Barriers to Third Mission: Organizational and Individual Antecedents

Gloria Naranjo-Africano (✉ gnaranjo@unisimonbolivar.edu.co)

Universidad Simón Bolívar: Universidad Simon Bolivar <https://orcid.org/0000-0001-9610-1604>

Jaider Vega-Jurado

Universidad del Norte

Liney Manjarres-Henríquez

Universidad de la Costa: Corporacion Universitaria de la Costa

Research

Keywords: Third Mission, barriers, organizational aspects, Stokes' quadrant, academics

Posted Date: January 25th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1238070/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Barriers limit the development of relations between the university and its environment within the framework of the Third Mission. Although it is widely understood that barriers to successful collaboration and knowledge sharing between universities and other social agents exist, few studies have attempted to measure and map these perceived barriers or investigate what can mitigate them. In this context, this work aims to identify the factors affecting the barriers perceived by academics in their relationship with the environment. The study was based on data derived from a survey applied to a sample of academics categorized in the *Sistema Nacional de Ciencia, Tecnología e Innovación* of Colombia and related to six higher education institutions located in the Colombian Caribbean region. To analyze the data obtained, binary logistic regression models were established. The results obtained suggest that in addition to the orientation of the research activity, the perception that academics have about the existence of processes or support services for the university's relationship with its environment is important to reduce the barriers perceived during the relationship. The foregoing implies that the institutions must progress with respect to the institutionalization of the third mission and in strengthening the functions of promotion, counseling, and support as well as promotion structures and, thus, being able to mitigate the barriers perceived in the process.

1. Introduction

In recent years, universities have gone through significant changes in their missionary functions derived from an expansion of their actions and the results that society expects from them (Youtie & Shapira, 2008). Thus, in this context, the universities began to develop and strengthen the so-called "Third Mission." In the fulfillment of this Third Mission, the profile of the academic plays an important role in the performance of these functions, considering that it is the academic who ultimately makes the decision on the degree and the form of connection with different non-academic agents (Cunningham & O'Reilly, 2018; Filippetti & Savona, 2017; Halilem, 2010; Perkmann et al., 2013). It should be noted that academics develop their work within the framework of an institution, from which it can be affirmed that the decisions made by academics about their participation in Third Mission activities not only depend on them but may also be influenced by the organizational conditions in their institution and their perception of them. These perceptions can stimulate or mitigate the realization of different forms of relations. Therefore, organizational aspects, internal politics, and university management can have a significant effect (Bruneel et al., 2010b) and impose specific limitations and opportunities for academics in the fulfillment of the Third mission.

During the development of the functions of the Third Mission, academics may perceive barriers that restrict its fulfillment (Arvanitis et al., 2008; Lee, 1996). Most studies have focused on the identification of the type of barriers or on the analysis of the effect of the barriers on the relationship but not on the analysis of the factors that influence the increase or mitigation of these barriers. In addition to the foregoing, few studies have tried to map these impediments perceived by the academic during the relationship process, in particular those associated with the organizational aspects of the university

(Filippetti & Savona, 2017). Moreover, it is possible that the perceived barriers vary considerably between different countries (Filippetti & Savona, 2017), considering that in the case of developing countries, there may be a range of heterogeneity in the institutional restrictions and organizational differences of universities in this type of context.

Based on the statements made above, the purpose of this article is to determine factors that influence the mitigation of the different types of barriers in fulfilling the Third Mission to have objective criteria that favor the effectiveness of intervention strategies to reduce the barriers presented. The article is structured as follows. Section 2 presents the literature review, Section 3 describes the methodology and variables analyzed in the study, Section 4 outlines the results, and Section 5 offers the conclusions of the study.

Nomenclature

SNCyT Sistema Nacional de Ciencia y Tecnología

MINCIENCIAS Ministerio de Ciencia y Tecnología en Colombia

2. Literature Review

2.1. Barriers in the fulfillment of the Third mission. Dependent variable

Barriers limit or slow down the development of relationships between the university and socioeconomic environment (Bruneel et al., 2010b; D'Este & Patel, 2007). Specifically, the literature recognizes the following types of barriers, which are considered for the development of this work: (a) from academics, related to their resistance to participate in activities of the Third mission, which may be based on their perception of the complexity of these processes (Closs et al., 2012), their previous experience, commercial and negotiation skills (Bekkers & Bodas Freitas, 2010; Tartari & Breschi, 2012) in addition to their personal interests (Ramos-Vielba, Sánchez-Barrioluengo, et al., 2016; Tartari & Breschi, 2012). To this is added the lack of time, rewards, and resources to carry it out (Bozeman, 2000; Bruneel et al., 2010a; Gulbrandsen & Smeby, 2005; Jacobson et al., 2004; Mansfield & Lee, 1996; Siegel et al., 2004). (b) from the Process, the structural impediments in the processes during the fulfillment of the Third Mission create barriers not only between academics and users but also within the organizations that host them (Jacobson et al., 2004). Therefore, regarding the processes carried out by the university for the fulfillment of the Third mission, aspects such as procedures, dedication, support structure, culture, and technology transfer operation (Lemos et al., 2014) have an important effect on the achievement of the expected results. Bureaucracy and centralization of administrative and legal support also play a significant role in the effectiveness of these mechanisms associated with the fulfillment of the Third Mission (Closs et al., 2012). (c) Barriers from the partner. It is often argued that there are barriers associated with cultural and organizational differences that limit interactions between the scientific community and society

(Belkhodja & Landry, 2005; Bruneel et al., 2010b; Dasgupta & David, 1994; Hughes & Kitson, 2012; Vega-Jurado et al., 2020).

