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Behavioral determinants of HEIs researcher's intention to collaborate with firms

Lizbeth Puerta-Sierra¹, Rogelio Puente-Díaz^{1*} and Carlos Montalvo²

Abstract: The collaboration between researchers from higher education institutions and firms deserves more research efforts and knowledge about the practices that favor or hinder this essential and valuable activity. Hence, we make the claim that attitudes, social norms, and perceived control over collaboration with firms, influence the intention of researchers to collaborate or not with firms. Therefore, the aim of this study was to explore the main researchers' attitudes, social norms, and perceived control factors affecting their intention to collaborate with firms. We collected 297 completed questionnaires from researchers that collaborated with firms. Given the exploratory design of our research, we conducted several analyses using structural equation modeling. The study revealed that the main researchers' attitude factors were: impact on students, institutional support, and researcher-firm relationship. The main researchers' perceived control factor was government capabilities. And, the main researchers' social norm factor was the community. Contributions of the results were discussed.

Subjects: Psychological Science; Business, Management and Accounting; Education - Social Sciences

Keywords: University-industry collaboration; higher education institutions; theory of planned behavior; intention

1. Introduction

In the last years, it has been recognized that an essential element for ecosystem development is the actors' connections (Wurth et al., 2021). The collaboration between Higher Education Institutions (HEIs) and firms is an example of agents promoting an entrepreneurial ecosystem (Bouncken & Kraus, 2021). Regions and countries benefit in different ways from the collaboration between HEIs and firms (Skute et al., 2019), their synergy allows the creation of valuable solutions (Lascaux, 2019), and also, they can face challenges through different mechanisms of cooperation, e.g. exchanging their abilities and capabilities (Bouncken & Kraus, 2021). The examination of HEI-Firm collaboration presents two opportunities. First, HEI-firm collaboration could be examined at the institutional level, using an ecosystem approach to the interactions between HEIs and firms. Second, the research could focus at the individual level, that is, on the researcher's and/or companies managers perceived facilitators and obstacles (e.g. incentives, initiatives, attitudes, abilities, etc.) to collaborate (Skute et al., 2019; Wurth et al., 2021). Consequently, we take this second psychological approach. We carry out this study because it is relevant to continue expanding knowledge at the individual level trying to understand what facilitates or hinders the

collaboration with firms from the researchers' perspective. It is important to highlight that obtaining knowledge of this practice allows stakeholders to direct synergies to better practices.

This research builds upon an HEI-Firm collaboration model and survey instrument developed in previous research (Puerta-Sierra et al., 2022). This model assesses the factors that facilitate or hinder the intentions of researchers from HEIs to collaborate with firms. The approach was developed by using the theory of planned behavior (TPB).

Our research contributes to the literature on determinants of researchers' willingness to develop a certain behavior in the context of potential HEI-Firm collaboration. The remainder of this paper is organized as follows. Section 2 presents the theoretical foundation and brief reviews of the HEI-Firm collaboration definitions and drivers of collaboration intention literature. Section 3 presents the research method employed to explore how the researchers' attitudes, social norms, and perceived control over collaboration influence the researchers' intention to collaborate with firms. Section 4 presents the results. Section 5 discusses the findings, contributions, limitations, future research directions, and conclusions.

2. Theoretical foundation

2.1. Theory of planned behavior (TPB)

TPB helps to understand and anticipate the behavior of individuals under certain conditions and contexts (Ajzen, 1991). It states that a desired behavior is more likely to occur when the individual shows a strong intention to carry out a behavior (Ajzen, 1991). This theory links the observation of the desired behavior with three independent predictors of intention. The first is the attitude toward the behavior. Attitude is related to the proportion in which a person evaluates or perceives as advantageous or disadvantageous certain behavior. The second is the subjective norm. This represents a social norm that is related to agents that exert pressure to carry out or not carry out a behavior. The third is perceived behavioral control. This predictor is related to the ease or difficulty of carrying out certain behavior and involves previous experience and faced challenges (Ajzen, 1991).

