

Motivations and barriers of university-industry cooperation: a comparison between Brazil and Ireland

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Abstract: University-industry cooperation (UIC) is increasingly seen as an essential innovation strategy and technology transfer offices (TTOs) play an important role in this process but are still neglected by industries and researchers. Public policies have been developed worldwide since the Bayh-Dole act in 1980, but emerging countries still face difficulties in promoting UIC compared to developed countries. This article aims to highlight and compare the main motivations and barriers for UIC in Brazilian and Irish TTOs. Based on a literature review, a questionnaire was applied to the heads of nine TTOs. This research is characterized as a multiple case study with a qualitative approach. Based on the results obtained, it can be concluded that the TTOs from Ireland and Brazil have different motivations for cooperation, but face similar barriers despite the completely different contexts they are in.

Keywords: university-industry; cooperation; technology transfer office; motivation; barriers.

Submitted: January 7th, 2022 / Approved: July 20th, 2022

1. Introduction

Innovation became an indispensable resource for the development, growth, and competitiveness of industries, and amid adversity to sustain high investment in research and development (R & D), many industries have sought to innovate beyond their borders. In this context, over recent decades universities have assumed the role of a source of external knowledge and how one ally is significant for the innovation industry (Jonsson et al., 2015) through the capacity to generate new knowledge through quality academic research and in the possibility of transferring this knowledge to industries, had become protagonists in the process of economic and social development (Dell'anno & Del Giudice, 2015; Jonsson et al., 2015; Etzkowitz & Zhou, 2017).

The main factor attributed to the expansion of university-industry cooperation (UIC) was the enactment, in 1980, of the Bayh-Dole Act, an American law that stimulated the production of patents in universities that obtained financing from federal funds. Follow by similar changes, other countries proposed similar legislation, which prompted the emergence and consolidation of the Technology Transfer Offices (TTOs) (Moreno, 2018; Holgersson & Aaboén, 2019), having their principal role to support the commercialization of research results, being considered an important stakeholder between universities and industries in this process (Holgersson & Aaboén, 2019).

Brazil, inspired by the American Act, enacted 2004 its first innovation act, Act n° 10.973, which established measures to encourage innovation and scientific and technological research in the productive environment. This law determines that public universities should have a technological innovation center (TIC), similar to TTOs, to manage their innovation policy. In 2016 this act was atualized with the edition of Act No. 13,243, which emphasizes the importance of UIC and the

need for adoption by declaring that one of the responsibilities of TICs is to promote and monitor the relationship between universities and industry (Brasil, 2016).

Despite the law, in Brazil, the results are not significant when compared to international scenarios, and this is because the legislation dealing with the subject is recent in the country. In spite of the incentives in some Brazilian universities being similar to the Massachusetts Institute of Technology (MIT) in the USA, for example, the conditions for its realization are very bad. Brazilian universities face internal obstacles such as the difficulty in hiring researchers, the reduced number of researchers, very bureaucratic internal processes, and excessive centralization of decisions within the public university, and at the same time, they face external obstacles such as the lack of stimulation by the government (De Negri, 2018). Additionally, another factor that may justify the low cooperation in countries like Brazil is due to the lack of culture and willingness of university students to link to the industry. The majority of Latin American universities evaluate several researchers using parameters and traditional criteria, and consequently, many choose to devote their time to basic research and publish their results, since they view it as a more reliable path to advancement and salary improvements (De Negri, 2018). Moreover, the absence of policies and support at the national level, as well as inadequate structures, are confirmed by literature (Nsanzumuhire & Groot, 2020).

On the other hand, developed countries have a strong investment in UIC. Ireland, for example, invests significantly in R&D and is involved in joint research with companies. Furthermore, its research, development, and innovation (RD&I) policy have in recent years emphasized the transfer of technology between universities and SMEs, evidencing effective results in this partnership. In 2017, €631.8 million was invested in

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research, with universities accounting for 20% of total annual national R&D expenditure, and this investment is estimated to have had an impact of €1.01 billion on the Irish economy (Indecon, 2019).

In Ireland, academic research has been pursued to facilitate the transformation of products and technologies into commercially viable through university–industry cooperation. Research and innovation are the pillars of economic development policy in this country, which can be determined due to the significant investments made by the government in the last decade in science and technology. Universities, technology institutes, and research organizations rely on a professional technology transfer infrastructure to work with existing industries and support new industries to leverage their results (Knowlegde transfer Ireland, 2019).

