FOR A MODEL OF PROCESSES FOR THE ADMISSION OF TECHNOLOGIES BASED ON IP IN A TLO

The present proposal was conceived through an action research carried out in a Technology Licensing Office (TLO) of a Brazilian Scientific and Technological Institution (STI) of the aerospace and defense sector, as already described.

In summary, according to Andrade, Soto Urbina and Follador (2016) and Andrade, Soto Urbina, Follador and Neves (2016), the flow of activities for the protection and commercialization of the TLO technologies studied at the beginning of this action research is described below: an STI researcher invents or develops a technology and if this STI has an interest in protecting it and transferring it to the productive sector, it communicates this invention to the TLO in an appropriate form; upon receipt of the notice of invention, TLO searches for priority to verify that the technology developed meets the requirements for the type of protection requested (eg patent, utility model patent, software registration, etc); it is possible to protect the technology, it goes to the writing of the request for intellectual protection and submits the request for protection to the protection body (in Brazil, INPI); besides submitting the request for protection, also, starts to control the "demands" and the remunerations to be paid, and gives them provisions; finally, the technology is included in the TLO technology portfolio and displayed on its website; and is available to companies for commercialization.

Looking at the above paragraph, it is possible to notice that the TLO does not make an evaluation of the technology, neither the technical nor the market characteristics. Also, there is no concern to assess what are the best ways to protect technologies or markets to which technology should be protected, to ensure greater value-added to technology. Still, TLO operates only on the demand of STI researchers. Thus, it can be noted that TLO plays a passive role in the management of intellectual property.

To reverse this situation, as seen in Item 2, it is necessary to equip the TLO with well-defined processes and tools. Such processes should be capable of proactively admitting a technology developed by STI researchers and devising appropriate strategies for protection (as Andrade,

Soto Urbina and Follador (2016)) and for commercialization (according to Andrade, Soto Urbina, Follador and Neves (2016)) of technologies, with the objective of supporting the management of intellectual property.

Thus, an organizational process called "Process Admit Technology" was developed, consisting of activities and tools with capabilities to make TLO more proactive and dynamic. The dynamics of this proposed process considers that an STI, in its R&D activities, invents or creates a technology, and with that, it communicates the invention/creation to the TLO. TLO receives the communication of the invention/creation, checks if the information is correct and performs an analysis of the technology, evaluating its technical aspects, to identify the technical potential of the technology and the feasibility of legal protection, as well as the market. With a view to identifying market potential and potential interested in the technology developed. If there is technical and marketing potential, the technology is sent for protection and commercialization. If the technical or marketing potential of the technology is low, STI should be communicated for the continuity of research or development, in an attempt to provide the technology with innovative aspects or that meet the market demand. The representation of this process is shown in Figure 1.

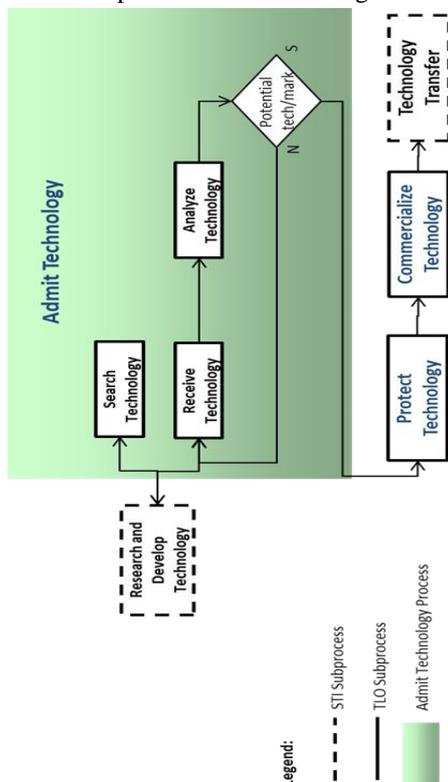


Fig.1: Admit Technology Process

The Admit Technology process is comprised of the subprocesses: Search Technology, Receive Technology, and Analyze Technology. The Sub-process Analyze

Technology is critical within this model, since it is from the evaluations and analyzes carried out in this subprocess that all the strategies for the protection and commercialization of the technologies are formulated. The strategies are formulated and defined according to the technical and market potential of each technology, that is, for each technology, a different strategy must be formulated, which requires dynamic process capability. According to Hall (2014), each of the technologies developed by an STI has its own opportunities and threats, due to its dynamic nature, and it is therefore a challenge to introduce them to the market. Still, according to Arora and Ceccagnoli (2006), decisions on the protection and commercialization of technologies must be taken at the same time. Therefore, this subprocess can be considered as critical in this structure, and in this context, it is important that it be executed with high efficiency and effectiveness, to allow reliable information to elaborate the strategies of the other subprocesses.