The study considers a dependent variable that represents the types of barriers perceived by an academic in the relationship with different non-academic agents of the socioeconomic environment in such a way that the dependent variable *BARR_i* represents the three types of barriers that are analyzed in this study, as follows: (i) Academic Barriers (*BINV*); (ii) Barriers from the Partner (*BALID*), and (iii) Barriers from the Process (*BPROC*). To construct these variables, we took the data obtained from the instrument in which the respondents were asked to indicate, on a scale of 1 to 5 where 1 is equivalent to “none” and 5 to “a lot,” to what extent different aspects have been an obstacle in relation to other entities. To this end, the instrument had 16 options to select. To simplify the variables, a factor analysis was carried out, the results of which show that the barriers are grouped into three factors similar to those identified in the literature, in which it is recognized that among the main types of barriers studied are those associated with (i) Academic Barriers (*BINV*); (ii) Barriers from the Partner (*BALID*); and (iii) Barriers from the Process (*BPROC*). The assessments made on each barrier were transformed into binary variables that take the value of 1 if the academic perceives the type of barrier and equal 0 if not.

2.2. Mitigating factors of the Barriers for fulfilling the Third Mission. Explanatory variables

The factors that could mitigate the barriers and constitute the focus of the study are as follows: (i) organizational aspects of the university for the fulfillment of the activities of the Third Mission; (ii) the focus of the academics’ research; and (iii) the nature of the institution (public/private). Thus, this article examines whether these factors play a critical role in reducing the barriers that academics face in their participation in Third Mission activities. Next, we describe theoretical aspects and the information taken into consideration for each of these explanatory variables. Table 1 presents the details of the measurement and ranges of the values associated with the explanatory variables.

Organizational Aspects of the University. Organizational aspects are understood as how power and authority is exercised in organizations for the allocation and management of resources. It involves the promulgation of policies and procedures for decision-making and control in the direction or management of organizations for the effectiveness of the processes (Carnegie & Tuck, 2010). They are also related to all those structures, processes, and activities that participate in the planning and management of institutions and people (Fielden, 2008). Thus, to ensure the fulfillment of the Third mission, the universities have developed processes and structures that have fostered the institutionalization of this mission in order to support, manage, and carry it out more efficiently (Geuna et al., 2009). Some of the main organizational processes that a university must carry out within the framework of the fulfillment of the Third Mission and its relationships with non-academic agents are as follows: establishing policies and procedures, having management capacity, having capacity for technology transfer and resource allocation. (Jacobson et al., 2004) in addition to developing strategies for connecting with the environment and allowing their effective measurement (OCTS-OEI & RICYT, 2017).

The factors described in this section are used in the empirical section to understand their impact on the relationship of academic professors with different types of non-academic agents and the use of different mechanisms associated with the fulfillment of the Third Mission. For this work, we obtained information about the research professor's perceptions on the management of the university to which he or she is affiliated with regard to the fulfillment of the Third Mission. Such information was directly obtained from the instrument applied for the study and after a factorial analysis with a total variance explained of 82.418, we identified four new factors as follows: (i) policies and procedures (POLyPROC); (ii) management capacity (CAPGest); (iii) capacity for technology transfer (CAPTransf); and (iv) allocation of ASIGNRec resources. Moreover, information was included on their opinion on the frequency in carrying out activities and processes to support relationships. A factor analysis was applied to reduce variables, which led to the construction of a series of variables that represent the researcher's perception of the frequency in which the university carries out these processes of (i) promotion and communication (PROYCOM), (ii) information (INF), (iii) management (AGEST), and (iv) two variables that represent the counseling, during, and at the end of the relationship (APREL) and relationship counseling (ADyDREL). The reliability values for each variable are as follows: (i) (PROYCOM), $\sigma^2 = 72,155\%$ and $\alpha = 0,934$; (ii) (INF), $\sigma^2 = 74,05\%$ and $\alpha = 0,883$; (iii) (AGEST) $\sigma^2 = 80,061\%$ and with $\alpha = 0,964$ y; and (iv) (APREL) and (ADyDREL) with $\sigma^2 = 76,891\%$ and $\alpha = 0,899$ and $0,947$, respectively.