The predictors or determinants of a person's intention mainly come from salient beliefs. These salient beliefs are known as 1) behavioral beliefs. They have an influence on the attitude toward the behavior; 2) normative beliefs. They act as determinants of subjective norms, and 3) control beliefs. They are the underlying predictors of perceived behavioral control (Ajzen, 1991). The behavioral beliefs that influence the attitude toward the behavior come from outcomes or attributes, characteristics or events in which a person associates the behavior with positive effects, or associates the behavior with negative effects, which finally have an impact on attitudes toward the behavior (Ajzen, 1991). Normative beliefs are formed by identifying actors approving or disapproving of the execution of certain behavior (Ajzen, 1991). Control beliefs involve the existence of capabilities, supplies, and goods, among others that a person can access. The perception of the availability of these resources can positively impact perceived behavioral control (Ajzen, 1991).

The HEI-Firm collaboration model suggests that the researcher's intention to collaborate with firms is influenced by attitudes toward the collaboration, perceived control over the collaboration, and social norms supporting the collaborative activity (Puerta-Sierra et al., 2022). Attitude represents an advantageous or disadvantageous appraisal of collaborating with firms, which arises from five domains: impact of HEI-Firm collaboration on firm and society, researcher-firm relationship, impact on students, institutional support, and government support. Perceived control over collaboration is defined as the ease or difficulty of collaborating with firms and is likely to arise from three domains: institutional capabilities, government capabilities, and firm capabilities. Social norms represent the perceived subjective norms dictated by important referents that either support or hinder collaboration with firms. These are divided into two important referent domains: institutions and community. Based on this framework, the purpose of our investigation is to

explore how the researcher's attitudes, social norms, and perceived control over collaboration influence their intention to collaborate with firms. The following research questions drive our efforts:

Q1: What are the main researchers' attitude domains that influence their intention to collaborate with firms?

Q2: What are the main researchers' perceived control domains that influence their intention to collaborate with firms?

Q3: What are the main researchers' social norms domains that influence their intention to collaborate with firms?

Q4: What are the relationships between these domains and their relative importance to explain the intention to collaborate with firms?

2.2. The HEI-firm collaboration

According to Arvanitis et al. (2008), knowledge and technology transfer between academic institutions and the business sector is understood as any activities aimed at transferring knowledge or technology that expect to generate benefits for the parties involved in the transfer activity. These activities include spin-offs (prototypes, licensing), start-ups, contract research, consulting (Wright et al., 2008), collaborative research, exchange of research staff between companies and research institutes, training, and the number of Ph.D. Masters theses, jointly supervised with firm members or carried out at firms (Debackere & Veugelers, 2005; Schartinger et al., 2002; Wright et al., 2008). D'Este et al. (2019) classify university-industry interaction into four modes: firm creation (academic entrepreneurship), technology transfer (licensing of IP), co-production (research partnerships), and response mode (research services).

Existing literature presents different approaches to understanding the factors that facilitate or hinder university-industry collaboration. Recently, He et al. (2021) emphasized that the success of the university-industry collaboration is related to the ongoing dynamics within the collaboration team, and to the orientation asymmetry, that is, differences in goals and expectations of the project members. Also, perceived benefits have a positive impact on the likelihood of partners continuing the collaboration and on the number of their future collaborations (De Silva et al., 2021). Additionally, the characteristics of the firm appear to be a fundamental factor to engage in university-industry collaboration. In this sense, universities may need to consider what the firm's expectations and priorities are that influence their decision of choosing certain universities (Atta-Owusu et al., 2021).

With a stronger focus on the perspective of researchers, it is important to understand the relationship between channels of interaction to the collaboration of universities and firms and researchers' motivation (Franco & Haase, 2015). The support of universities, combined with internal and external stimulation plays a relevant role in the collaboration between researchers and firms (Olaya Escobar et al., 2017). In addition, the motivation of researchers, channels of interaction and communication with firms, as well as mechanisms to deliver applied results, represent important elements associated with the researchers' disposition to interact with industry (Rajaeian et al., 2018).

In this vein, incentives and their effectiveness encourage researchers to engage in collaborative projects with industry and society (Sormani et al., 2021).

Until now, these findings allow to identify of elements and factors that exist in the interaction of HEIs and firms and also allow to align of them with the HEI-Firm collaboration model (Puerta-

Sierra et al., 2022) to examine what are the attitudes, social norms, and control over the collaboration that influence the researcher's intention to collaborate with firms. The following section presents the findings of previous research related to the collaboration between HEIs and firms. These findings are organized in line with the TPB.

