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MANAGEMENT PRACTICES OF ACADEMIC PATENT APPRAISAL

PRÁTICAS GERENCIAIS DE VALORAÇÃO DE PATENTES ACADÊMICAS

PRÁCTICAS DE GESTIÓN PARA LA VALORACIÓN DE PATENTES ACADÉMICAS

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Abstract
Objective: To understand the patent valuation practices developed in the academic context to promote innovation.
Methodology: A systematic review of the literature was carried out from the scientific bases Scopus and Web of Science using specific search strings, in which 377 works were found. After applying the defined criteria, eight articles were analyzed.
Originality: The study is justified due to the importance of understanding the valuation of academic patents as an inducer of innovation.
Main results: The results led to a current understanding of perspectives related to the valuation of academic patents on two fronts: models of academic patent valuation and managerial practices of patent valuation in order to promote innovation.
Theoretical-methodological contributions: The research presents an incremental theoretical contribution in the area of valuation of academic patents.
Social/Managerial Contributions: Academic patent valuation practices are important mechanisms to induce technological innovation by universities, and the gains are generally defined in the form of royalties.

Keywords: Valuation. Patents. Academics.

Resumo
Objetivo: Compreender as práticas de valoração de patentes desenvolvidas no contexto acadêmico para promoção da inovação.
Metodologia: Foi realizada revisão sistemática da literatura a partir das bases científicas Scopus e Web of Science com a utilização de strings de busca específicas, em que 377 trabalhos foram encontrados. Após a aplicação dos critérios definidos, foram analisados oito artigos.
Originalidade: O estudo se justifica em função da importância de entender a valoração de patentes acadêmicas como indutor de inovação.
Principais resultados: Os resultados levaram a uma compreensão atual das perspectivas relacionadas à valoração de patentes acadêmicas em duas frentes: modelos de valoração de patentes acadêmicas e práticas gerenciais de valoração de patentes com a finalidade de promover a inovação.
Contribuições teórico-metodológicas: A pesquisa apresenta contribuição teórica incremental na área de valoração de patentes acadêmicas.

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Contribuições Sociais / Gerenciais: As práticas de valoração de patentes acadêmicas são importantes mecanismos para induzir a inovação tecnológica pelas universidades, sendo que os ganhos são geralmente definidos em forma de royalties.

Palavras-chave: Valoração. Patentes. Acadêmicas.

Resumen
Objetivo: Comprender las prácticas de valoración de patentes desarrolladas en el contexto académico para promover la innovación.
Metodología: Se realizó una revisión sistemática de la literatura desde las bases científicas Scopus y Web of Science utilizando cadenas de búsqueda específicas, en la que se encontraron 377 trabajos. Después de aplicar los criterios definidos, se analizaron ocho artículos.
Originalidad: El estudio se justifica por la importancia de comprender la valoración de las patentes académicas como inductor de innovación.
Resultados principales: Los resultados llevaron a una comprensión actual de las perspectivas relacionadas con la valoración de patentes académicas en dos frentes: modelos de valoración de patentes académicas y prácticas gerenciales de valoración de patentes para promover la innovación.
Aportes teórico-metodológicos: La investigación presenta un aporte teórico incremental en el área de valoración de patentes académicas.
Contribuciones Sociales/Gerenciales: Las prácticas académicas de valoración de patentes son mecanismos importantes para inducir la innovación tecnológica por parte de las universidades, y las ganancias generalmente se definen en forma de regalías.

Palabras clave: Valuación. Patentes. Académica.

Introduction

Universities are important because they produce knowledge and develop technologies that provide innovation on the market in order to improve society's quality life. The valuation of the invention is one of the challenges faced by the academy in the process of inserting a new technology (GARNICA; TORKOMIAN, 2009).

In the field of knowledge universities make an important function when they transfer technology, innovations and inventions produced by themselves (SANBERG *et al*., 2014).

The notorious increase of technological innovation, the growth in the relationship between companies and universities and the transfer of technology of university research to corporations contribute to increase the importance of patent valuation in the technology transfer process (TUKOFF-GUIMARÃES *et al*., 2021).

