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MARKETING ROLES OF UNIVERSITY TECHNOLOGY TRANSFER OFFICES: A SYSTEMATIC REVIEW

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ABSTRACT

This paper seeks to understand marketing roles in the activities of technology transfer offices in universities worldwide, relying on the fact that universities play a key role in the technological development of a nation. To this end, a systematic review was performed using the Web of Science portalTM, which generated 40 articles. It was found that no marketing-related periodical presented on the subject, as well as any of the articles was evaluated based on the marketing theories. Thus, gaps have been identified within marketing research in the context of a theme that is greatly relevant in today's world. This research will address these gaps. In essence, it was found that marketing can contribute to the improvement of practices that foster innovation in universities in various ways, to the understanding of the internal relationships within institutions, to partnerships between these institutions' internal and external actors, to the promotion of technologies and the development of channels with the market, and to the performance of the developed actions and their results.

Keywords: Marketing. University. Technology transfer.

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1. INTRODUCTION

Universities play a fundamental role in the technological development of a nation, as research, one of the pillars of their existence, can contribute greatly to the generation of applied knowledge that has the potential to meet market demands, even if this is not one of the main objectives for most of these institutions (DIAS; PORTO, 2014; MALVEZZI, ZAMBALDE, 2013; SIEGEL *et al*, 2004).

In Brazil, universities are part of the national system of innovation, and thus, they play a prominent role in national technological development. Universities accomplish this despite various barriers, in a competitive global arena where universities' performance considerably impacts countries' economic growth and development (DIAS; PORTO, 2014; MALVEZZI, ZAMBALDE, 2013).

However, Brazilian universities have still not benefited from the transfer of their technologies to the Market. Thus, they are unable to obtain the possible benefits resulting from such practices, such as additional financial resources, the development of students' and teachers' entrepreneurial potential, and talented students (MALVEZZI, ZAMBALDE, 2013; SIEGEL *et al*, 2004).

The academic culture is also unfavorable to the transformation of the knowledge in technologies and, consequently, in products that will serve consumer markets. Professors/researchers are often motivated to contribute to scientific development and seek the recognition of the academic society, and to gain more resources for their projects and scholarships of various modalities, both for themselves and for their undergraduate and graduate students. However, these professionals are not similarly motivated to contribute to the market (SIEGEL *et al*, 2004).

In the Brazilian case, difficulties also exist for public-private partnerships, such as the prevalent and sluggish bureaucracy, with legislation that hinders and discourages relationships between professors/researchers in public institutions and private initiatives.

However, as the theoretical basis of this article will make explicit, a few universities, even in developed nations, still promote technology transfer naturally, in the midst of the environment and culture generally observed in such institutions.

Thus, it is the universities' responsibility to understand this scenario properly and to develop strategies in response to this urgent new reality. Only then can universities contribute more directly to the country's economic and technological development and not remain anchored in the persistent ideological extremisms.

Thus, marketing can contribute to the process of improving practices that foster innovation in universities in a variety of ways, such as by understanding internal relationships in institutions (e.g., endomarketing), by creating internal partnerships (marketing of relationships), by promoting technologies and developing channels with the market (integrated marketing), and performing the developed actions and their results (performance marketing).

Amadei and Torkomian (2009) affirm that companies depend fundamentally on technological innovation, both to remain active in the market and to contribute to the country's growth and development. Tidd, Bessant and Pavitt (2008) argue that continual innovation is the key to creating and maintaining an organization's competitive advantage, regardless of the technological, social, or market conditions involved.

Complementarily, Küster and Avilés-Valenzuela (2010) affirm that universities are not exempt from competing globally, and they require strategies that position them locally, nationally, and globally. They also assert that universities face the same difficulties as companies do when they plan their future.

Thus, these institutions should not be restricted to only producing and diffusing scientific knowledge but should also be involved in thinking about and implementing the knowledge to further realize the full potential of the natural part of their mission. Malvezzi and Zambalde

(2013) point out that companies can gain competitive advantage by transferring technologies developed by universities and can consequently obtain additional resources in such processes.

This scenario confirms the pre-eminent need for universities to enhance their institutional mechanisms for the development of their technology transfer capacities.