3. Analyzing HEI-firm drivers of collaboration intention

3.1. Researchers' attitude toward collaboration with firms

Researchers can show a favorable or unfavorable appraisal towards HEI-Firm collaboration, depending on the benefits or positive outcomes of this relationship (Puerta-Sierra et al., 2022). Researchers can perceive benefits in different ways. Researchers expect to obtain a promotion, tenure (Rajaeian et al., 2018; Sormani et al., 2021), recognition (Fullwood et al., 2013; Olaya Escobar et al., 2017; Sormani et al., 2021), satisfaction (Olaya Escobar et al., 2017), the reputation of the research group (Franco & Haase, 2015), and rewards (Franco & Haase, 2015; Rajaeian et al., 2018). Likewise, researchers consider the possibility of engaging in other projects and obtaining resources to carry out them (Bodas Freitas & Verspagen, 2017; Sormani et al., 2021), and preserving the relationship with firms (Arzenšek et al., 2018). Learning from the business sector is important for researchers (Meng et al., 2019), which allows them to go deep into innovation topics (Xu et al., 2018). Researchers expect that through collaboration, firms increase their interest in researchers' projects and implement this knowledge in their industry (Berggren, 2017; Rajaeian et al., 2018).

In addition, academics value the benefits for students (Davey et al., 2011). For this reason, collaboration with firms allows the development and improvement of education programs with the purpose of providing students with the abilities and knowledge demanded by regions (Gunasekara, 2006). Joining together universities and firms' dynamics allow the development of programs for courses, and modules, among others, to offer nourished academic experiences at different levels (Davey et al., 2011). In turn, students can have the opportunity of developing their academic projects and practice with firms. This benefit local firms in the process of recruitment of students and in the retention of young talent (Gunasekara, 2006).

3.2. Researchers' control over collaboration with firms

Researchers' perceived control over the collaboration process relates to the ease or difficulty of collaborating with firms. Through their collaboration with firms, researchers can perceive ease or difficulty either with the institution, government, or with the firm (Puerta-Sierra et al., 2022). Regarding the institution, some factors negatively influence collaboration. For example, the lack of internal rules, limited support from the administrative staff of universities in terms of communication and creation of activities to promote cooperation with external actors, weak management process (Olaya Escobar et al., 2017), and bureaucracy of administrative departments (Cunningham et al., 2014). In addition, the lack of competitive and strong internal processes focused on managing innovative and entrepreneurial initiatives. For example, efficient policies that allow the protection and transfer of research findings, processes, products, or other types of technology (Ávila et al., 2017; Bercovitz & Feldmann, 2006; Callaert et al., 2015; Chais et al., 2018; D'Este & Patel, 2007; Fichter & Tiemann, 2018; Siegel et al., 2004). Researchers also need equipment, materials, and facilities to carry out their research activities (van der Sijde, 2012), time to collaborate with firms, information on how to get in touch with the industry, reinforcement of the relevance of collaborating with industry, guide to obtain successful interactions with external agents, and financial resources to carry out collaborative projects (Knaggård et al., 2019). In terms of government, researchers face the lack of a supportive framework focused on policies for developing science, and technology and collaborating with industry, as well as funding for their projects (Fichter & Tiemann, 2018; Zhimin et al., 2016). Regarding the firm, researchers can perceive the lack of financial resources as an obstacle to collaborating with HEIs, the lack of understanding of the industry (Nsanzumuhire & Groot, 2020), and the limited ability to absorb research findings (Davey et al., 2011).

3.3. Researchers' social norms to collaborate with firms

Social norms refer to the perception of those internal and external actors pressuring (or not) researchers to collaborate or not to collaborate with firms. Researchers can perceive pressure through internal or external stakeholders (Puerta-Sierra et al., 2022). Regarding internal stakeholders, work colleagues can exert positive or negative pressure on researchers about collaborating with firms (Arzenšek et al., 2018), and postgraduate students (Davey et al., 2011; Debackere & Veugelers, 2005; Wright et al., 2008). Concerning external stakeholders, researchers can perceive the need for research and technology from the industry as a source of pressure (Bodas-Freitas et al., 2013; Laursen et al., 2011), and government, with its processes of evaluation, policies, and guidelines typical from the research and scientific system (Zhimin et al., 2016).

In this sense, this research contributes to the exploration of how the researcher's attitudes, social norms, and perceived control over collaboration influence their intention to collaborate with firms. Thus, we take a psychological perspective. We now explain our methodology.