Among the various types of technologies developed by universities and thus there are patents that are main of knowledge protection. The strategic value of inventions provide the exploration of monopoly in the country of origin and it is limited in the period of time of 15 years to Utility Model and 20 years to Patent for an Invention (SOUZA, 2009).

Patents represent important intangible assets given to an invention. They can be monetized and support the recent growth of technology markets. Patent valuation is very

important because it defines the value of an invention for different purposes (CAVIGGIOLI, *et al.,* 2020).

Patents are developed for the purposes of being transferred to society, promoting innovation. It is important to evidence that in a technology transfer contract process, it is also necessary to go through some steps, such as technological and market prospecting, technology valuation and negotiation with business people (FOCHESATTO, 2020).

Valuing technologies consists of defining a fair value, that is, it deals with the base value that is expected in an eventual commercialization of the developed knowledge. The objective is to provide a value that considers the risks inherent in the process of technological innovation, as well as in helping to negotiate and define a portfolio (SANTOS; SANTIAGO, 2008).

Defining patent values is a great challenge. The unknown value of the patent makes difficult business transaction, affecting the related people in the negotiation. Some challenge are faced as the representation of an evaluation object, place construction and how to generate and measure the value of the patent (LIU; LIU; QIAO, 2020).

Valuation determines a monetary value of an asset. It is difficult, complex and multidisciplinary work. The economic value of a technology is often affected by factors that are not technical, but they are known after transference and analysis according to market volatility (SANTIAGO et al., 2015).

The price represents the bottom line for technology managers to initiate negotiations for technology transference and which can represent a fair trade with institutions as a licensor to enter into a comercial agreement (DE OLIVEIRA, 2020).

There are some difficulties that universities face in activities to value their patents, especially in difficulties related to the absence of accurate information in the degree of technology development, the market, cost development and marketing, and also absence of the information necessary for an adequate valuation of patents (CABRERA; ARELLANO, 2019).

Because of the lack of information and the secret of negotiations, the valuation of patents from universities is a complex activity, and there are not comparable market parameters. Therefore, some variables can be used to value an academic patent, such as numbers of assignors and inventors, claims, technological scope, time for concession, geographic scope of protection (CAVIGGIOLI, *et al.,* 2020).

The valuation of academic patent is characterized as a complex work because of the difficulties from academic inventions and these ones being able to be transferred for level of technological expedition (BUENSTORF; GEISSLER 2013).

For this reason to establish the value of a technology is complex task due to the difficulty in determining the allocation of values to intangible assets created by technological innovation (BOER, 1999).

Exploring the value of a patent demands strategies. Delaying the request to examine a patent purposely is an efficient management method because it allows its owners to obtain more time to explore its technology (ZHANG *et al*., 2020).

It is important to point out that the valuation of patent occurs due to the interest in transferring the technology to the market. In this respect to understand technology transfer contracts impacts the way as revenues can be acquired by the university (TISSOT, 2019).

Academic patent valuation strategies result in different levels of risks and returns and the most appropriate way depends on the specific characteristics of the invention. Whilst in the context of licensing it generates in reception of royalties, generally based on the dvision of profits or revenues, in this moment occurs the sale of invention in which depending on contract signed can occurs in payment made in one or more installments, characterized as a less risky strategy for the University. When inventions are uncertain, the patent owners prefer to license them. The decision between licensing and transference does not depend only on the characteristics of the patent, but on the technological field and the technology transfer mechanisms (MEGANTZ, 2002; JEONG et al, 2013).

There are two basic forms of contracts related to technology transfer: transference and licensing. The transference contract consists of a private device in which ownership of Intellectual Property is transferred to another owner, promoting total exclusivity to the contractor. Licensing defines the permission for exploitation of Intellectual Property, with or without its creator or owner losing their rights. It is important underlined that they can have some costs or be totally free (ALMEIDA, 2019; AREAS; FREY, 2019).

Generally transference contracts use the following patent valuation models, as it is shown in Chart 1.