Thus, in the effort to contribute to technological innovation and obtain additional financial resources, both foreign and Brazilian universities have established technology transfer offices.

In this context, this article aims to understand the roles of marketing in the activities of technology transfer offices in both international and national universities, along with the impact of these units on the transfer of technologies from universities to the market, through a systematic review of indexed publications in the *Web of Science™* database.

Thus, the guiding question of this research is as follows: what marketing roles are carried out by universities' technology transfer offices/Technological Innovation Centers (TTOs) in their technology transfer processes?

In the following sections, the theoretical foundation, the research methodology, the results and discussions, and the final conclusions will be presented.

2. THEORETICAL GROUNDING

In recent decades, researchers, policymakers, and governments have been increasingly interested in the transfer of technological knowledge from universities to the market as a way of contributing to innovation. This is largely due to the impact of the 1980 Bayh–Dole Act in the US as it contributed to the commercialization of research technologies, which became the property of universities in that country (HSU, *et al.*, JEONG, LEE, 2015).

By understanding that innovation is a process of transforming new ideas into opportunities, universities present themselves as natural and essential elements of a nation's innovation systems (TIDD *et al.*, 2008).

According to Nunes *et al.* (2009), Brazilian universities showed a substantial lack of familiarity regarding the protection of intellectual assets, leading to complete disinterest in the market in seeking partnerships with such institutions. However, these authors indicate that universities are now more aware of the need to protect knowledge through patents, thus ensuring potential gains.

Even in the US, Siegel *et al.* (2004) highlight that universities' management of intellectual property is a relatively new phenomenon.

According to Couto (2000), a limited group of US universities have acquired this capacity. Siegel *et al.* (2004) affirm that some regions are true nurseries of the activities of technology transfer and quote Cambridge and Boston (MIT and Harvard) and the San Francisco Bay Area (Stanford and UC Berkeley) as examples. Siegel *et al.* (2004) stress that such universities have unique and extremely favorable conditions for technology transfer activities, which enable them to achieve a high rate of success (through patents, licenses, and startups). Some of these conditions include the following: a strong scientific and engineering base and readily available venture capital. These conditions make them exceptions to the rule in the academic environment. Siegel *et al.* (2004) assert that this selected group of institutions has achieved success independent of the direct interference of university administrators.

Nunes *et al.* (2009, p.2) also present a powerful barrier to the development of strategies that return to knowledge produced, stating that "the organizational culture of Brazilian public universities is supported by ideological values; they defend the unrestricted access to the results of all the research developed". For Nunes *et al.* (2009), the scenario is even more complex because of the existence of an inflexible and bureaucratic administrative hierarchy.

In this direction, Merton (1957) *apud* Siegel *et al* (2004) clarifies that the main motivation of scientists in universities is recognition by the scientific community, which is generally obtained through publications in the best periodicals, presentations at prestigious scientific events, and obtaining financing for research.

Although this reality persists in the Brazilian public university, Malvezzi (2013) affirms that discussions have been held to find alternatives for the conversion of patents into innovation, aiming to obtain results that not only generate knowledge but also produce social and economic benefits for the university and the society. Costa, Porto and Plonski (2010) affirm that cooperation between universities and companies can no longer be ignored by the three interested segments—business, academic, and government—as this may delay the technological development of companies and countries.

Amadei and Torkomian (2009) point out that in view of the Brazilian government's policies for science and technology, universities have enhanced their contribution to the country's economic and technological development. They point out that "such maturation is evidenced by the creation of structures within the universities with the objective of facilitating the transfer of scientific knowledge to the business environment" (AMADEI, TARKOMIAN, 2009, p.10). They believe that this is achieved through research partnerships between universities and companies, generation of startups, and the licensing of patents.

Couto (2000) states that there are changes in the market for intellectual assets that make the production of knowledge, converted into patents, more mobile through commercial transactions. However, the same author presents the existence of a conflict of interests in the commercialization of intellectual assets by universities, in the face of a culture of free information exchange and dissemination of research results.

Therefore, Malvezzi (2013) presents marketing as an important factor in this process—that of Brazilian universities becoming more active in innovation. The author states that such a process can be an instrument in the early stages by contributing to the cooperation between researchers and organizational units in the process of technology development and take responsibility for placing new technologies in the market.