4. Method

4.1. Data collection

To carry out this study, 3375 invitations were sent out to researchers from 14 recognized HEIs. According to the researchers' profiles available online, they might or might not be involved in activities of collaboration with firms. From the 3375 invitations, we received 297 questionnaires of participants involved in collaborations with firms. In all these completed questionnaires (questions were labeled as mandatory) the researchers indicated that they collaborated with firms. Researchers completed the questionnaires from January to April 2021 without any missing data. The study protocol was approved by the human subjects committee of our university.

4.2. Measures

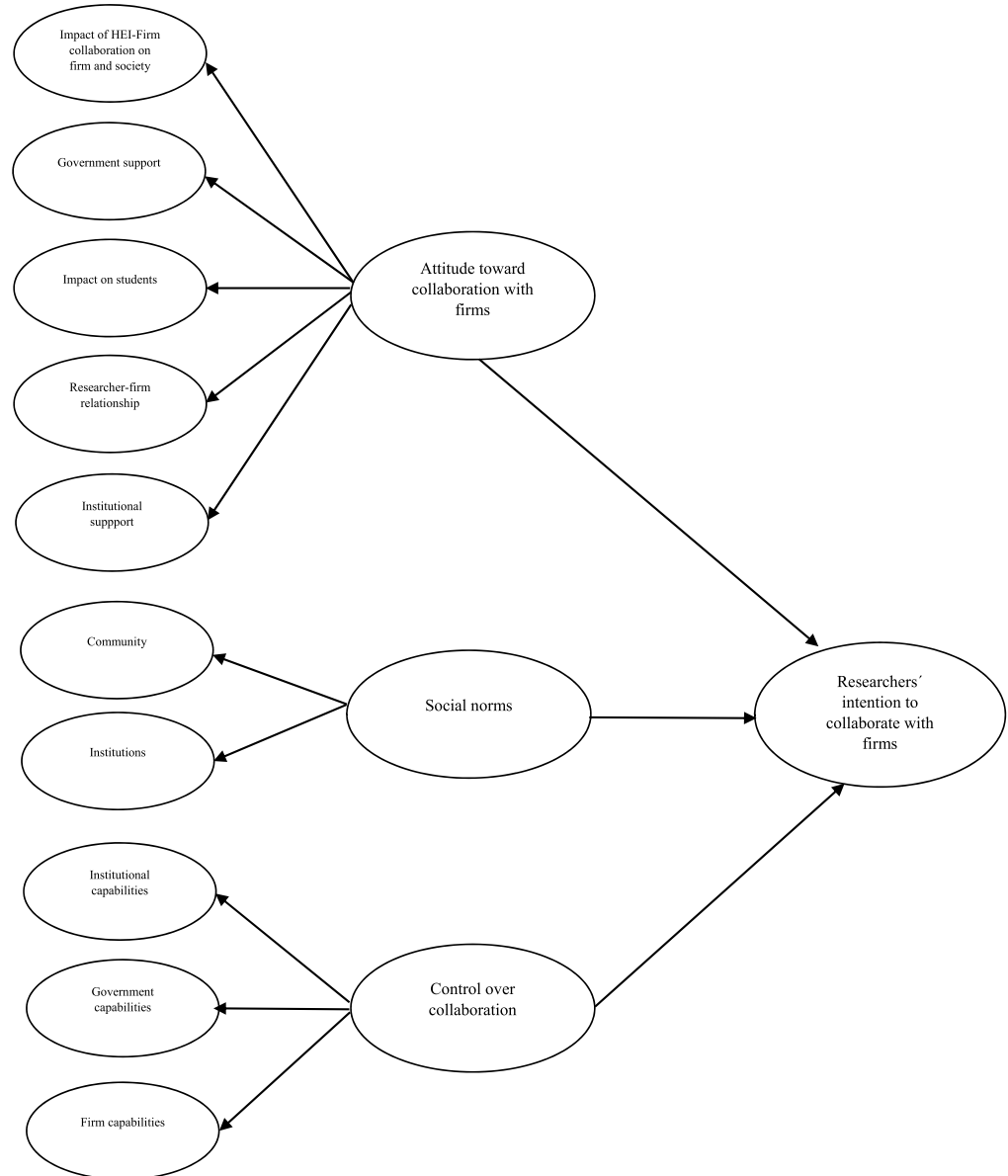
"HEI-Firm collaboration intention questionnaire" (HEI-F CIQ) (Puerta-Sierra et al., 2022).