Chart 1

Valuation Method by Transference

Valuation Method	Description	Benefits	Disadvantages
Valuation by Costs	Considers the costs involved in technology development	Simplicity in determining the value of technology	Disregards future earnings and value, as well as inherent risks
Valuation by Multiples	Based on benchmark of comparable assets in aspects such as technology, profits, cash generation	Simplicity of use with the use of few assumptions, reflecting the market situation	Disregards risks and potential of technology, difficulty in collecting information to establish a comparative
Discounted Cash Flow	Value of technology defined by projected cash flow discounted at a rate that reflects project risk.	Ease of use, intuitive method, well-known and objective results for projects with constant cash flows	It disregards managerial flexibility and difficulty in choosing an adequate discount rate to define risk
Real Options	Makes the pricing models of financial options more flexible to value assets that have managerial options based on behavioral market theories	Considers uncertainties and managerial decisions	Complexity in carrying out the definition of value

Reference: authors as from Almeida (2019).

In relation to valuation methods based on technological licensing, it can be mentioned how Royalties are defined according to what is shown in Chart 2.

Chart 2

Licensing Valuation Methods

| Valuation Method	Description	Benefits	Disadvantages
Industry Standards	Royalties are set based on data from previous transactions	Simplicity in use and understanding, it needs few assumptions besides reflecting the market situation	Impossibility of accessing data from previous negotiations, calculations performed subjectively and difficulty in defining equality in terms of economic benefits, risks and royalties used
25% rule	Transfer of 25% of the net income earned to the licensor	Useful when the most reliable valuation method acceptted by both parties	Unpredictability regarding receipt, in addition to technological uncertainties
Surplus profit	Informs the royalty value based on the excess profit obtained by the technology	Simplicity of use and considers the value generated by the technology when estimating royalties	Difficulty in surveying some parameters for calculating the DCF of the other party to the negotiation

Valuation Method	Description	Benefits	Disadvantages
Financial Contributions	Company for the exploration of technology in which the value of royalties is defined according to the participation of the partners/co-owners	Used when investment in PD&I is required	Difficulty in the presence of funding sources
Fixed single policy for all licenses	Fixed valuation methodology with a percentage of royalties defined in Institutional Innovation Policy	Simplicity of use Used by ICT	Harmful for negotiation depending on the size of the interested company

Reference: Authors as from Almeida (2019), Areas. Frey (2019).

It is also necessary to evaluate the costs versus benefit in the technology valuation process, because as greater the detailing of analysis it is also greater the cost of the work perfomed, as can be seen in Figure 1.

Figure 1

Cost versus Benefit of Technological Analysis
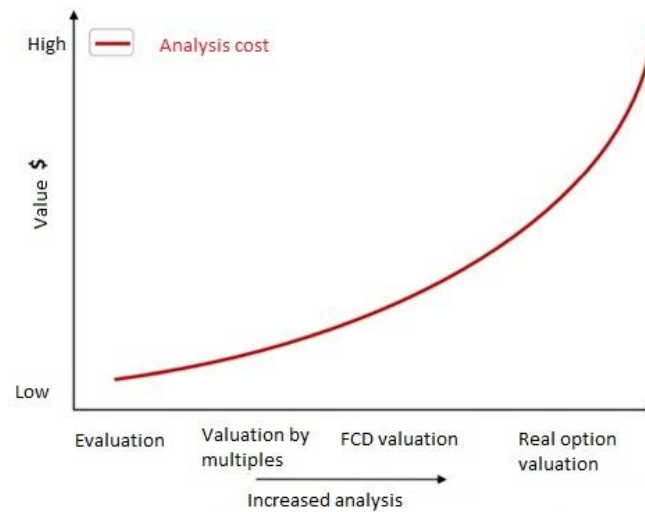
Reference: Santos, 2015.

According to Figure 1, the expense spent by valuation of multiples is lower than the method for real options.

About Brazilian universities, there are few studies related to the valuation of academic patents ((TUKOFF-GUIMARÃES *et al*., 2021). Thus, opportunities emerge to improve in this área of knowledge.

The present study aims to answer the following question: what is the patent valuation model made by universities? How do management practices define the value of patents in academic areas in order to promote innovation?