It is not an question of finding a simple solution, since Siegel *et al* (2004) point to important differences between the objectives of academic researchers, universities (generally represented by the patent office/technology transfer/Technological Innovation Center (hereinafter denominated only as TTOs) and private companies. According to these authors, academic researchers aim to be recognized, have a personal financial gain, and finance their research. The purpose of the TTOs is to protect the intellectual property produced in the institution and negotiate them with companies, to guarantee additional resources for the institution obtained through *royalties*, licensing fees, and more research resources and to diffuse new technologies.

The TTOs are organizations specialized in transferring technology or knowledge from universities and research institutes to other organizations (internally or externally linked to such organizations) and, as their central mission, aim to promote the conversion of discoveries into products and services useful to society (DIAS; PORTO, 2014).

The scope of TTOs encompasses more than the management of intellectual property (IP) and licensing contracts, deploying R&D project management in partnerships, and supporting the creation of *spin-off* companies. These jobs demand a high level of technical knowledge about a wide range of innovative products and services, new business development, training, incubation of companies, seed capital funds, and technology parks (DIAS, PORTO, 2014).

In turn, private firms or new entrepreneurs want to use the technologies developed by universities to earn profits and, therefore, have the desire to make processes as agile as possible so that they can meet their objectives before the competition. It is natural for the private investor to be aware that the advantages of innovation can soon diminish if competitors gain the capacity to imitate, improve, or replace it. This consequently generates tension and a sense of urgency, that is, private firms and entrepreneurs (TIDD *et al*, 2008; SIEGEL *et al*, 2004).

However, the connections between private firms and universities can have mutual benefits. Technology transfer can itself be a great source of additional resources (BRADLEY, HAYTER, LINK, 2013, SIEGEL *et al*, 2004).

Rivera-Camino and Ayala (2010) present market orientation as one of the most important concepts in marketing literature in the last decade. They also affirm that there is some confusion in its definition and, consequently, in its measurement. The same authors affirm that this concept has been applied in the most distinct contexts of private activities without, however, a use in non-profit organizations and still less in educational contexts.

In this sense, Malvezzi (2013) points out that market orientation is adequate when universities seek partnerships with companies to raise resources through incremental innovations, but when the use of patent marketing that leads to radical innovation, it necessary adopt an orientation toward innovation.

In this way, at least two marketing-related roles are seen, considering the need to strengthen the role of Brazilian public universities in the country's economic and technological development by contributing more actively to innovation: a market orientation that supports narrowing relations with companies, favors incremental innovations, and supports generation of extra funds for universities and researchers, and an innovation orientation that is capable of producing innovations previously not imagined by the market, contributing to the country's scientific and technological development (MALVEZZI, 2013; RIVERA-CAMINO; AYALA, 2010).

Through an alternative model of explanation of the process of technology transfer from universities to the market, Bradley, Hayter and Link (2013) clarify that despite the formal process of technology transfer from the university to the market, transfer may occur informally, i.e., without the control of institutional management.

In this way, one can no longer neglect the importance of using marketing strategies to take advantage of all the potential of academic research in generating resources, both for the university and for researchers, as well as contributing to national technological development.

Malvezzi and Zambalde (2002, p.27) affirm that marketing is relevant to the process of technological innovation in the university by contributing to an understanding of "the dynamics of the market, its importance in the process of creation and development of new technologies, considering the customer, price, competition, distribution channels." For the same authors, it is essential to understand the role of marketing in the process of technological innovation within the university.

In this direction, Moyseyenko (2008) cites the model proposed by Chekitan Dev and Don Schultz, in which the marketing mix (4 Ps: product, promotion, price, and place) is converted into SIVA, a model equivalent to 4 Ps, applied to industrial property issues, consisting of solution (in place of product), information (in place of promotion), value (in place of price), and, access (in place of place).

Thus, this model provided an adequate marketing perspective for the planning of technology transfer activities. However, more work is needed to understand the role of marketing in this process (MOYSEYENKO, 2008).

Thus, Kotler and Keller (2012) present a marketing alternative that extends the possibilities of analysis—holistic marketing. They present this concept as being based on the de-

velopment, structuring, and implementation of marketing programs, processes, and activities, considering their breadth and interrelationships.