The HEI-F CIQ was validated by Puerta-Sierra et al. (2022). Our study adopted this research instrument. This questionnaire consists of five sections that match the model presented in Figure 1. Section 1 focuses on attitude toward collaboration, Section 2 on social norms, and Section 3 on perceived control over collaboration. These sections have been measured through a differential semantic scale. Section 4 corresponds to the intention of researchers to collaborate with firms. The intention was measured on a scale of (1) strongly disagree to 7 (strongly agree). Section 5 requests personal data. The scores have shown adequate properties for scientific research in terms of reliability and validity (Puerta-Sierra et al., 2022). Sample items are: "Solving problems of firms through HEI—Firm collaboration is:", "The communication of expected results from HEI—Firm collaboration is:", "Access to incentives for HEI—Firm collaboration is:", "In my organization, the processes for the acquisition of materials needed for research are:". Appendix A includes the complete HEI-F CIQ.

5. Overview of analytical strategy

Given the exploratory nature of our research approach, we conducted several analyses. We first focused on analyzing the relationship between attitudes and intention to collaborate with firms. From this first analysis, we identified and kept only the variables that had a significant relationship with intention. We followed the same strategy for social norms and perceived control over the collaboration. Last, we tested a model with only the significant variables from the first three analyses. We used structural equation modeling with Mplus 7.11, treating all variables as latent and non-normally distributed. We reported a combination of absolute and incremental fit index: χ^2 , Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker Lewis Index (TLI). We used the cutoff scores of RMSEA \leq 0.08 and CFI and TLI $>$ 0.90 as the minimum acceptable levels of model fit (West et al., 2012).

Figure 1. HEI-Firm collaboration intention model.



5.1. Attitudes toward collaboration

The measurement model included six latent variables: impact of HEI-Firm collaboration on firm and society, impact on students, institutional support, government support, researcher-firm relationship, and intention. Results for the measurement model showed an acceptable model fit $\chi^2 = 1288.47$, $p < 0.001$ ($df = 449$), $RMSEA = 0.08$, $CFI = 0.95$ and $TLI = 0.95$. Examination of the individual parameters revealed that all factor loadings were significant and in the expected direction (ranging from 0.66 to 0.98). The bivariate correlations between the latent variables were moderate to strong, ranging from 0.35 to 0.68, below the recommended threshold of .85 to establish discriminant validity (Brown, 2006). The h coefficients and the Average Variance Extracted (AVE), as indicators of reliability and convergent validity respectively, had acceptable levels: impact of HEI-Firm collaboration on firm and society (0.91 & 0.78), impact on students (0.90 & 0.75), institutional support (0.88 & 0.72), government support (0.91 & 0.75), researcher-firm relationship (0.91 & 0.68), and intention (0.98 & 0.92). Given the results of our measurement model, we proceeded to test our structural model.

Results for the structural model showed an acceptable model fit $\chi^2 = 1288.47$, $p < 0.001$ ($df = 449$), $RMSEA = 0.08$, $CFI = 0.95$ and $TLI = 0.95$. Examination of the individual parameters showed significant positive relationships between the impact on students, researcher–firm relationship, and intention, $\gamma = 0.31$, $p < 0.001$, $\gamma = 0.34$, $p < 0.001$, respectively, and a negative relationship between attitude toward institutional support and intention $\gamma = -0.13$, $p = 0.04$. Conversely, the relationships between the impact of HEI–Firm collaboration on firm and society, government support, and intention were not significant, $\gamma = 0.08$, $p = 0.30$, $\gamma = -0.08$, $p = 0.23$, respectively.

5.2. Social norms

The measurement model included three latent variables: institutions, community, and intention. Results for the measurement model showed an acceptable model fit $\chi^2 = 165.99$, $p < 0.001$ ($df = 50$), $RMSEA = 0.08$, $CFI = 0.99$ and $TLI = 0.99$. Examination of the individual parameters revealed that all factor loadings were significant and in the expected direction (ranging from 0.53 to 0.96). The bivariate correlations between the latent variables were moderate to strong, ranging from 0.21 to 0.74, below the recommended threshold of .85 to establish discriminant validity (Brown, 2006). The h coefficients and AVE estimates had acceptable levels respectively: institutions (0.82 & .59), community (0.72 & .56), and intention (0.98 & .92). Given the results of our measurement model, we proceeded to test our structural model.