Research focus: One element that has been considered is how professors approach their research process, which affects their actions and, respectively, their collaboration process with the socioeconomic environment. Traditionally, this factor has been approached from the academic disciplinary area. Today, some authors have taken as a theoretical reference the distinction of the Stokes quadrant that distinguishes two basic dimensions from the focus of the research: (i) the realization of scientific contributions for understanding phenomena and facts and (ii) the practical use and/or application of knowledge outside the scientific or academic field [40-42]. This variable was operationalized through the so-called Stokes quadrant from two questions in the instrument in which the academics were asked to rate the following items on a Likert scale from 1 to 5, with 1 = none and 5 = a lot: (i) the extent to which the scientific activity is inspired by making contributions to the fundamental understanding of phenomena and facts and (ii) the extent to which the academic's activity is inspired by considerations of use. This was used to obtain a map of the values that guide the work of the academics (Olmos-Peñuela, Castro-Martínez, & Fernández-Esquinas, 2014) in such a way that the resulting configurations for each quadrant are the following: (i) NN: low fundamental understanding and consideration of use; (ii) Edison: low fundamental understanding and high consideration of use; (iii) Bohr: high fundamental understanding and low consideration of use; and (iv) Pasteur: high fundamental understanding and consideration of use.

Type of University

In the case of universities in Latin America, there are differences between each of the typologies of universities in their organizational aspects and governance structures, which is the result of a different process of social, economic, and intellectual development (Molas-Gallart et al., 2002). In the case of

universities in Latin America, there are differences between each of the typologies of public or private universities, in their organizational aspects and governance structures. Therefore, it is possible to affirm that the barriers perceived in the fulfillment of the Third mission vary between public and private universities. Considering the differences between the typologies of public and private universities, both in their organizational aspects and governance structures, in the applied instrument, the professors were asked about the type of university to which they are affiliated.

Finally, two variables were included to control the effect of the explanatory variables in the analysis: *Previous experience in the public sector (EXPPubl)* and *the private sector (EXPPriv)*, which is measured by the number of years in which the academic has worked in the public or private sector, prior to joining the university, of which it is assumed that the professor has acquired relationship capital in the sector associated with his or her previous experience and expertise for the development of activities associated with the Third Mission according to that stated in the literature and *Type of connection at the university*. In the literature, it is recognized that the status of the professor at the University (Azagra-Caro et al., 2006; Este & Patel, 2007; Schuelke-Leech, 2013), particularly with regard to the status of their career in the teaching structure (Bonaccorsi et al., 2014), may have an impact on the performance of the process in its relationship with the environment, particularly with companies. For this reason, the academics in the sample were asked to indicate the type of relationship they have within the university.

3. Methods

The aim, design and setting of the study. This article seeks to determine the incidence that the organizational aspects of the university have on the barriers perceived by professors during the relationship process. This in relation to those organizational activities carried out by the university for the fulfillment of the Third Mission. The perception that the professors has about these and the incidence they have on the adequacy of the mechanisms of the Third Mission are considered, and what can constitute a barrier to the fulfillment of the Third Mission

The characteristics of participants. The study context for this research was framed in the Colombian Caribbean Region. This region in general has lagged in terms of TC + I (*Mendoza Meza, 2017*). To the extent possible, these characteristics of the context contribute specific characteristics to the analysis carried out regarding the conditions for the fulfillment of the Third Mission in this type of context. For the development of this research study, an email survey was applied to academics. The population under study consisted of academics recognized in the SNCyT of Colombia and categorized by MINCIENCIAS as Emeritus, Senior, Associate, and Junior, according to their individual contributions to Science, Technology, and Innovation. A criterion for inclusion in the study was that these academics needed to have employment ties for 2017 with any of the 6 institutions in the Colombian Caribbean region, considered according to their nature (public or private) and having institutional accreditation. We applied in its entirety the instrument to the population, which consisted of 872 professors who completed the survey online after receiving an email with it. A sample size of 210 was calculated under a 95% reliability level. The instrument's application period was six months (December 2017–May 2018). A response rate was

obtained from more than 230 academics who responded to the survey. After a review, 211 valid responses were obtained for the study.

Processes and methodologies employed. In order to accomplish the proposed objectives, a quantitative-oriented research with an explanatory scope and cross-sectional measurement was modeled. (Hernández Sampieri y Fernández Collado, Carlos Baptista Lucio, 2006).

The type of statistical analysis used. The relationship between the explanatory variables described above and the barriers in the fulfillment of the Third Mission was studied by estimating binary logistic regression models. This was done considering that the analysis is based on the idea of finding the determinants of the probability that an academic does or does not perceive a type of barrier as significant for the development of Third Mission activities. The econometric specifications show the linear function of the binary logistic regression model.

$$(i) \text{ BARR} = \beta_0 + \beta_1 \text{POLYPROC} + \beta_2 \text{CAPGEST} + \beta_3 \text{CAPTRANSF} + \beta_4 \text{ASIGNREC} + \beta_5 \text{PROYCOM} + \beta_6 \text{INF} + \beta_7 \text{APREL} + \beta_8 \text{ADyDREL} + \beta_9 \text{AGEST} + \beta_{10} \text{TVINC} + + \beta_{11} \text{TUNI} + \beta_{13} \text{EXPPPriv} + \beta_{14} \text{EXPPubl} + \beta_{14} \text{OINV} + \alpha$$

where β_j ($j = 0, \dots, 14$) are the parameters of the model to be estimated, and α is an error term. The β are the coefficients, and α , τ , and λ are the error terms associated with each regression model.