In this context, this research aims to understand which patent valuation practices are applied in the academic universe with the purposes of promoting innovation.

Methodology

About to the scientific technique for the production of this research was used a systematic review of the literature which introducing the scenario to the knowledge in the researched area about the subject, through the identification, selection and analysis of important studies wich may be repeated. It is a type of secondary study which follows a methodologically well-defined sequence according to a previous protocol in order to reduce perspective inherent in an informal review (LIMA, 2019).

The literature systematic review is also characterized as a method of collecting extensive and exhaustive studies with objective method and quality evaluation and validity of what is found in these searches, adding value to the results presented (MARTINEZ-SILVEIRA; SILVA; LAGUARDIA, 2014).

In this study was made a protocol of research in which the procedure was defined in the present investigation, as it is shown in Figure 2.
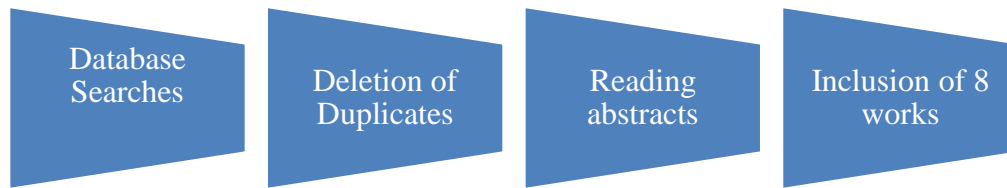
Figure 2

Search procedure
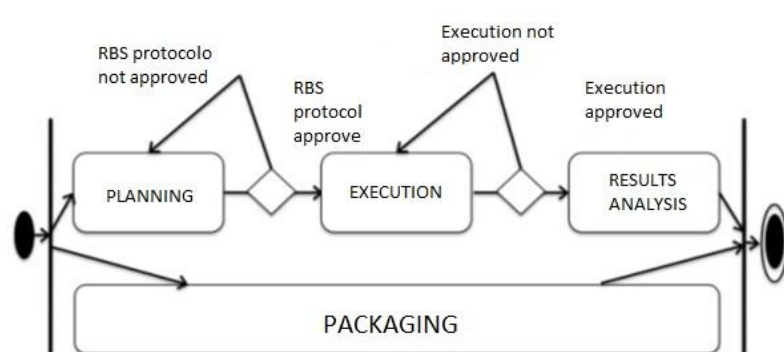
Reference: Conforto; Amara; Silva (2011).

For the realization of work it was defined its search flow, according to Figure 3.

Figure 3

Search flow

Reference: Authors.

The searches in the databases were made in July 2020 from site of Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) based on articles found in Scopus and Web of Science using terms according to Table 1 in wich 377 works were found in them.

Table 1

Articles found in the databases

Search String	Database	Quantity	Database	Quantity	Total +
Intellectual Property and Valuation and Patent	*Scopus*	85	*Web of Sicence*	70	155
Valuation and patent and university	*Scopus* 246	33	*Web of Sicence* 131	16	49
Intellectual Property and Valuation and University		23		14	37
Monetization and patent and university		3		2	5
"Intellectual Property" AND price AND university		89		23	112
"valuing" AND patent AND university		13		6	19
Total				377	

Reference: Authors.

The purpose of the research was to define that articles were collected from the title, summary or keyword. The searches used the connector "AND" to restrict to articles found with objective proposed in this research and eliminating works that were not within the scope of the study in question.

Because of all the works identified it were used exclusion methods as (a) duplicate documents, (b) those are not available in their full format in the researched sources, (c) that had a very specific approach, that is, that was impossible to be extended, (d) works that are not in the scope of this study.

The inclusion method used in this research were articles (a) with models of valuation of academic patents (b) researches related to management practices focused on valuation with the objective of promoting innovation.

First of all, titles and abstracts were read. In cases where the abstracts were not clear, introduction and conclusion were understood, applying the inclusion and exclusion criteria. In this stage, 5 articles were selected and the references of these were analyzed according to the inclusion and exclusion requirements, being selected 3 more documents, totaling 8 works that contemplate the present research.