The reflection of the performance of the two countries can be seen in The World Bank (2022), which analyzes the UIC index in R&D. In 2020, Brazil occupied the 74th position in the ranking while Ireland occupied the 15th position.

Given the importance of UIC for economic and social development, this article presents a multiple case study that describes and compares motivations and barriers in two countries that suggest opposite results in this process. On the one hand, Brazil, with mediocre results, and on the other, Ireland, a country that has been investing massively in R&D and encouraging UIC.

The contribution of this article lies in the literature review that we used to organize the factors that motivate and the barriers that hinder the process of cooperation between university and industry, based on several other. Finally, it was applied a questionnaire in Brazilian and Irish TTOs seeking to identify the differences that the institutions face and to confirm the coherence of studies that were previously carried out. To perform the research, this study has a strong focus on the central question ‘What are the motivating factors and barriers faced by TTOs for cooperation between universities and industry in different contexts?’

The results obtained from this research can be used to adapt public policies and to identify whether the motivations and barriers for UIC faced by TTOs differ or are similar between an emerging country and a developed country.

Therefore, this paper is structured in six sections. First, this introduction, the following section contains the elements theoretical that support this research. The third section reports the methodological procedures employed and the fourth presents the research results, followed by a discussion. Finally, the fifth section presents the study's conclusions, followed by the references.

2. University-Industry Cooperation

University-Industry Cooperation refers to the development of dynamic and intentional cooperation between universities and industries to create, expand or modify knowledge, innovations, and technologies on a local or global level (Turchi *et al.*, 2013).

This relationship has had a long history (Ankrah & Al-Tabaa, 2015; Rybníček & Königsgruber, 2018; Thomas, 2019), since universities become a protagonist in the process of economic and social development (Dell'anno & Del Giudice, 2015; Jonsson *et al.*, 2015; Etzkowitz & Zhou, 2017), providing a fertile environment for innovation (Etzkowitz & Zhou, 2017; Thomas *et al.*, 2017; Nam *et al.*, 2019), that is why governments in many countries are developing public policies to promote UIC (Thomas *et al.*, 2017; Thomas, 2019).

In the UIC process, industries expect to obtain economic benefits, solve their problems or increase their innovative capacity (Goel *et al.*, 2017). While for universities the positive effects are related to the return of public investments to society, generation of new knowledge for researchers, development of theses and dissertations, training of human resources (Turchi *et al.*, 2013), acquisition or access to updated equipment and generation of revenue source (public and private) (Ankrah & Al-Tabaa, 2015). Thus, university–industry cooperation is extremely important for industry and government, as the knowledge they accumulate is an important input for innovation, making it an alternative path for companies to obtain significant results in technological development (Sartori *et al.*, 2017).

2.1 Technology transfer offices and the university–industry cooperation

To meet the third mission, universities undertake efforts to establish structures that enable the innovation process. In this sense, the creation of TTOs stands out, aimed at managing the commercialization of academic research and articulating R&D connections with other actors. TTOs are considered one of the main ways to promote UIC (Huyghe *et al.*, 2016; Thomas *et al.*, 2017; De Negri, 2018).

The TTOs assume several functions in the university context, among them: intermediating the relationship between the university and other actors; commercializing the knowledge generated at the university; managing intellectual property to protect research results; providing services for the benefit of society; increasing the competitiveness of public and private industries, enhancing the impact of research results; encourage contract research or the joint development of projects; promote an entrepreneurial culture; manage academic human capital; provide professional advice to researchers on the fate of their innovations; and provide new educational experiences for researchers and students (Moreno, 2018).

However, these structures are still ignored by researchers and industries (Jonsson *et al.*, 2015; Huyghe *et al.*, 2016; Thomas *et al.*, 2017; Holgersson & Aaboen, 2019), in addition, face internal and external obstacles that can implement UIC more complex, among which the poor visibility and lack of office identity stand out (Moreno, 2018); the lack of trained personnel (Moreno, 2018; Viana *et al.*, 2018; Ha & Kwon, 2016); the low participation of researchers in research activities and technology transfer and the challenges in the area of public policies, making the process more bureaucratic (Moreno, 2018; Viana *et al.*, 2018). So, encouraging UIC is crucial to enhance the innovation capacity of a country, as it provides economic, institutional, and social benefits.