This process model was successfully implemented on TLO of this STI. Thus, it was possible to identify, accurately, the characteristics of each new technology subject to the TLO for protection and thus develop the most appropriate strategy for their protection. As a result, the TLO from this STI commercialized its first technology, ie promoted the first transfer technology. The subprocess of Admit Technology will be detailed in the following sections.

3.1 SUBPROCESS SEARCH TECHNOLOGY

This subprocess consists in carrying out a diligence to the STI to evaluate if it has invention or intellectual creation, here denominated technology, not yet protected. This diligence should be carried out by a team of TLO professionals and members of the STI R&D areas. The team, in conducting the diligence, interviews the STI researchers, verifies the results of the developed R&D projects, including those developed jointly with companies, and at the end of the diligence, describes a report, indicating or not, technologies invented or created Still unprotected, and which may present potential for protection and transfer. This report is sent to the person in charge (upper level) by the STI, who must decide on the adoption of the recommendations, that is, to request or not to protect the technologies to the TLO. For Santos (2011), it is important that the TLO has a tool that is able to identify the new technologies that can be appropriated. Silva et al. (2015b) complement this issue, showing that this is a great challenge.

In the event that STI decides to protect the technologies found, it must request the protection and transfer of technology to the TLO, which will follow the process of Receiving Technology.

This subprocess is justified by the possibility of identifying technologies invented or created within the scope of the STI, which the researcher has not identified potential for application, and thus has not requested its protection. Once the subprocess is finished, it is passed to the following: Receive Technology.

3.2 SUBPROCESS RECEIVE TECHNOLOGY

This subprocess consists of receiving, registering and formally verifying documents that are part of requests for protection and transfer of technology and of opinions in joint R&D contracts with other organizations submitted to TLO.

In the receipt of the Request for Protection and Transfer of Technology, all requirements defined in the specific TLO standards/procedures/instructions to be observed by the requesting STI must be verified. The receipt of the technology consists of:

- Record the request for protection and transfer;
- Perform formal verification of forms and documents;
- Check for complete and correct completion of forms;
- Check the instruments of formalization (contract, agreement, protocol of intentions, power of attorney, etc.) of the contribution and division of the IP, if there is participation of members of entities external to the STI, that is, a joint R&D project with other organizations;
- All patents and academic publications found must be attached, with their respective summaries and explanations of the differences in relation to the invention/creation communicated;
- Check the scientific and technical publications made by the inventors, among other relevant disclosures, of the invention/creation, If there are; and
- Check other relevant documents.

If situations that differ from those specified are found, corrections or clarifications should be requested from STI. The technology should only be routed to the Analyze Technology subprocess after meeting all procedural requirements for adoption of the technology by TLO.

As for the opinions on joint R&D contracts with other organizations, including in situations characterized as open innovation, according to Chesbrough (2007), careful evaluations should be carried out to identify or propose clauses that define, according to AlbieroBerni et al. (2015), the division of ownership of the intellectual property of future technologies to be developed, not to become the object of future dispute or to damage the relationship between the STI and the organization.

Such a subprocess is important to identify, preliminarily, if all the elements necessary for the requested protection request are met, and to subsidize the subprocess Analyze Technology, regarding the technical and marketing analysis. Reaffirming in this subprocess, in addition to the other items, it is important to evaluate all contracts or research agreements that STI has signed with other organizations, in order to ensure that the rights to IP, potentially resulting from this interaction, are safeguarded. Regarding the request for protection and transfer of technology, it is necessary to evaluate whether all documents necessary to promote the drafting of the protection request (Process Protect Technology) have been attached to the request, in order to avoid wasted time with documentation returns, impacting in TLO productivity. After completing this subprocess, the following is passed: Analyze Technology.

3.3 SUBPROCESS ANALYZE TECHNOLOGY

This subprocess consists of the technical and marketing analysis of the technologies received, according to the subprocess Receive Technology.