Considering the defined strings, the first work is from 1996, and 2019 was the year in which the most recent publication was written.

The results of this work are mainly reviewed articles by pairs (07), with exception of a proceeding paper. The articles are from 2001 to 2019, being 6 quantitative and 2 qualitative.

Results and discussions

In this section are analyzed the works selected in this present research.

Academic patent valuation models

Universities have incentives to patent and seek innovation revenue from their professors. In spite of growing licence revenues by ICT, there are few efforts to develop pricing models for patent licenses (RICHARDS; RICKARD, 2014).

A crucial challenge presented is to identify technologies efficiently that are worth investing in or transferring at initial fase because investments are relatively expensive when they are compared to other technology sectors. An objective approach to determine potentially valuable technologies is necessary to join interested parts in transference of technology and facilitate the flow of technology from academy to industry (LIN; OUYANG; HU, 2019).

Wang and Hsieh (2015) present a model for measuring the value of patents that can be applied in several areas of knowledge. The proposed valuation system can be used to allow an effective utilization of intellectual property rights generated by research institutes and high technology companies, being recommended in cases of uncertainty and that several methods are necessary for valuation and decision making. The authors constructed a hierarchical structure in which the criteria were categorized into strategic values, commercialization values and protection values.

(4) se pode gerar crescimento organizacional (longo prazo busca de receita), como pode ser melhor observado na figura 4 (WANG; HSIEH, 2015).

The strategic value of the patent may include (1) if this patent can increase technological competitiveness (short term of technological leadership), (2) if it can increase discovery (long term of technological leadership), (3) if it can generate business potential (short term revenue search), or (4) if it can generate organizational growth (long term revenue search), as can be seen in Figure 4.

Figure 4

Patent value measurement system model
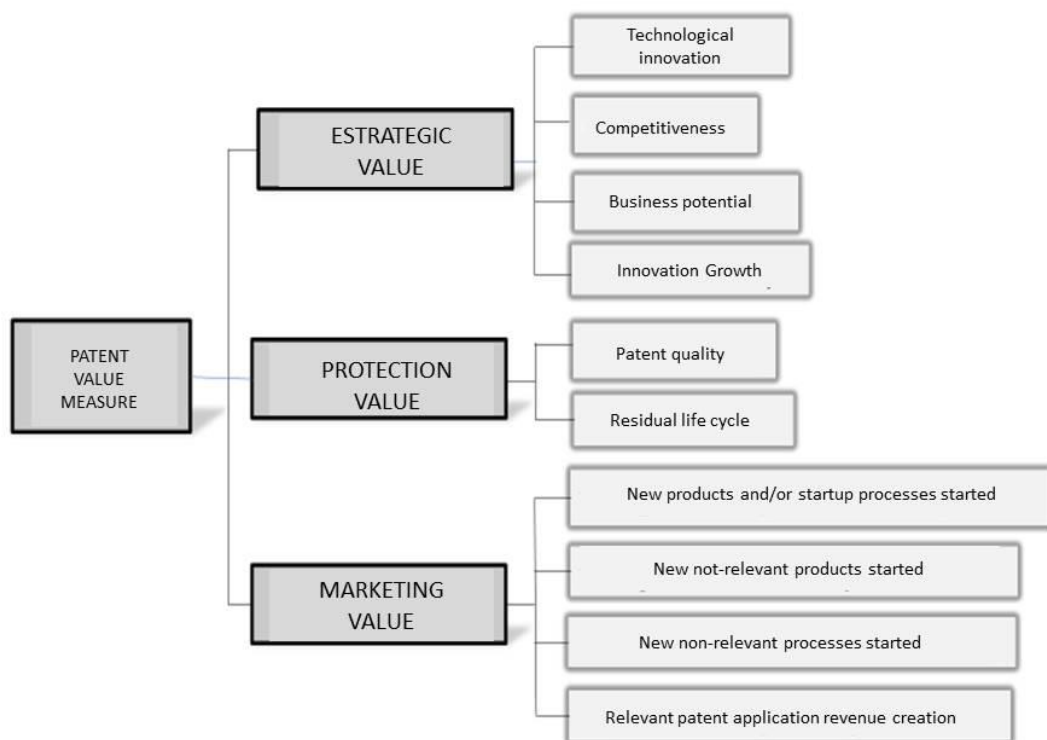
Reference: Wang and Hsieh (2015).