Despite the benefits arising from UIC, this relationship depends on the motivation of both companies and universities and can also be hampered by the internal barriers and obstacles of the TTOs for its implementation, for that reason, studies seeking to explain the aspects that motivate universities and industries to cooperate, as well as the barriers faced in this process.

2.2 Motivations and barriers to university-industry cooperation

In the literature, several factors are found to explain the motivations and barriers to UIC. Cunningham and Link (2015) suggest that the main motivation for university-industry cooperation tends more towards the financial side; for Goel et al. (2017) it is influenced by values and beliefs about the role of science. Regarding the barriers to UIC are mainly in the cultural sphere (Sierra *et al.*, 2017; Rybníček & Königsgruber, 2018; Lima & Sartori, 2020). Based on numerous authors, table 1 presents numerous factors that motivate UIC and barriers to a successful partnership.

Table 1: Motivation and barriers to university-industry cooperation

Motivation	Barriers
<ul style="list-style-type: none"> - Lack of funding sources for research. - Lack of equipment and/or materials for laboratories. - Obtaining resources/funds for undergraduate students. - Recognition of work with society. - Possibility of generating additional income for the university researcher and the research center. - Increased institutional prestige. - Dissemination of knowledge. - Means to maintain research groups. - Allowing researchers to have access to the industrial sector. - Expansion of educational experience. - Topics for dissertations. - Realization of social function. 	<ul style="list-style-type: none"> Lack of entrepreneurial culture in both researchers and teachers and in the administrative sphere. Cultural differences. Disagreements regarding ownership of the results of the partnership. Interest conflicts. Focus on basic science. Lack of regulations or excessive rigidity of existing ones. Failure to use marketing policies applicable to university technological offer. Discontinuity of projects due to political and / or labor problems. Researchers isolated from reality, without understanding the needs of the productive sector. View of the productive sector as only interested in its own benefits and not in giving back to the university and society. Slowness in bureaucratic procedures for approval of agreements. Lack of financial resources. Teachers with an excessive workload. Researchers' performance assessment based on the number of articles published. Low or scarcity of infrastructure.

Source: Bolívar-Cruz et al. (2016), Sierra et al. (2017), Goel et al. (2017), Rybníček & Königsgruber, 2018, e Thomas (2019), Lima & Sartori (2020), Nsanzumuhire & Groot (2020).

Therefore, it is concluded that the university-industry cooperation process can be both hampered by barriers and obstacles and engaged by motivations and facilitators, so that, if managed correctly, it has a positive effect on cooperation. On the other hand, poor management can have negative effects (Ankrah & Al-Tabbaa, 2015).

3. Research methodology

This study is an exploratory study, with a qualitative approach. We compared the main motivations and barriers related to the cooperation process between universities and industries in Brazil and Ireland, the method used was the qualitative multiple case study. The research was conducted with six TTOs from public Brazilian universities, located in the state of Paraná, and three from universities in Ireland, two in the city of Dublin and one in the city of Dundalk.

3.1 Literature Review

A review of the available literature on the topic related to university-industry cooperation was carried out. The search for relevant papers and articles was carried out using Scopus and Web of Science data-

bases using keywords related to the research topic (technology transfer office, university-industry, cooperation, interaction, relation, relationship, collaboration, university-firm, and university-company).

3.2 Qualitative data collection

A questionnaire was used for data collection, built from a systematic review of the literature. Prepared on Google Forms, the questionnaire consisted of six questions (four open and two closed). The closed questions corresponded to the objective of this research, of which the respondent should indicate the degree of frequency (always, sometimes, never). The open questions are aimed at identifying the TTOs, such as the year the office was created, the number of people working there, the respondent's position and working time, as well as a question so that the respondent could add factors not covered in the other questions. The research objective was 'to highlight and compare the main motivations and barriers for university-industry cooperation in Brazilian and Irish technology transfer offices'.

To select the Irish universities that participated in the survey, first, a search was carried out on Google Search using the term "technology

transfer office Ireland” and the Knowledge Transfer Ireland website was found. This site contains information on 8 universities, 1 university of technology, and 11 institutes of technology in Ireland that have TTOs and their respective contacts, such as the name of the official representative and their email address.