The analysis is carried out with the purpose of characterizing the technology in detail and indicating its technical-marketing potential, so that it can subsidize the decision making process of the protection and commercialization of technology. According to Chagas Júnior (2009), to achieve success in a process related to technological innovation is necessary to consider technical progress and market forces. Thus, it is necessary to understand the operation of technology and its insertion in the market. According to Rozenfeld et al. (2006), good market research is the rigorous and adequate compilation of data from various sources. For Fujino and Stal (2004), an important issue to be identified during the analysis of the technology is whether it is "attractive" from a commercial point of view. However, Bianchi et al. (2011) warn that the analysis of emerging technologies can be difficult due to present strong technical/scientific content, which makes it necessary to interact with the researchers or inventors of the technology. Fujino and Stal (2004) indicate some factors that impact the evaluation of a technology:

- Potential for application of technology in other areas;
- Benefits or differentials of the technology, when compared to the predominant or concurrent technology;
- Time needed to finalize technology development (production scale);
- Production and distribution costs, compared to prevailing or competing technology;

- Possibility of expansion of the current market or opening of new markets;
- Market potential of technology; and,
- Adequacy of technology to the STI portfolio.

Thus, in addition to the provisions indicated in the item Receiving Technology, one or more meetings with the representatives of the STI research unit and the responsible inventor should be scheduled in order to remedy any differences and resolve procedural doubts, and thus, properly analyze the technology. The technology analysis consists of:

- I. Analyze the documents presented;
- II. Interview(s) with the inventor responsible for the technology, to better know the technology;
- III. Conduct desk research to complement the information collected during the interview;
- IV. Perform technical characterization and proof of concept of technology. At this point, an assessment of the technical and marketing potential of the technology should be carried out to support the decisions to be taken, that is, the elaboration of protection and commercialization strategies;
- V. Prepare a draft on the conclusions of the analysis;
- VI. Present the draft to the responsible inventor so that any suggestions or modifications may be proposed;
- VII. Make the final adjustments to the content of the analysis draft, if necessary;
- VIII. Elaborate a proposal of Technological Profile, which consists of a kind of pamphlet, with the main characteristics of the technology, without, however, revealing the novelty aspect of the invention/creation. The profile should include a brief explanation of the technology, its differentiation from the other technologies available in the market that solve the same problem as the technology, its benefits and its applications;
- IX. A Technology Analysis Committee should be created, with the participation of fixed members (TLO members) and flying members (depending on the technology to be analyzed). The committee has the function of deliberating on the recommendations proposed by the analysis, corroborating the proposals presented or making new proposals. It should also be composed of at least the following members: the TLO manager, the official responsible for managing the subprocess Admit Technology, the official responsible for managing the subprocess Technology Protection, the officer responsible for managing the sub-process

Technology Commercialization, the person responsible for the Research unit Of STI and an External Member with technical or market knowledge on (guest) technology. The inventor responsible for technology should not participate in this committee to avoid bias;

- X. To prepare a Technical Opinion on the Technical and Market Analysis of Technology, based on the deliberations presented by the Technology Analysis Committee. If the resolution is to protect and/or transfer the technology, the Technical Analysis of Technology Analysis should be sent, in a degree of secrecy, to the officer responsible for the Subprocess Format Protection. If the decision is not to protect or transfer the technology, the opinion should be sent to the requesting research unit of the STI, with additional justifications, if applicable.

This subprocess is of fundamental importance for the success of all other processes and subprocesses indicated in this proposal, since it is through this that the strategies for protection and commercialization are elaborated. Because of this, special attention must be given, because an error or misunderstanding in the technical or marketing analysis may mislead the actions of protection and commercialization of the technology, including directing for protection a technology that does not have the technical or marketing potential for it (Protection of a technology that already has similar ones that generate better results, for example) and vice versa. Finished the subprocess, the technology having technical and marketing potential, it goes to the processes of protection (Andrade, Soto Urbina e Follador (2016)) and the commercialization of technology (Andrade, Soto Urbina, Follador e Neves (2016)).

IV. CONCLUSION

The Admit technology process, presented in this article, proposes a more proactive performance of the TLO, both to seek new technologies developed in STI R&D units that can be appropriated through IP, as well as to receive such technologies and proceed with a Depth analysis of its technical and commercial aspects, and thus indicate its main applications and markets where this technology should be protected and the marketing effort should be applied.

Reaffirming what has already been described in this article, before beginning the formatting of technology protection and commercialization mechanisms, based on PI, it is necessary to carry out a detailed analysis on the technical questions about the technology created or developed and on the market aspects of this technology. This is essential to support the formulation of strategies

for the protection and commercialization of technologies adopted by TLO, and thus to be successful.

In other words, this process supports the processes to protect and to commercialize a technology, helping TLO to perform its functions related to the management of intellectual property.

As a result of the application of the model, the TLO management practices under study were changed, and internal procedures were created to standardize this process. These procedures guide the TLO performance in achieving its institutional objectives.

To conclude, it can be considered that this proposed process model was adequate, since it was executed coherently, being applied in 10 technologies, and, until the present moment, a technology transfer contract was marketed.

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