Results for the structural model showed an acceptable model fit $\chi^2 = 165.99$, $p < 0.001$ ($df = 50$), $RMSEA = 0.08$, $CFI = 0.99$ and $TLI = 0.99$. Examination of the individual parameters showed a significant positive relationship between community and intention, $\gamma = 0.34$, $p = 0.024$, and a non-significant relationship between institutions and intention, $\gamma = -0.04$, $p = 0.77$.

5.3. Control over the collaboration

The measurement model included four latent variables: institutional capabilities, government capabilities, firm capabilities, and intention. Results for the measurement model showed an acceptable model fit $\chi^2 = 559.87$, $p < 0.001$ ($df = 183$), $RMSEA = 0.08$, $CFI = 0.98$ and $TLI = 0.98$. Examination of the individual parameters revealed that all factor loadings were significant and in the expected direction (ranging from 0.78 to 0.98). The bivariate correlations between the latent variables were moderate to strong, ranging from -0.02 to 0.52, below the threshold of .85 to establish discriminant validity (Brown, 2006). The h coefficients and AVE estimates had acceptable levels respectively: institutional capabilities (0.94 & .78), government capabilities (0.96 & .88), firm capabilities (0.94 & .89), and intention (0.98 & .92). Given the results of our measurement model, we proceeded to test our structural model.

Results for the structural model showed an acceptable model fit $\chi^2 = 559.87$, $p < 0.001$ ($df = 183$), $RMSEA = 0.08$, $CFI = 0.98$ and $TLI = 0.98$. Examination of the individual parameters showed a significant positive relationship between firm capabilities and intention, $\gamma = 0.36$, $p < 0.001$, and a significant negative relationship between government capabilities and intention, $\gamma = -0.23$, $p = 0.001$. The relationship between institutional capabilities and intention was not significant, $\gamma = 0.10$, $p = 0.19$.

5.4. Complete model

Our last model included all significant variables from the attitude, social norms, and perceived control over the collaboration components, all the variables explaining intention. Consequently, the measurement model had seven latent variables: impact on students, researcher–firm relationship, institutional support, norms from community, government capabilities, firm capabilities, and intention. Results for the measurement model showed an acceptable model fit $\chi^2 = 1321.18$, $p < 0.001$ ($df = 506$), $RMSEA = 0.07$, $CFI = 0.96$ and $TLI = 0.96$. Examination of the individual parameters revealed that all factor loadings were significant and in the expected direction (ranging from 0.67 to 0.98). The bivariate correlations between the latent variables were moderate to strong, ranging from 0.08 to 0.78, below .85 to establish discriminant validity (Brown, 2006). The h coefficients and AVE estimates had acceptable levels respectively: impact on students (0.90 & .75), researcher–firm

relationship (0.92 & .68), institutional support (0.88 & .72), community (0.85 & .72), firm capabilities (0.94 & .90) government capabilities (0.96 & .88), and intention (0.98 & .92). Given the results of our measurement model, we proceeded to test our structural model. Table 1 presents the results structural model.e

Results for the structural model showed an acceptable model fit $\chi^2 = 1321.18$, $p < 0.001$ (df = 506), RMSEA = 0.07, CFI = 0.96 and TLI = 0.96. Examination of the individual parameters showed significant positive relationships between the impact on students, researcher-firm relationship, community, and intention, $\gamma = 0.30$, $p < 0.001$, $\gamma = 0.35$, $p = 0.001$, $\gamma = 0.12$, $p = 0.043$, respectively. In addition, we found negative, significant relationships between attitude toward institutional support, government capabilities, and intention, $\gamma = -0.12$, $p = 0.050$ and $\gamma = -0.17$, $p = 0.010$. Last, the relationship between firm capabilities and intention was not significant, $\gamma = 0.014$, $p = 0.89$. The R^2 for the intention was 0.32 (See Figure 2).