Zandberg (2012) clarifies that there are five marketing orientations commonly reported in the literature: production orientation, product orientation, sales orientation, marketing orientation, and holistic marketing orientation. However, in an increasingly competitive world, the first three orientations have been considered limited by researchers, while holistic marketing has emerged as the most complete proposal.

Kotler and Keller (2012, p.17) argue that “holistic marketing... recognizes and reconciles the scope and complexities of marketing activities” and present an overview of the four components that characterize it: relationship marketing, integrated marketing, internal marketing, and performance marketing.

Thus, Kotler and Keller (2012) present the following definitions for the component dimensions of holistic marketing:

- Relationship marketing: seeks to develop deep and lasting relationships with those people or organizations that can affect the success of the company’s marketing activities, and aims to build mutually satisfactory long-term relationships with its key components;
- Integrated marketing: the one in which the company plans marketing activities and sets up marketing programs with the goal of creating, communicating, and delivering value to consumers, aiming for synergy. Two key themes are as follows: 1. Various marketing activities can create, communicate, and deliver value; 2. Professionals should plan and implement all marketing activity considering all other activities of the organization.
- Internal marketing: dedicated to hiring, training, and motivating capable employees who want to serve customers well. “Smart marketing professionals recognize that marketing activities within the company can be as important as marketing activities outside the company, if not more important” (KOTLER and KELLER, 2012, p.20);
- Performance marketing: It has, as a presupposition, an understanding of the financial and non-financial returns of the company and the society from activities and marketing programs. It is not limited to analyzing results by means of financial returns only, but also encompasses the marketing scorecard and the interpretation of market share, rate of loss of customers, level of customer satisfaction, product quality, or services and other indicators.

Thus, based on this scenario as well as the marketing aspects discussed here, we aim to understand the roles of marketing in the work developed by the TTOs.

The next section will present the research methodology.

3. METHODOLOGY

A systematic review was carried out, with the search for articles beginning in November 2014, with the general objective of understanding the roles of marketing in the activities of the technology transfer offices of national and international universities.

The systematic literature review uses literature on a given topic as a data source and provides a summary of evidence through the application of explicit and systematized methods of searching, critical appreciation, and synthesis of related information (SAMPAIO; MANCINI, 2007).

According to Conforto, Amaral and Silva (2011), there are specific reasons for performing a systematic review: consolidate evidence in the literature and results of an area, identify gaps in recent research, provide baseline and theoretical models to position new research themes and opportunities, and create, refute, or validate hypotheses.

The result of a systematic review should contribute to the existing body of knowledge. Thus, it is useful to (1) assist the researcher to understand existing knowledge of a subject matter, (2) provide a theoretical basis for further study, (3) provide evidence and the basis for the research problem, (4) provide justifications for the research, (5) contribute to defining and structuring a research method, objectives, and questions (CONFORTO; AMARAL; SILVA, 2011).

Table 1 summarizes the steps to be developed in the implementation of the systematic review, as proposed by Conforto, Amaral and Silva (2011).

The literature on administration is a vastly relevant tool given its diversity of knowledge. This is particularly important in studies on innovation, since the subject is treated from different viewpoints, i.e., marketing, organizational studies, strategy, and operations management. Thus, the literature review should be systematic, structured, and transparent so as to be replicable (VALLADARES; VASCONCELLOS; DI SERIO, 2014).

Table 1: Proposed Steps for Conducting Systematic Review

Phases	Description
1. Definition of the Research Problem	What are the roles of marketing in the technology transfer processes of universities' technology transfer offices (TTOs)?
2. Objectives	a) Identify studies on the role of TTOs; b) Understand the roles of marketing in the transfer of technologies from universities to the market; c) Identify marketing gaps in the work of the TTOs.
3. Research Portal	<i>Web of Science</i> (all databases available), which covers a total of approximately 12,000 journals.
4. Words or phrases to search	"Technology transfer office"; "Núcleo de Inovação Tecnológica"
5. Inclusion criteria	Articles that do not specifically address the activities of TTOs will be excluded. Languages: Portuguese, English, and Spanish. Areas of research considered: Detailed in the results.
6. Qualifying criteria	Only articles listed in <i>Web of Science research</i>
7. Method and tool	The research will follow an iterative process, making it possible to review the steps initially presented here. Articles selected for final use will be uploaded to <i>MyEndNoteWeb</i>

Source: Adapted from Comfort, Amaral and Silva (2011).