Afterward, an electronic message was sent to the heads of the TTOs at the eight universities, containing the researcher's identification and presentation and asking if they could participate in research on the university-industry cooperation theme, with only three responding with confirmation of participation in the research. To obtain a better sampling for the research, an electronic message questioning the possibility of participating in the research was also sent to the technological university and the institutes of technology. These institutes have been considered, since 2018, as higher education institutions, with the status of technological universities (Citizens Information, 2021). Only one institute responded by confirming its participation in the survey. Thus, three universities and an institute were available to par-

ticipate in the research, however, effectively, only two universities and an institute responded to the research, Trinity College Dublin, Dublin City University, and Dundalk Institute of Technology.

For the selection of universities in southern Brazil, the criterion used was that of convenience, given that the researcher belongs to one of these universities, as well as resides in the territory of Paraná. Federal universities were excluded from this research because federal and state universities are under different hierarchies and, consequently, have different norms and guidelines for different processes.

Subsequently, as with the Irish universities, an electronic message was sent to the managers of the TTOs of these six universities containing the identification and presentation of the researcher and asking if they could participate in research on the topic of university-industry cooperation. All universities responded positively to participation in the survey. Thus, nine TTOs participated in the survey, three from Ireland and six from Brazil. The main information about the TTOs is listed in table 2.

Table 2: Data from survey respondents

TTO/University Name	Amount of people	Job position	Time in office
Office of Corporate Partnership and Knowledge Exchange (OCPKE)/Trinity College Dublin	9	Director	4 years
Invent Center/Dublin City University	8	Marketing director	13 years
Regional Development Centre/Dundalk Institute of Technology	4	Director	7 years
Innovation Agency/State University of Londrina	6	Director	7 years
Technological Innovation Center/State University of Maringá	4	Advisor	1,6 years
Technological Innovation and Intellectual Property Agency/Northern Paraná State University	2	Director	4 years
Innovation and Intellectual Property Agency/State University of Ponta Grossa	2	Director	1 year
Technological Innovation Agency/State University of the Midwest of Paraná	4	Director	6 months
Technological Innovation Center/State University of West Paraná	4	Coordinator	4 years

Source: Author (2022).

After performing the data collection phase, they were registered with the aid of a Microsoft Excel spreadsheet and then systematically organized and classified, considering the following steps: (a) selection, which concerns a thorough examination of the data; (b) coding, to transform qualitative data into quantitative data; and (c) tabulation, to provide the arrangement of data in a table (Prodanov & Freitas, 2013). The closed questions, which sought to analyze the degree of frequency, were transformed into quantitative data in percentage form, which were later tabulated. The open questions, which were intended to raise general information about the university and the TTOs, were treated individually (Prodanov & Freitas, 2013).

This research observed the ethical aspects, and to guarantee the confidentiality of the research respondents and voluntary adherence, a Free and Informed Consent Form was created, presented in the initial part of the questionnaire, containing information regarding the researcher and the research, voluntary participation the respondent and the guarantee of anonymity, as well as the use of data exclusively for the research.

3.3 Limitations

Stake (2005) affirms that the use of multiple cases provides evidence inserted in different contexts, however, he draws attention to the fact that research with multiple cases requires replicating the same questions in all cases, making it difficult to deal with the quantity and information complexity.

Therefore, this multiple case study has limitations, as the marked difference between the countries studied makes it difficult for the data to be generalized, especially with regard to the motivations for the UIC, however, they make it difficult to apply them to all universities, opening new possible perspectives.

4. Results

The motivation for university-industry cooperation is based on different factors (Thomas, 2019). As shown in table 3, 100% of the respondents to the survey of Brazilian TTOs indicated that the lack of equipment and/or materials for laboratories, means maintaining

research groups, permission for researchers to have access to the industrial sector, and expansion of the educational experience are motivations to cooperate with industries. For 83% obtaining resources for undergraduate students, for 66% the possibility of generating additional income for university researchers and research centres, the dissemination of knowledge, ideas, and themes for dissertation and the performance of the social function, for 50% the lack of funding for research and recognition of their work in society and 33% the increase in professional prestige are factors that occasionally motivate.