Table 1
Details of Variables in the study

Explanatory variables	Measurement	Method (Range)
Perception of organizational aspects of the university (POLyPROC-CAPGest - CAPTranf – ASIGNRec)	Score on a Likert scale from 1 to 5, where 1: Completely disagree and 5: Completely agree <i>“at what level do you agree with the management at his university.”</i>	The new variables are defined from the dichotomous point of view where they take a value of 1: ≥ 4 and 0: < 4 .
Perception of the frequency of activities and processes for the relationship. (PROYCOM), (INF), (AGEST), (APREL) and (ADyDREL).	Rate on a Likert scale from 1 to 5, where 1 = Never and 5 = Always <i>“How often your university”</i> : 1. Carries out and/or participates in promotional and communication activities 2. Offers information services 3. Offers counseling 4. Carries out management processes	Each of the four new variables is defined. The new variable is defined from the dichotomous point of view, where they take a value of 1: ≥ 4 and 0: < 4 .
Researcher Activity Orientation	Score on a Likert scale from 1 to 5 where 1 = none and 5 = a lot: 1) the extent to which scientific activity is inspired by making contributions to the fundamental understanding of phenomena and facts and 2) The extent to which the researcher's activity is inspired by considerations of use.	Each of the resulting categorical variables were transformed into binary variables with a value of “1 = high” if the academic had answered “a lot = 4” and “a lot = 5” and with a value of “0 = low” in the rest of the cases. This division is taken as reference to avoid a desirability bias (Olmos-Peñuela, Castro-Martínez, & D'Este, 2014). The resulting categorical variables were as follows: 4: NN's quadrant; 3: Edison's quadrant; 2: Bohr's quadrant; 1: Pasteur's quadrant.
Type of University	Indicate the type of university to which you are affiliated	Categorical 0: Public; 1: Private
Source Author's own elaboration (2019)		

4. Results

Organizational Aspects of the University. As seen in Table 2, regarding organizational aspects, it is found that the political and procedural variables (-0.991) $p > 0.01$, information services (-1.195) $p > 0.01$, and counseling during and after the relationship (-0.803) $p > 0.01$ have a significant and negative effect on the barriers in the process. This shows that they have a mitigating effect on the process barriers such that as

the perception of these aspects improves, the barriers associated with the process decrease. Particularly, the technology transfer capacity of the university with $(-0.406) p > 0.1$ and $(-0.581) p > 0.05$ obtained a negative statistical significance for both the academic and process barriers, respectively. This shows that to the extent that the academic perceives greater institutional support, in terms of research and technological development processes, the capacity to carry out knowledge transfer activities and manage the protection of industrial or intellectual property reduces the perception of this type of barrier. This contrasts with the estimates of management activities $(0.626) p > 0.1$ in which increasing the scores tends to increase the probability of this barrier's occurrence. Considering that a large part of these barriers are measured through the perceptions of academics, it should be mentioned that these results form a personal assessment made by the academic of the conditions and contexts that surround the fulfillment of the Third Mission and their assessment of the real barriers to collaboration arising from bad policies or the lack of motivators on the part of the university to which they are affiliated (Belkhodja & Landry, 2005).

Academic focus for research. As can be seen in Table 2, in the academic barriers model, research focus is statistically significant with negative coefficients for the Pasteur $(-1.841) p > 0.05$, Edison $(-1.624) p > 0.1$, and Bohr $(-1.808) p > 0.05$ quadrants in relation to the NN quadrant. This shows that the increased focus by the academic toward the generation or application of knowledge has a mitigating effect on the academic barriers in fulfilling the Third Mission. Hence, it is important that there is a clear focus and interest in the investigative process, which can help dispel any obstacle or limitation to be able to relate. This is consistent with the fact that when academics are highly motivated to advance in research, they can reduce the effect of the perceived risk for scientific autonomy, regardless of the type of social organization to which they are affiliated (Ramos-Vielba, Sánchez-Barrioluengo, et al., 2016).

Type of University. As can be seen in Table 2, academics coming from a public university, compared to a private university is statistically significant, and it has a negative coefficient for the three types of barriers. This shows that, according to the results obtained, it is understood that when moving from a public university to a private one, any type of perceived barrier decreases, which means that the relationship support processes in this type of university are better perceived by professors. These results reaffirm the differences found between the types of university studied, allowing to infer that in the case of private universities, flexibility conditions are established inherent to their nature and autonomy that could support this type of Third Mission activity, unlike the public universities that must respond to guidelines from centralized levels at the regional or national level when applicable. Table 1 contains information on the detail of the variables included in the analysis.