According to Carvalho, Fleury and Lopes (2013), there are different possibilities in developing a systematic literature review, including a bibliometric approach (focus on scientific information), meta-analysis (focus on quantitative data), and analysis of content (focus on qualitative analysis).

In this study, we opted for content analysis of the selected articles, focusing on qualitative analysis.

The next section will present and discuss the results of this study, obtained by applying the steps and criteria presented in Table 1. The aim is to see the main *journals* that publish on the topic in question as well as the evolution of scientific production and areas of research. There will also be a theoretical discussion, which aims to foster debate on the participation of marketing technology transfer from universities to the market.

4. RESULTS AND DISCUSSION

The initial search was performed using the expression “*technology transfer office*.” Results were refined for document type “*Article*,” languages “*English, Spanish, and Portuguese*,” and the following research areas: “*Business Economics, Engineering, Public Administration, Operations Research, Management Science, Computer Science, Sociology, Science Technology Other Topics, Information Science Library Science, Government Law, Education Educational Research*.” Only one search area was removed (*Agriculture*). The final search result generated a total of 39 articles.

The search for “*núcleo de inovação tecnológica*” in Portuguese generated only two results, one of which was already included in the previous search. Thus, the search for articles by the aforementioned expressions generated a total of 40 articles, which were read and selected for use in the discussions that follow.

4.1. Characteristics of articles obtained

Table 2 shows the number of articles found per journal as well as the impact factor of each.

Table 2: Periodicals, Number of Articles, and their Impact Factors

N.	Journal	Articles	Impact factor*
	Journal of Technology Transfer	7	1.305
	Research Policy	4	2,598
	Technovation	3	2,704
	International Journal of Industrial Organization	2	0.947
	Journal of Engineering and Technology Management	2	2,106
	Journal of Technology Management & Innovation	2	**
	Latin American Journal of Management Academy	1	**
	Current Science	1	**
	Economic Inquiry	1	1,028
	Hand Clinics	1	**
	IEEE Transactions on Engineering Management	1	0.938
	Industrial and Corporate Change	1	1.330
	Industrial Management & Data Systems	1	**
	Information Sciences	1	**
	Journal of Economics & Management Strategy	1	1.042
	Journal of Evolutionary Economics	1	0.675
	Journal of Intellectual Property Rights	1	**
	Journal of Management Studies	1	3,277
	Management Science	1	2,524
	R & D Management	1	1,266
	Spanish Journal of Scientific Documentation	1	0.717
	Revista O&S	1	**
	Science and Public Policy	1	0.985
	Small Business Economics	1	1.641
	Technological Forecasting and Social Change	1	1,959
	Revista Brasileira de Zootecnia	1	-
	Total	40	-

* JCR - <http://admin-apps.webofknowledge.com/JCR/JCR?RQ=HOME>; ** Not available.

Source: Research data.

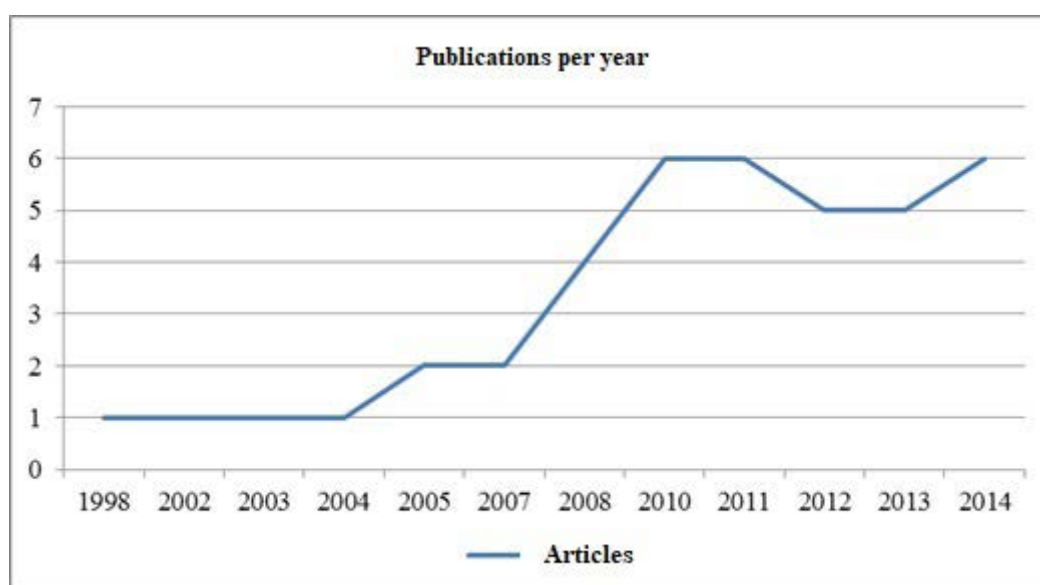
The first relevant consideration is the fact that 26 different journals have published articles on the subject in question. However, the publications are dispersed in several areas. The *Journal of Technology Transfer* has published the most articles (7), followed by *Research Policy* (4), *Technovation* (3), and the others with one or two published articles related to the terms sought.