Furthermore, for another half of Brazilian respondents, the lack of funding for research, the recognition of their work by society, and the increase in institutional prestige are factors that always motivate cooperation with the productive sector. Just for 34% the dissemination of knowledge and the realization of the social function, for 17% obtaining resources for undergraduate students, the possibility of generating additional income for university researchers, and ideas for dissertation topics are motivations to cooperate with industries.

In contrast, the Irish TTOs indicated that the dissemination of knowledge and the realization of the university's social function are factors that always motivate cooperation between universities and industries. Following by the recognition of their work by society, the possibility of generating additional income for university researchers, increased institutional prestige, means to maintain research groups and permission for researchers to have access to the industrial sector pointed for 67%. The lack of funding for research, expansion of educational experience and ideas, and themes for dissertation are always motivations for 33% of the respondents.

Is never a motivation for Irish TTOs: the absence of equipment and/or materials for laboratories, indicated by 67% and, obtaining of resources for undergraduate students, indicated by 33%. By contrast, sometimes the lack of research funding, funding for graduate students, expansion of educational experience, theme ideas for dissertations, and expansion of educational experience are factors that occasionally motivate university-industry cooperation according to 67% of the respondents.

Table 3: Motivating factors for university-industry cooperation

Motivating factors for university-industry cooperation	Country	Always	Sometimes	Never
Lack of funding sources for research	Brazil	50%	50%	
	Ireland	33%	67%	
Lack of equipment and/or materials for laboratories	Brazil		100%	
	Ireland		33%	67%
Obtaining resources/funds for undergraduate students	Brazil	17%	83%	
	Ireland		67%	33%
Recognition of work with society	Brazil	50%	50%	
	Ireland	67%	33%	
Possibility of generating additional income for the university researcher and for the research center	Brazil	17%	66%	17%
	Ireland	67%	33%	
Increased institutional prestige	Brazil	50%	33%	17%
	Ireland	67%	33%	
Dissemination of knowledge	Brazil	34%	66%	
	Ireland	100%		
Means to maintain research groups	Brazil		100%	
	Ireland	67%	33%	
Allowing researchers to have access to the industrial sector	Brazil		100%	
	Ireland	67%	33%	
Expansion of educational experience	Brazil		100%	
	Ireland	33%	67%	
Topics for dissertations	Brazil	17%	66%	17%
	Ireland	33%	67%	
Realization of social function	Brazil	34%	66%	
	Ireland	100%		

Source: Author (2022).

Additionally, one respondent from an Irish TTOs stated that creating job opportunities for doctoral candidates and obtaining industry sponsorship for these students are factors that motivate cooperation between university and industries. Another respondent commented that the key to motivating cooperation between universities, industries, and governments is a joint effort by all three.

These factors were also confirmed in a survey carried out in Ireland in 2017 on the factors that motivate cooperation from the point of view of the university management, which indicated the improvement of the researcher's employability, the fact of addressing challenges and social issues, the contribution to the university mission, obtaining funding and resources for the university, and using research in a more practical field (Sheridan & Fallon, 2018).

Even though several factors motivate cooperation between universities and companies, several studies reveal the barriers that affect innovative activities and cooperation. Culture can be both a facilitator and a barrier to innovation activities (Sartori *et al.*, 2017). Thus, while companies have greater flexibility, universities reveal enormous bureaucratization, which can hinder cooperation (Ryan *et al.*, 2008; Bolivar-Cruz *et al.*, 2016).

In table 4 are presented the barriers for UIC. For 100% of the Brazilian TTOs participating in the survey, the focus on basic science, the non-use of marketing policies applicable to the university technology offer, the high workload of teachers, and the absence or low infrastructure for research are barriers that occasionally hamper cooperation, in the same way, 83% pointed out the disagreements between university and company regarding the ownership of the partnership results, conflicts of interest, researchers isolated from reality and without understanding the needs of the productive sector and evaluation of researchers' performance based only on publications, followed by 66% that indicated cultural differences, the lack of regulations or excessive rigidity of existing ones, the discontinuity of projects due to political and/or labor problems, the vision of the productive sector restricted to their interests and not in giving back to the university and society and the lack of financial resources, always represents barriers to cooperation.