Table 2
Results of the Binary Logistic Regression Model

Variables	Academic Barriers (<i>BINV</i>)	Barriers of the Partner (<i>BALID</i>)	Barriers of the Process (<i>BPROC</i>)
Policies and Procedures (<i>POLYPROC</i>)	0,034	0,038	-0,991***
Management Capacity (<i>CAPGEST</i>)	-0,363	0,145	0,096
Capacity for Technology Transfer (<i>CAPTransf</i>)	-0,406*	-0,247	-0,581**
Allocation of resources (<i>ASIGNREC</i>)	0,111	0,093	0,132
Promotion and Communication (<i>PROYCOM</i>)	-0,106	-0,272	-0,357
Information (<i>INF</i>)	-0,135	-0,363	-1,195***
Relationship Counseling (<i>APREL</i>)	-0,108	0,220	0,870**
During and at the end of the relationship counseling (<i>ADyREL</i>)	-0,054	-0,356	-0,803***
Management (<i>AGEST</i>)	-0,038	-0,135	0,626*
Type of University (Private) (<i>TUNI</i>)	-0,647*	-0,565*	-1,402***
Private Sector Experience (<i>EXPPPriv</i>)	-0,072*	-0,018	-0,041
Public Administration Experience (<i>EXPPubl</i>)	0,065***	0,054***	0,107
Orientation of the research (NN) (OINV)			
PASTEUR	-1,841**	-0,391	-0,832
EDISON	-1,624*	-0,203	-1,591
BOHR	-1,808**	-0,481	-0,771
Type of Relationship (Other) (<i>TVINC</i>)			
TC	-0,998	-0,204	-1,324*
TC From time to time	-0,487	0,732	-1,202
MT	-1,723*	-0,502	-4,252***
MT From time to time	-2,284*	-0,715	-2,606*
Professor	-1,510*	0,140	-1,059
Intercept (Constant)	5,752	2,625	9,273

Source: designed by the authors (2019)

Variables	Academic Barriers (<i>BINV</i>)	Barriers of the Partner (<i>BALID</i>)	Barriers of the Process (<i>BPROC</i>)
Omnibus test			
Chi-square	40,258	24,954	85,556
p-value	0,005	0,203	0
Pseudo R2			
Logarithm of the likelihood -2	247,611 ^a	251,257	197,85
Cox-Snell	,176	0,113	0,337
Nagelkerke	,235	0,154	0,453
Hosmer and Lemeshow test			
Chi-square	5,564	3,844	4,634
p-value	0,696	0,871	0,796
Predictive capacity of the models			
Precision (IC 95%)	72,1%	65,9%	75,5%
Source: designed by the authors (2019)			

5. Discussion

The way in which research professors perceive the processes of support for the fulfillment of the Third Mission, carried out by the university to which they are linked, has much to do with the activities they carry out in the framework of the fulfillment of the Third Mission and the barriers perceived during the execution of this process. Considering then what was proposed in this work in that the organizational aspects have an impact on the barriers to relate with the socioeconomic environment, it was found that as the perception of the university's policies and procedures improves, the barriers perceived during the relationship diminish; likewise, the perception of the university's technology transfer capacity increases and helps to dissipate the barriers of the researcher as well as those associated with the process of establishing relationships.

Particularly, the advisory activities carried out by the university during and after the relationship have an inverse effect on the barriers perceived by the research professor, so that improving the researcher's perception of these types of activities would reduce the perceived barriers. In the case of management activities, these have a directly proportional relationship with perceived barriers. It is worth mentioning that researchers mainly perceive important support in administrative aspects and accompaniment in the management process for project execution, so these types of activities should be maintained in their current state or improved so that the barriers perceived by research teachers in this area do not increase.

In the results obtained, it is evident that it is necessary to improve the perception, especially in the support activities for knowledge transfer. It can be affirmed that to the extent that the perception of the professors about the capacity and activities carried out by the university to support the fulfillment of the Third Mission improves, the perceived barriers are mitigated, especially those associated with the relationship process.

Considering that most of these barriers are measured through the perceptions of the researchers, they result from an evaluation of the conditions and personal contexts surrounding possible collaboration (Belkhodja & Landry, 2005). Therefore, it is necessary that the management carried out by the university in these processes can impose opportunities and limitations for researchers; where the context within the university remains an ivory tower, where work and academic life is defined through the double discourse of academic freedom and professional autonomy (Halilem et al., 2011). Thus, the university must be able to understand its true dynamics in these processes and develop alternatives that go hand in hand with the way in which professors carry out certain relationships, in addition, that constitute catalysts of these.