The value of patent protection is related to its writing and life cycle residue. Its writing must be clear with claims and purpose associated of protection extensive and quality of increase its value. The life cycle residue of a patent relates after the monopoly of invention ends. After that including to make a new and possible patent application after the original patent expires,

or making a possible reinvention application through the licensing of the original invention (WANG; HSIEH, 2015).

The commercialization value is in the degree of research and development efforts that allows for internal and external innovations is a critical concept in developing the value of the patent application, being necessary to formulate an internal process and external strategy to develop and gain in the management of the patent. New products and services or new processes initiate is an important consideration in relation to the innovation value of a patent (WANG; HSIEH, 2015).

The model generates a classification of patents in classes A, B and C in which "A" are more valuable and "C" are less valuable. The authors suggest that for Class A patents, external licensing or for new startup companies. For class C patents, auction or abandonment is the right alternative to its minimum value. Class "B" patents must await future market applications, or alternatively subject these patent families to remeasurements of value before to any further decision (WANG; HSIEH, 2015).

Richards and Rickard (2014) developed a proposal for defining the value of patent licensing, as can be seen in Figure 5.

Figure 5

Patent licensing model

Reference: Authors as from Richards and Richard (2014).

As noted in Figure 5, the authors recognize that patents are options in the future revenue flow, and applying option valuation techniques to determine dependent license prices in way at revenue flow generates more realistic prices. While independent prices yield sensitivity to volatility, dependent prices are static. These results are important to both patent licenses and licensor looking to maximize revenues (RICHARDS; RICKARD, 2014).

Values for patents tend to be determined in *ad hoc* ways through institutional mechanisms that are unlikely for efficient or economically justifiable prices, therefore the market for innovations is poorly developed, participants are not well informed, players are not

transparent and there are no economically justifiable value. Licensing presents itself as an alternative that presents the true value of innovation (RICHARDS; RICKARD, 2014).

In a patent valuation proposal oriented at the agricultural sector, it is pointed out that it is path dependent, that is, it means that the price of the patent at a given moment depends not only on its value at expiration, but on the trajectory or path of its underlying value over time. Path dependence is particularly important for agricultural innovations because of the time lapse between patent licensing and realization of returns (RICHARDS; RICKARD, 2014).

A prestigie of university positively impacts its patent licensing fee which, in turn, affects licensing performance. Whether through an implicit guarantee or in the form of a social learning effect, the result is that licensing creates a positive feedback loop in which successful universities are more recognize (RICHARDS; RICKARD, 2014).

The valuation model to incorporate more realistic premises can be important in determining patent ideal values: (1) the option to exercise before expiration (American option hypothesis), (2) the codependency of cash flow duration and duration of post-patent investment and (3) the value of the option to exclude patents and replace them with other alternatives (RICHARDS; RICKARD, 2014).

There are five essential elements to the value of a real options patent: the cash flows for the patented innovation, the time period until the patent expires, the post-patent investment required to generate cash flows, the volatility of the underlying flows. and the free risk interest rate (RICHARDS; RICKARD, 2014).

Patents are derivatives like scrips, or options, on the innovation. Unlike options with an exercise date, the option implied in possession of a patent can be exercised at any time at the holder's discretion. Consequently, the value of patent licenses for an agricultural innovation is path dependent. The developed model proposes risk neutral option pricing in both fixed exercises (European) and a path dependent assumption (American), and compares the values with each other and with those observed in the real world (RICHARDS; RICKARD, 2014).

Lin, Ouyang e Hu (2019) present an objective proposal to identify valuable pharmaceutical technologies through a support vector machine classifier model using pharmaceutical patent data from universities to predict the licensing results of these patents using some previously defined variables. The model proposes to contribute to solving the existing difficulty between researchers who need financial support for the development of research and companies that have difficulties in identifying interesting projects to invest.