The lack of an entrepreneurial culture both concerning researchers and professors and in the administrative sphere and the slowness in bureaucratic procedures for the approval of agreements are seen as frequent barriers for 50% of respondents, and for the other 50% are occasionally barriers.

Cultural differences, lack of regulations or excessive rigidity of existing ones, and lack of financial resources are recurring barriers for 34% of Brazilian TTOs. But, just 17% pointed out conflicts of interest, the discontinuity of projects due to political and/or labor problems, researchers isolated from reality and without understanding the needs of the productive sector, the vision of the productive sector restricted to their interests and not on giving back to the university and society and the performance evaluation of researchers based only in publications as a common barriers.

Conversely, only 17% of respondents indicated that disagreements between university and industry regarding ownership of the results of the partnership, the discontinuity of projects due to political and/or labor problems, and researchers isolated from reality and without understanding the needs of the productive sector, never hinder the cooperation of universities with companies.

The Brazilian respondents suggested that industry must want to cooperate, plus the government must hire human resources, improve physical and organizational structures, and provide adequate legislation for technology transfer management as well as know-how and qualified human resources.

These same suggestions have been made in other research. Turchi and Morais (2017) found that the complexity of the legislation, the time spent on hiring and monitoring the team, the qualification of the team, and the size of the technical team are aspects considered highly difficult in Brazilian TTOs, however, it is the regulatory environment which presents the greatest difficulty.

Furthermore, a study carried out in 2016 by the Institute of Applied Economic Research with 2,000 laboratories and Brazilian research facilities pointed out that most of these facilities are distributed in predominantly public university departments, and as a characteristic of the public system, universities are subject to stricter and more bureaucratic operating rules, which make it difficult to purchase and import inputs, as well as hiring researchers temporarily to work on projects (Turchi & Morais, 2017).

Unlike Brazilian TTOs, only three factors were identified by 33% as barriers for Irish TTOs: lack of regulations or excessive rigidity of existing ones, researchers isolated from reality, without understanding the needs of the productive sector and, researchers' performance assessment based on the number of articles published.

On the other hand, it can be seen that for 100% of the respondents, the factors that occasionally become barriers to UIC are: lack of entrepreneurial culture in both researchers and teachers and in the administrative sphere, the focus on basic science, the vision of the productive sector restricted to their interests and not in giving back to the university and society, and the lack of financial resources. Likewise, 67% pointed out cultural differences, disagreements between university and company regarding the ownership of the results of the partnership, conflicts of interest, the lack of regulations or excessive rigidity of existing ones, the non-use of marketing policies applicable to the technological offer university, researchers isolated from reality without understanding the needs of the productive sector, the slowness of bureaucratic procedures for the approval of agreements, the high workload of professors and the performance evaluation of researchers based only on publications, and 33% indicated scarcity or low infrastructure.

Furthermore, 100% of respondents indicated that at any time the discontinuation of projects due to political and/or labor problems is considered a barrier to university-industry cooperation, in the same way, 67% indicated scarcity or low infrastructure and 33% indicated

differences cultural issues, disagreements between the university and the company regarding the ownership of the results of the partners-

hip, conflicts of interest, the slowness of bureaucratic procedures for the approval of agreements and the high workload of teachers.

Table 4: Barriers to university-industry cooperation

Barriers to university-industry cooperation	Country	Always	Sometimes	Never
Lack of entrepreneurial culture in both researchers and teachers and in the administrative sphere.	Brazil	50%	50%	
	Ireland		100%	
Cultural differences	Brazil	34%	66%	
	Ireland		67%	33%
Disagreements regarding ownership of the results of the partnership	Brazil		83%	17%
	Ireland		67%	33%
Interest conflicts	Brazil	17%	83%	
	Ireland		67%	33%
Focus on basic science	Brazil		100%	
	Ireland		100%	
Lack of regulations or excessive rigidity of existing ones	Brazil	34%	66%	
	Ireland	33%	67%	
Failure to use marketing policies applicable to university technological offer	Brazil		100%	
	Ireland		33%	67%
Discontinuity of projects due to political and / or labor problems	Brazil	17%	66%	17%
	Ireland			100%
Researchers isolated from reality, without understanding the needs of the productive sector	Brazil	17%	83%	
	Ireland	33%	67%	
View of the productive sector as only interested in its own benefits and not in giving back to the university and society	Brazil	17%	66%	17%
	Ireland		100%	
Slowness in bureaucratic procedures for approval of agreements	Brazil	50%	50%	
	Ireland		67%	33%
Lack of financial resources	Brazil	34%	66%	
	Ireland		100%	
Teachers with an excessive workload	Brazil		100%	
	Ireland		67%	33%
Researchers' performance assessment based on the number of articles published	Brazil	17%	83%	
	Ireland	33%	67%	
Low or scarcity of infrastructure	Brazil		100%	
	Ireland		33%	67%