As for the researcher's university of origin, it is found to be a significant variable for all types of barriers. From the researcher's perspective, relationships with non-academic agents and their relationship support processes can be affected by the nature of their institution of origin. Thus, according to the results obtained, it is understood that moving from a public to a private university decreases the value of the perceived barrier. This suggests that there are differences in the way universities deal with these processes, considering their typology and nature, which in the Colombian case has its own specificities, this provides elements to consider associated with the fact that the nature of the university of origin of the researcher influences the way in which the links with the socioeconomic environment are carried out. Based on the above, it can be affirmed that there is an impact between the organizational aspects of the university and the barriers perceived at the level of the researcher and the process.

It is worth mentioning that this is a topic of potential interest and growing importance for those who study the organizational aspects of the Third Mission, the organization and structures that are created to respond to this type of process. A misinterpretation or assumption of these processes in the university could lead to the implementation of strategies and intervention mechanisms that are distant from the real university dynamics and to the erroneous adaptation of organizational models that are adequate to support and sustain this type of process.

It is hoped that, in the future, a more comprehensive national study of Third Mission organizational practices can be undertaken, and regional and inter-institutional differences understood. Furthermore, that qualitative data should be collected in the future to better understand these types of practices and processes, and the adaptations that universities have made to these processes, and to contribute to the literature on these processes.

6. Conclusions

This article emphasizes the organizational aspects of the university that affect the barriers perceived by academics in the fulfillment of the Third mission as well as the focus of an academic's research in contexts of the Colombian Caribbean region, a developing region. As the universities improve their policies and procedures established for the fulfillment of the Third mission, the barriers perceived during the relationship are reduced. Further, a better capacity for technology transfer in the university helps to dissipate the barriers of both the academic and those associated with the process of establishing these relationships with the socioeconomic environment. Regarding the activities carried out, an improvement in the advisory activities carried out by the university during and after the relationship would reduce the perceived barriers for academics.

Therefore, the challenge in universities is to develop support processes that allow not only support for the administrative execution of projects and processes related to the fulfillment of the Third Mission but also carry out promotion, counseling, and support functions that aid academics in this type of process and provide them with reasons that mitigate both barriers of the process and typical of academics.

Regarding the university of origin of academics, it is found to be a significant variable for all the types of barriers analyzed in the econometric models. From the academic perspective, relationships with non-academic agents and their relationship support processes can be affected by the nature of their institution of origin. In this way, according to the results obtained, it was found that a professor affiliated with a public university perceives more barriers than those affiliated with a private one. This suggests that there are differences in how universities attend to these processes, considering their typology and nature. For the Colombian case, these have their own specific characteristics, in which public universities have some limitations in their relationships with the productive sector and the transfer processes in terms of their legal and contractual conditions.

Further, it is noteworthy that the existence of a researcher's focus toward research whether a basic focus to the application and applied research focused on practical use and innovation helps mitigate the barriers that may arise in the fulfillment of the Third mission, which in addition to a favorable organizational context within the university could constitute important dynamizing elements in the fulfillment and performance of this Third mission.

This is a topic of potential interest and growing importance for those who study the organizational aspects of the Third mission, the organization, and structures that are formed to respond to this type of process. A misinterpretation or assumption of these processes in the university could lead to the implementation of strategies and intervention mechanisms distant from the requirements of the university's relationship with its socioeconomic environment as well as the needs of the professors within their framework when they are the ones who ultimately operationalize them. Moreover, there is the risk of an erroneous adaptation of organizational models that are not adequate to support and sustain this type of process and which are linked to other types of contexts and needs.

7. Declarations

Consent for publication: Not applicable

Availability of data and materials: Raw data were generated at [Encuestas 4 de mayo de 2018 CODIFICADA PARA SPSS3 CODIFICADA PF.xlsx]. Derived data supporting the findings of this study are available from the corresponding author [GN] on request.

Competing interests: The authors declare that they have no competing interests

Funding: No sources of funding for the research were obtained.

Authors' contributions: JV and LM analyzed and interpreted the data. GN was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

Acknowledgements: The development of this research was carried out within the framework of a project financed by the Ministerio de Ciencia, Tecnología e Innovación (MINCIENCIAS) of Colombia through a Doctoral Scholarship.