Table 3 presents a summary of the characteristics of the resources selected to predict the results of patent licensing.

Chart 3

Summary of the characteristics of the seven resources selected to predict the results of patent licensing

Aspects	Factors / characteristics	Quantification
Licensing (universities or faculties)	research prestige	Average number of non-proprietary citations for a patent stock before sample patent granted to a licensor
Patent data	technological scope	Number of classes of a patent
Patent data Therapy	patent age	Year the patent was granted minus the year the patent was filed
	Patent recognition	Countries in which the invention was granted
	Patent citation index	Number of patent citations
	patent claims	Number of claims in a patent
	Therapeutic indications	The number of therapeutic indications of a pharmaceutical patent

Reference: Authors as from LIN; OUYANG; HU, 2019.

The model can be used if interested people want to predict the potential value of patented pharmaceutical technology. This is about to the fact that technologies with initial maturity levels present high risks (LIN; OUYANG; HU, 2019).

Management practices in patent valuation

For a long time, the two main missions of universities were teaching and research, with a change with the commercialization of research contributing to innovation, thus playing a more entrepreneurial role, the so called third mission (MEYER; TANG, 2007).

Thursby, Jensen, Thursby (2001) state that unlike the private sector, where success is measured by the profits achieved, the university's objectives are more diverse. In addition to generating royalties and sponsored research, universities, in particular public ones, contribute to economic development. ICT are also expected to value licensing or commercialization of an invention, regardless of monetary rewards.

ICT basically have three distinct objectives in terms of purpose. While some aim to maximize revenue, in the short or long term, others want recognition from the university, while other ICT prefer to be seen as important drivers for technology-based regional economic development, smoothing the way from laboratory based research to marketing the product on the market (HALLAM; LEFFEL; CHINEA, 2015).

Meyer and Tang (2007) state that income generation is not necessarily the main common objective among universities. Leute (2005) states that biotechnology startups have a lot of appetite for patents. Aiming to become a new "Intel", they seek institutions such as Stanford University to explore their technologies. If ICT perceives the company's potential success in bringing the technology to market, its Technology Transfer Office will negotiate a licensing agreement.

When companies perceive the strategic value of new academic technologies for use in their businesses, they tend to establish exclusivity agreements with universities. This occurs in order to ensure a greater probability of market success with the technology developed, as a tool to protect the investment made. Once the company decides to engage or deepen a research relationship with a university to develop and acquire a new technology, it also represents importance for university innovation managers who need to balance the often conflicting demands of generating adequate returns on investments in research and satisfy the competitive needs of industry partners. Therefore, a balance must be sought between the parties (VAN DEN BERGHE; GUILD, 2008).

The main factors considered in the valuation of patents are, in order of importance: market analysis, stage of technological development, comparison with other inventions, established business plan, nature of invention, employee experience and discussion with inventors and experts. The most used non financial metrics are: qualitative factors, characteristics of the invention, economic potential, necessary resources foreseen in the business plan, technological stage and compared opinions between inventors and employees (HALLAM; LEFFEL; CHINEA, 2015).

In respect to the value of technologies, this is defined by means of a contract with a short term return, through sponsored research or with payments; long term return through royalties or company equity and through social return through the use of free licenses for the purpose of technology-based regional economic development (HALLAM; LEFFEL; CHINEA, 2015).

Stanford uses two types of payments for its licenses as a valuation strategy, annual minimums and phased payments. In the first, an amount is due each year of the licensed

company. In part, it is seen as an indication of diligence, as companies generally do not pay for technologies that they are not developing products for, but it is also typically credible to royalties earned, therefore meaning the 'minimum' amount due each year for sales of products. In the payment in stages, an adaptation to the technology and the business plan of the startup is carried out and must reflect some careful steps that are also included in the agreement. The payments reflect this as the value of the technology's tranches increases gradually, with the university sharing the benefits, especially in the case of startups that did not have the initial resources to compensate Stanford for the bet made (LEUTE, 2005).