Despite presenting barriers to cooperation, Ireland has shown satisfactory results since the implementation of strategies to increase technology transfer. Licensing activities, for example, increased sevenfold, and spin-out creation grew by around 400% (Fitzgerald & Cunningham, 2016). However, empirical studies in Ireland have shown that researchers do not see any career benefit from cooperating with companies and suffer from time pressure and publication restrictions (Ryan *et al.*, 2008).

In summary, this research showed that the motivation of TTOs to carry out university-industry cooperation derives from different reasons: in Ireland, it was evident that fulfilling the social function of the university is highly relevant, while in Brazil recognition of work

and lack of funding for research are more important. Nevertheless, it should be noted that there are similarities in motivations, such as the lack of funding for research, expanding the educational experience, access to industry, and maintaining research groups, suggesting that the stimuli for both are similar.

In terms of barriers, Brazilians TTOs face bureaucracy and the researchers' lack of entrepreneurial culture, whereas for Irish TTOs, these comprise the performance evaluation carried out because of the number of publications, lack or excessive regulation and researchers without knowledge of market demand. Even though, is evident that Brazilian TTOs face more barriers than Irish TTOs and they are more frequent.

Not to mention, discontinuation of projects due to political or labour issues is very frequent in Brazilian TTOs, which does not occur in the reality of Irish TTOs. Also, in Brazil, infrastructure is a factor that negatively affects scientists' work, as scarcity or low quality can reduce the impact of research and, often, the absence of adequate infrastructure makes good scientists look for better working conditions in other countries (De Negri, 2018).

Sartori *et al.* (2017) emphasis that it is essential that TTOs count on co-laborators who think and act with the principles of innovation. Unlike Brazil, the Irish government seeks to ensure that the country becomes a global innovation leader, creating a highly supportive business environment, facilitated by government agencies (O'dwyer *et al.*, 2017).

According to Awasthy *et al.* (2020), universities can overcome UIC barriers by demonstrating the applicability of research to industry in a relevant context and promoting their research results, creating a platform for people to reach relevant contacts to discuss ideas and achievements, promoting research, encouraging cooperation, educating researchers to publish research that can be applied across industries, and maintaining a connection with alumni.

Finally, efforts should be made to provide effective incentives to university researchers for their levels of cooperation with industry in order to encourage them to act in an entrepreneurial manner (Cunningham & Link, 2015), the lack of knowledge of TTOs is also a barrier, which is why these institutions should be disclosed to the academic community (Huyghe *et al.*, 2016).

5. Conclusions

The literature confirmed the importance of cooperation between the academic and productive sectors for the promotion of innovation, as well as it became evident that public policies can stimulate this process. Still, it was identified that in Brazil, unlike developed countries, the stimulus to the use of knowledge generated in universities by the productive sector came late.

It was evidenced that TTOs perform numerous functions that stimulate innovation and have a fundamental social role, however, they are still despised by industries and even researchers. It was found that the UIC can be motivated by several factors, but barriers can also make these relationships difficult.

The main objective of this research was 'to highlight and compare the main motivations and barriers for university-industry cooperation in Brazilian and Irish technology transfer offices'. The research discovered that in Brazil the main motivations for UIC are recognition of work and lack of funding for research, while for Irish TTOs it is about fulfilling the social function. Regarding barriers, Brazilian TTOs face bureaucracy and the lack of an entrepreneurial culture on the part of researchers, while in the Irish it is performance evaluation (based on publications), lack/excessive regulation, and researchers without knowledge of the market demand that most affect the process. It can be concluded that, both countries face barriers to UIC, even though in comparison to Ireland, Brazil still face more difficulties.

For future studies, we recommend an exploration of the motivations and barriers for university-industry cooperation from the perspective of researchers and industries and, explore public policies in different countries.

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