8. References

1. Arvanitis, S., Sydow, N., & Woerter, M. (2008). Is there any impact of university-industry knowledge transfer on innovation and productivity? An empirical analysis based on swiss firm data. *Review of Industrial Organization*, 32(2), 77–94. <https://doi.org/10.1007/s11151-008-9164-1>
2. Azagra-Caro, J. M., Archontakis, F., Gutiérrez-Gracia, A., & Fernández-de-Lucio, I. (2006). Faculty support for the objectives of university-industry relations versus degree of R&D cooperation: The importance of regional absorptive capacity. *Research Policy*, 35(1), 37–55. <https://doi.org/10.1016/j.respol.2005.08.007>
3. Bekkers, R., & Bodas Freitas, I. M. (2010). Catalysts and barriers: Factors that affect the performance of university-industry collaborations. Catalysts and Barriers: Factors That Affect the Performance of University-Industry Collaborations Citation. <https://pure.tue.nl/ws/portalfiles/portal/3101042/Metis238472.pdf>
4. Belkhdja, O., & Landry, R. (2005). “The Triple Helix collaboration: Why do researchers collaborate with industry and the government? What are the factors influencing the perceived barriers?” 5th Triple Helix Conference, 1–48
5. Bonaccorsi, A., Secondi, L., Setteducati, E., & Ancaiani, A. (2014). Participation and commitment in third-party research funding: Evidence from Italian Universities. *Journal of Technology Transfer*, 39(2), 169–198. <https://doi.org/10.1007/s10961-012-9268-5>
6. Bozeman, B. (2000). Technology transfer and public policy: a review of research and theory. *Research Policy*, 29(4–5), 627–655. [https://doi.org/10.1016/S0048-7333\(99\)00093-1](https://doi.org/10.1016/S0048-7333(99)00093-1)
7. Bruneel, J., D’Este, P., & Salter, A. (2010a). Investigating the factors that diminish the barriers to university-industry collaboration. *Research Policy*, 39(7), 858–868. <https://doi.org/10.1016/j.respol.2010.03.006>

8. Bruneel, J., D'Este, P., & Salter, A. (2010b). Investigating the factors that diminish the barriers to university–industry collaboration. *Research Policy*, 39(7), 858–868.
<https://doi.org/10.1016/j.respol.2010.03.006>
9. Carnegie, G. D., & Tuck, J. (2010). Understanding the ABC of university governance. *Australian Journal of Public Administration*, 69(4), 431–441. <https://doi.org/10.1111/j.1467-8500.2010.00699.x>
10. Castro-Martínez, E., Olmos-Peñuela, J., & Fernandez-De-Lucio, I. (2016). La Vinculación Ciencia-Sociedad: Estereotipos y Nuevos Enfoques. 11(2)
11. Closs, L., Ferreira, G. C., Soria, A. F., Sampaio, C. H., & Perin, M. (2012). Organizational factors that affect the university-industry technology transfer processes of a private university. *Journal of Technology Management and Innovation*, 7(1), 104–117. <https://doi.org/10.4067/S0718-27242012000100007>
12. Cunningham, J. A., & O'Reilly, P. (2018). Macro, meso and micro perspectives of technology transfer. *Journal of Technology Transfer*, 43(3), 545–557. <https://doi.org/10.1007/s10961-018-9658-4>
13. D'Este, P., & Patel, P. (2007). University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy*, 36, 1295–1313.
<https://doi.org/10.1016/j.respol.2007.05.002>
14. Dasgupta, P., & David, P. (1994). Toward a new economics of science. *Research Policy*, 23(5), 487–521. [https://doi.org/10.1016/0048-7333\(94\)01002-1](https://doi.org/10.1016/0048-7333(94)01002-1)
15. Este, P., & Patel, P. (2007). University-industry linkages in the UK: What are the factors underlying the variety of interactions with industry? *Research Policy*, 36(9), 1295–1313.
<https://doi.org/10.1016/j.respol.2007.05.002>
16. Fielden, J. (2008). Global Trends in University Governance. In The World Bank
17. Filippetti, A., & Savona, M. (2017). University–industry linkages and academic engagements: individual behaviours and firms' barriers. Introduction to the special section. *The Journal of Technology Transfer*, 42, 719–729. <https://doi.org/10.1007/s10961-017-9576-x>
18. Geuna, A., Muscio, A., Geuna, A., Geuna Brick, A., Alberto, C. C., & Muscio, A. (2009). The Governance of University Knowledge Transfer: A Critical Review of the Literature. *Minerva*, 47, 93–114.
<https://doi.org/10.1007/s11024-009-9118-2>
19. Gulbrandsen, M., & Smeby, J. C. (2005). Industry funding and university professors' research performance. *Research Policy*, 34(6), 932–950. <https://doi.org/10.1016/j.respol.2005.05.004>
20. Halilem, N. (2010). Inside the Triple Helix: An Integrative Conceptual Framework of the Academic Researcher's Activities, a Systematic Review. *Journal of Research Administration*, 41(3), 23–50.
<https://doi.org/10.1016/j.ejca.2012.08.017>
21. Halilem, N., Amara, N., & Landry, R. (2011). Is the academic Ivory Tower becoming a managed structure? A nested analysis of the variance in activities of researchers from natural sciences and engineering in Canada. *Scientometrics*, 86, 431–448. <https://doi.org/10.1007/s11192-010-0278-5>