Only two national journals presented the desired results, *Revista O&S* and *Revista Brasileira de Zootecnia*.

Several journals in the administration or related field also presented publications on the activities of the TTOs; however, it is verified that they are only eventual productions and not a concentrated effort to study them widely.

Another relevant verification for the proposal of this article is the fact that no *journal* devoted to marketing was listed in the searches carried out, demonstrating the research gap that exists in marketing research regarding the transfer of technologies from universities to the market. The reading of the selected texts confirms this consideration, since none of the articles focused clearly on the marketing aspect when studying the relationship of universities with markets and/or governments and their processes of transfer of technology, their capacities, and strategies.

Figure 1 summarizes the results of the systematic review, reporting the number of publications per year. There is a clear increase in the number of publications, and 2014 already has the same number of publications as 2010 and 2011 (six articles). In this way, we can see a growing interest in the field, which will certainly lead to the identification of research opportunities for marketing.



In this way, the main considerations drawn from the articles selected after reading are then discussed in order to identify the research gaps. These can be filled by the marketing research.

4.2. Content analysis of the articles obtained in the systematic review: Roles for marketing

All the texts were read, selected, and recorded, and thus, the main considerations obtained in the literature (qualitative step of analysis) will be presented in this section.

For the North American reality, the emergence of technology transfer offices (TTOs) has facilitated the commercialization of the research results of university scientists (ALDRIDGE; AUDRETSCH, 2010).

Some relevant points are highlighted by Baldini (2010), who states that in Italy and other parts of Europe investments in specific structures in universities are not justified (unfeasible) to protect and transfer intellectual property, whereas creating regional structures may make it difficult to establish a relationship between TTOs and the faculty in different institutions.

In the United Kingdom, in citing Locket et al., Aldridge and Audretsch (2010) argue that there is a positive relationship between the resources of a TTO and the faculty's propensity to market. They also found that marketing is promoted in universities where the professor/researcher receives a favorable copyright distribution. Further, Clarysse, Wright and Van d and Velde (2011) point out that only when a university houses an experienced TTO is when university *startups* benefit by starting activities with a new technology.

At this point, two relevant considerations are found, one on the structure of transfer offices that, when appropriate, leverage the commercialization of intellectual property, thus pointing to marketing innumerable opportunities to understand internal marketing in Brazilian universities and the attention directed by senior management in consolidation of the TTO's work structure. Another relevant issue is to discover, in the Brazilian scenario, the satisfaction and motivation of the researchers as to the possibilities of commercializing their findings and the relation thereof, with expected personal benefits.

According to Aldridge and Audretsch (2010), another factor that can influence commercialization, whether through the front door of the TTO or the back door, may be specific characteristics of the university in which the scientist acts. Different universities have different dissemination cultures. The authors cite Bercovitz and Feldman, who show, in a study based on the commercialization activities of scientists at two universities, that the likelihood of a scientist marketing through one or another medium is shaped by the marketing behavior of the doctorate in the institution where the scientist was trained, as well as the behavior and marketing attitudes displayed by the department involved.

Faced with such an assertion, an opportunity arises for research on what goes on behind the scenes to understand how high-level researchers connect with large companies through joint research, consulting, and other processes, thereby generating innovation, but how the university is incapable of marshaling or earning direct gains.