Perceived strategic value can be measured along a number of dimensions, such as: the perceived value of the new product to the customer, the improvement that the new technology brings to current capabilities, the usefulness of the new technology over time, the roadmap for investing in technology, the application of technology to a range of products, the synergy between new technology and existing capabilities, and the contribution of technology to building new strategic capabilities (VAN DEN BERGHE; GUILD, 2008).

The definition of the value of patents is usually based on patent citation, applications filed in other countries, licensing and patent renewal. Patent litigation is also increasingly associated with high value, specifically due to the prohibitive costs involved, although universities avoid situations of this nature as much as possible (MEYER; TANG, 2007).

According to Meyer & Tang (2007), although some measures can be derived from patent data directly, others are more difficult to track. In addition, much of the research has focused on corporate patents. On the other hand, studies that explore the value of university patents are still very scarce.

Furthermore, such as by tracking patent citations, they consider past aspects in their guidelines and tend to cover past patenting periods and therefore do not adequately provide an estimate of the value of recent university inventions. As noted, a challenge in relation to the development of innovation indicators is to find measures that also capture relatively recent developments. In addition, value measures need to consider the specific environment in which universities operate, specifically the potential to influence the type of commercialization activities (MEYER; TANG, 2007).

Thursby, Jensen, Thursby (2001) argue that intellectual property, revenue sharing, stage of technological development, marketing strategy, licensing policy and licensing objectives and the inventor's role in licensing are key aspects for defining the value of technologies. Royalties are typically higher the higher the quality of faculty and the higher the fraction of licenses that

run in late stages of development. The agreements, usually royalties and small upfront fees, often include evaluated research and, less often, include equity guarantees.

The main form of technology transfer practiced by the researched offices is through technology licensing through the use of royalty rates to determine the financial value of their innovations, and the main motivation is the fact that universities report that the main causes is the staff shortage, with more than half of the technology transfer offices surveyed having fewer than two employees (HALLAM; LEFFEL; CHINEA, 2015).

An interesting alternative is the involvement of the ICT faculty. Thursby, Jensen, Thursby (2001) argue that it is very important for faculty to participate in finding commercial partners, especially for technologies at an early stage of development, as they better articulate the value and nature of such inventions.

Few technology transfer offices formally determine the financial value of their technologies prior to licensing, and there is also little evidence that managers are willing to value these technologies. In this way, the most common methodology to define the value of the invention is the comparison through royalty rates, but the process itself is more of an art than a science (HALLAM; LEFFEL; CHINEA, 2015).

Final considerations

The present research synthesized studies related to the valuation of academic patents. The review of 8 works suggests some ways to understand, based on the systematization of actions, strategies and management models, how patent valuation practices are carried out in the academic environment.

Another interesting aspect is that the present research contributes to the literature by outlining the research patterns in the area of patent valuation in the academic universe, since it provided an opportunity to understand the knowledge related to the subject, through analysis according to the criteria established by this work.

It was found in the works analyzed in this research that the technology transfer practices applied by the ICT are based on licensing with the gains defined in the form of royalties. The vast majority of transferred inventions are at an early stage of development, and the inventor's involvement in the process is important, not only to find potential interested parties, but also for technological improvement.

An interesting aspect in the technology valuation process is the institutional objective regarding the use of inventions in the market, given that some ICT aim to maximize revenue through patents while others focus on regional development based on technology.

There were not many efforts aimed at the valuation of academic patents, with few studies related to this theme, having generally defined the value through comparative royalty rates, when it is possible due to the lack of information.

The importance of this work is emphasized, as it addresses academic patent valuation models through a systematic literature review that may be useful in research related to the topic at hand.

It is recommended that future research can detail how royalty rates are defined and how the valuation of patents can contribute to a better management of the intellectual property of academic entities.

Authors' contributions

Contribution	Silva, TS	Russo, SL
Contextualization	X	X
Methodology	X	X
Software	X	X
Validation	X	X
Formal analysis	X	X
Investigation	X	X
Resources	-	------
Data curation	X	X
Original	X	X
Revision and editing	X	X
Viewing	X	X
Supervision	-------	X
Project management	X	-------
Obtaining funding	-------	-------

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