22. Hernandez Sampieri, R. (2006). & Fernandez Collado, Carlos Baptista Lucio, P. Metodologia de la Investigación.
23. Hughes, A., & Kitson, M. (2012). Pathways to impact and the strategic role of universities: new evidence on the breadth and depth of university knowledge exchange in the UK and the factors constraining its development. *Cambridge Journal of Economics*, 36, 723–750.
<https://doi.org/10.1093/cje/bes017>
24. Izique, C. (2005). El Cuadrante de Pasteur: Revista Pesquisa Fapesp.
<https://revistapesquisa.fapesp.br/es/2005/04/01/el-cuadrante-de-pasteur/>
25. Jacobson, N., Butterill, D., & Goering, P. (2004). Organizational Factors that Influence University-Based Researchers' Engagement in Knowledge Transfer Activities. In *Science Communication* (Vol. 25, Issue 3, pp. 246–259). <https://doi.org/10.1177/1075547003262038>
26. Lee, Y. S. (1996). "Technology transfer" and the research university: a search for the boundaries of university-industry collaboration 1. *ELSEVIER Research Policy*, 25, 843–863. http://ac.els-cdn.com/0048733395008578/1-s2.0-0048733395008578-main.pdf?_tid=697be81e-2993-11e7-9bdc-00000aabb0f26&acdnat=1493110056_e1b990680bf9e033c15d1334f40c76e7
27. Lemos, C., Antonio, S., & Cario, F. (2014). Análise da interação universidade-empresa para o desenvolvimento inovativo a partir da perspectiva teórica institucionalista-evolucionária. 14(2),361–382
28. Mansfield, E., & Lee, J.-Y. (1996). The modern university: contributor to industrial innovation and recipient of industrial R&D support. *Research Policy*, 25(7), 1047–1058.[https://doi.org/10.1016/S0048-7333\(96\)00893-1](https://doi.org/10.1016/S0048-7333(96)00893-1)
29. Merchán-Hernández, C., & Valmaseda-Andia, O. (2018). La comunidad científica ante los usos de la ciencia: un análisis de la orientación de la actividad investigadora en el CSIC.Revista Española de Documentación Científica, 41(4),215. <https://doi.org/10.3989/redc.2018.4.1536>
30. Molas-Gallart, J., Salter, A., Patel, P., Scott, A., & Duran, X. (2002). *Measuring Third Stream Activities: Final Report to the Russel Group of Universities* (p. 85). SPRU-Science and Technoly Policy Research
31. OCTS-OEI, & RICYT (2017).Manual de Valencia
32. Olmos-Peñuela, J., Castro-Martínez, E., & D'Este, P. (2014). Knowledge transfer activities in social sciences and humanities: Explaining the interactions of research groups with non-academic agents. *Research Policy*, 43, 696–706. <https://doi.org/10.1016/j.respol.2013.12.004>
33. Olmos-Peñuela, J., Castro-Martínez, E., & Fernández-Esquinas, M. (2014). Diferencias entre áreas científicas en las prácticas de divulgación de la investigación: un estudio empírico en el CSIC. *Revista Española de Documentación Científica*, 37(2), e040.
<https://doi.org/10.3989/redc.2014.2.1096>
34. Perkmann, M., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P. ... Sobrero, M. (2013). Academic engagement and commercialisation: A review of the literature on university-industry relations. *Research Policy*, 42(2), 423–442. <https://doi.org/10.1016/j.respol.2012.09.007>

35. Ramos-Vielba, I., S??nchez-Barrioluengo, M., & Woolley, R. (2016). Scientific research groups??? cooperation with firms and government agencies: motivations and barriers. *Journal of Technology Transfer*, 41(3), 558–585. <https://doi.org/10.1007/s10961-015-9429-4>
36. Ramos-Vielba, I., S??nchez-Barrioluengo, M., & Woolley, R. (2016). Scientific research groups' cooperation with firms and government agencies: motivations and barriers. *Journal of Technology Transfer*, 41(3), 558–585. <https://doi.org/10.1007/s10961-015-9429-4>
37. Schuelke-Leech, B. A. (2013). Resources and research: An empirical study of the influence of departmental research resources on individual STEM researchers involvement with industry. *Research Policy*, 42(9), 1667–1678. <https://doi.org/10.1016/j.respol.2013.06.010>
38. Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. (2004). Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: Qualitative evidence from the commercialization of university technologies. *Journal of Engineering and Technology Management - JET-M*, 21(1–2), 115–142. <https://doi.org/10.1016/j.jengtecman.2003.12.006>
39. Tartari, V., & Breschi, S. (2012). Set them free: scientists ' evaluations of the benefits and costs of university – industry research collaboration. 21(5), 1117–1147. <https://doi.org/10.1093/icc/dts004>
40. Vega-Jurado, J., Manjarr??s-Henr??quez, L., Fern??ndez-De-Lucio, I., & Naranjo-Africano, G. (2020). A virtuous circle? The effects of university-industry relationships in a region with low absorptive capacity. *Science and Public Policy*, 47(4), 503–513. <https://doi.org/10.1093/scipol/scaa030>
41. Youtie, J., & Shapira, P. (2008). Building an innovation hub: A case study of the transformation of university roles in regional technological and economic development. *Research Policy*, 37(8), 1188–1204. <https://doi.org/10.1016/j.respol.2008.04.012>