For Resende, Gibson and Jarrett (2013), intellectual property is strategic in a globalized and competitive scenario, since knowledge and the capacity to innovate play an important role in the development of a country.

In this sense, it is questionable whether the management of university-company relationships should follow the bureaucratic line or should be stimulated to occur spontaneously and naturally. Thus, numerous opportunities are presented to understand the relationship between high-level researchers and the companies they serve.

This is corroborated by Boehm and Hogan (2014) in stating that the marketing of scientific knowledge has become one of the central goals of universities worldwide. Thus, collaborative research projects are seen as the key to achieving this goal; however, the role of high-level researchers in these research projects still needs to be analyzed.

The relationship between the market, universities, and researchers presents numerous challenges. On the one hand, scientists and industry often criticize government agencies and TTOs as being well-meaning but ineffective. On the other hand, the industry and TTOs often criticize students for their lack of understanding of the world trade (BOEHM, HOGAN, 2014).

This reality seems to be even more complex in Latin America, where universities appear as the main employer of researchers and also the main recipient of public funding for research. However, today's world increasingly requires universities to improve their relationship with the business sector and to contribute to economic and technological development. Historically, Latin American universities and public research centers have maintained a minimum level of interaction with industry, which represents a great potential to be exploited (GUADALUPE CALDERON-MARTINEZ, GARCIA-QUEVEDO, 2013)

Globally, a third mission of universities is now being pursued from the perspective of a basic institution for the transfer of research and development and knowledge. However, in Latin America, universities have traditionally had a more social role in solving certain regional needs and acquiring their own third mission, thus presenting Extension as an academic activity directed to social development (GUADALUPE CALDERON- MARTINEZ; GARCIA-QUEVEDO, 2013).

Thus, there is considerable marketing research, especially on integrated marketing, where universities need to think about intellectual property issues from a strategic marketing viewpoint and to set up programs to create, communicate, and deliver value to researchers and the market. Thus, they would develop a clear strategy to treat innovation as one of their priorities (ZANDBERG, 2012; KOTLER AND KELLER, 2012; MOYEYENKO, 2008).

Another fundamental question is presented by Chapple *et al.* (2005), who claim that licensing has been the main mode of technology transfer in US universities. As a result, studies on the relative performance of TTOs of US universities use the number of licenses or licensing revenues as a measure of technology transfer success. Thus, most of the studies on the relative efficiency of these organizations are based on the production function. This is probably not the best way to evaluate performance in other countries.

Although performance marketing (KOTLER; KELLER, 2012) presents explanatory potential for this type of situation, the focus is specifically on sales revenue, which has brought the issue closer to disciplines such as economics and finance than marketing, with little or no emphasis in these processes on environmental and community issues, for example.

The article by Dalmarco *et al.*, 2011 examines the process of technology transfer in public universities in Brazil. Results show that universities face difficulties in requesting and licensing patents from scientific results, which is due to the low level of commercial contact with companies and their limitations in adapting available technologies.

These authors point out that the increase in scientific production is effectively transformed into new technologies for products and services, exposing the need for new policies for university–industry relations. Thus, the authors suggest that universities should rethink the simple approach of intellectual property protection and seek a continuous approach to the market.

For Dalmarco *et al.* (2011), in Brazil, although the creation of TTOs represents the legal and institutional recognition to incorporate technology transfer, the introduction of these new routines in the academic environment was not effectively implemented due to different perceptions of the university community about the mission of the university.

The TTOs are not prepared to respond to the needs of the companies; they lack specialized professionals because the universities do not invest sufficiently, leaving the task of executing business activities to teachers. As a consequence, TTOs rely mainly on patent registration, sharing licensing responsibility with researchers (DALMARCO *et al.*, 2011).

In this sense, in Brazil, opportunities for marketing research are further confirmed, especially the understanding of university–market relationships (relationship marketing) and the diffusion and development of entrepreneurial culture and innovation within universities (internal marketing).

This is confirmed in the conclusions of Dias and Porto (2014), which state that even the TTO of USP (NIT/USP), the largest Brazilian university, is in a stage of minor maturity in relation to the international reality, which led them to conclude that this office still has to undergo several stages of maturity so that the greater its capacity for articulation with different units of the university and with society, the higher will be its chances of success.

Hewitt-Dundas (2012) is more emphatic and states that the results of her research demonstrate that the universities' approach to knowledge transfer is mainly formed by institutional and organizational resources (ethos and the quality of research), rather than the ability to transfer knowledge through a TTO.

The US case differs a great deal from other countries and causes Jensen, Thursby and Thursby (2003) to state that TTOs are responsible for facilitating the disclosure of inventions, evaluating them, as well as seeking licensing and enforcement contracts for universities.

It is believed that the pragmatism and the natural coexistence of North Americans with market relations facilitate the practices that drive the generation of innovation through academic research.

Thus, it is believed that in countries like Brazil, the recognition by the marketing academia that the transfer of technologies from universities to the market points to relevant research themes may contribute to the study and development of this practice, which is recent but also ignored by marketing scholars.

5. FINAL CONSIDERATIONS

In this work, a systematic review was conducted with the objective of understanding how marketing can be inserted in the discussions about the transference of technologies from universities to the market. To this end, searches were conducted in the portal *Web of Science™*, which generated 40 articles, which were used in the content analysis.

The most fundamental finding is that no work from among the selection was published in a marketing *journal*, demonstrating the extent to which the subject is disregarded by researchers of the area, which, perhaps, is provoked by the incipience of the subject. However, since transfer of technology from universities and research centers is, nowadays, considered a key factor for innovation in any country, affecting its economy and its development, the marketing department cannot help but understand and collaborate to develop internal capacities of universities and their relationships with the market.

Likewise, none of the articles surveyed had a theoretical basis for marketing, demonstrating the neglect of the area in such a recent, current, and significant theme.

In Brazil, the innovation law, which establishes the mandatory implementation of TTOs in national scientific and technological institutions, is extremely new, enacted in December 2004. The legislation that inspires it, the Bayh–Dole Act of the USA, was enacted in 1980. In this way, an extremely recent framework of discussions on the theme and practices of technology transfer from universities to the market is internationally available (DIAS, PORTO, 2014).

Literature obtained and analyzed qualitatively demonstrated that the USA, in some universities of excellence, performs transfers in an absolutely ingenious manner, better than other developed countries.

As pointed out by studies in Brazil and Italy, many universities are unable to put together a structure capable of offering adequate support to technology transfer processes, and this can be an important constraint for the development of skills in this area. On the other hand, shared offices may become ineffective by distancing themselves from the distinct realities and competencies of each institution (BALDINI, 2010; DIAS; PORTO, 2014).

The discussion content of the articles pointed to several marketing research opportunities in transfer of technologies from universities to the market.

A potential research gap to be filled by marketing research in Brazil is to understand the view of national-level teachers regarding the role of universities in technological innovation. This can be significant since the third mission of universities in the country is usually linked to its social role and to the University Extension. Internationally, as pointed out by some studies, there is talk of the third mission also being associated to its economic role.

In Brazil, in most public institutions, the TTOs have simplistic structures, with little or no business experience, and too much focus on protecting intellectual property. Thus, they drive up costs. Marketing has considerable potential to contribute to the understanding and changing of this scenario.

In light of such considerations, there emerges an understanding that marketing can contribute to improving practices that drive innovation in universities by understanding internal relationships in institutions, the partnerships of these institutions with internal and external actors, the promotion of technologies, the development of channels with the market, and the performance of the actions developed and their results.

It is true that our public universities have much to learn about entrepreneurship, patent registration, licensing, revenue generation, and distribution. However, there are innumerable international experiences that can contribute to the development of institutional policies and practices that may stimulate the patenting of inventions/discoveries and their market capitalization.

Universities are fundamental in interacting with other players to develop a nation's innovative and technological capabilities and are a great source of knowledge and products for both society and the market. The market cannot be excluded from this relationship, since it is an inseparable part of society. In this sense, to foster innovation, it is fundamental that relationships occur among the various social actors so that opportunities can be detected and returns can be obtained.

Finally, the article presents a limitation on the number of national articles raised, since only two of the *Web of Science*TM portals were found. Thus, for future studies, a direct search in the national journals is recommended, given the limitation of their indexations in international bases.

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