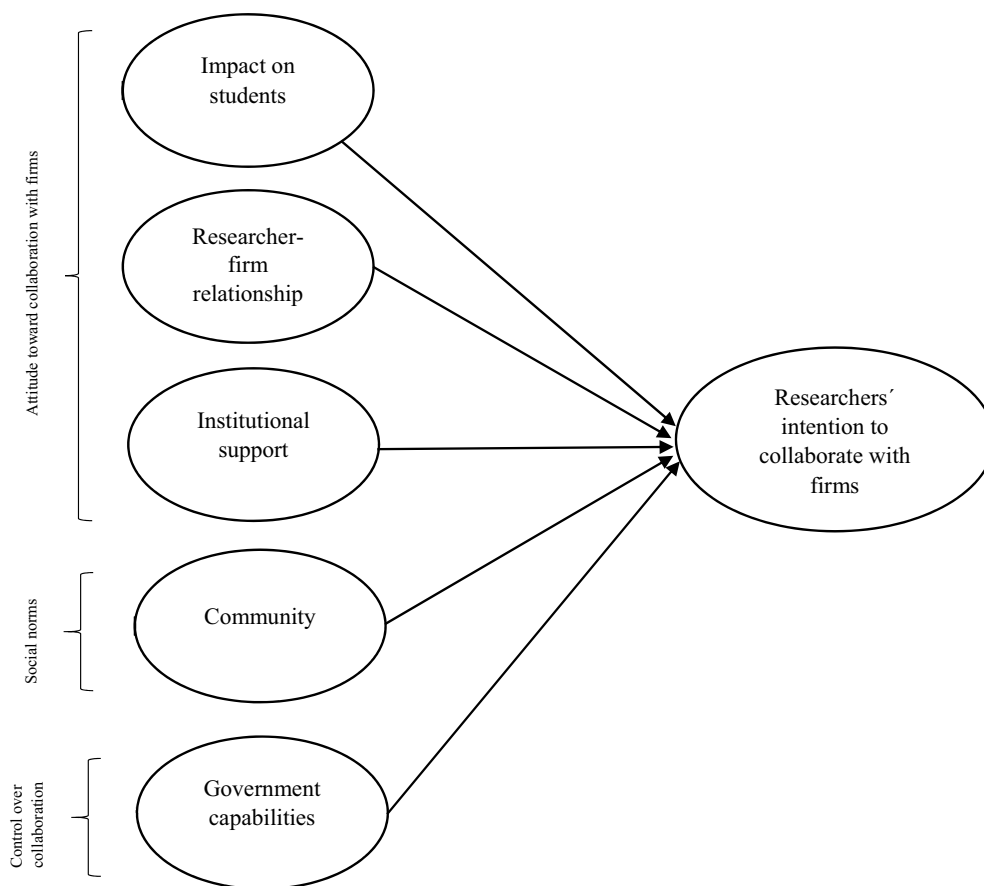
6. Discussion

The purpose of our investigation was to explore how researchers' attitudes toward collaboration, social norms, and perceived control over collaboration, influence their intention to collaborate with firms. We assessed the main researchers' attitudes, perceived behavioral control, and social norms factors that influence their intention to collaborate with firms. The results indicated that the main researchers' attitudinal factors are: impact on students, institutional support, and researcher-firm relationship. Specifically, institutional support had a negative impact on the researchers' intention. In addition, the main researchers' perceived control over the collaboration factor was government capabilities. This represented a negative influence. Finally, the main researchers' social factor was the community. We discussed the contributions.

Table 1. Structural model

Attitudes toward ollaboration	
Effects	Coefficient
Impact on students on intention	.31, $p < .001$
Researcher-firm relationship on intention	.34, $p < .001$
Institutional support on intention	-.13, $p = .04$
HEI-Firm collaboration on firm and society on intention	.08, $p = .30$
Government support on intention	-.08, $p = .23$
Social Norms	
Community on intention	.34, $p = .02$
Institution on intention	-.04, $p = .77$
Control over the collaboration	
Firm capabilities on intention	.36, $p < .001$
Government capabilities on intention	-.23, $p = .001$
Institutional capabilities on intention	.10, $p = .19$
Complete Model	
Impact on students on intention	.30, $p < .001$
Researcher-firm relationship on intention	.35, $p < .001$
Community on intention	.12, $p = .04$
Institution on intention	-.12, $p = .05$
Government capabilities on intention	-.17, $p = .01$
Firm capabilities on intention	.014, $p = .89$

Figure 2. Structural model of researchers' intention to collaborate with firms.



6.1. Contributions

Our research contributes to the HEI-firm collaboration research, and to the TPB literature. First, by assessing the researchers' attitudes, perceived control over the collaboration, and social norms, we supported the relevance to continue studying the collaboration between HEIs and firms. This is what we intended to contribute. Unlike previous studies (Atta-Owusu et al., 2021; De Silva et al., 2021; He et al., 2021; Olaya Escobar et al., 2017; Rajaeian et al., 2018) our research provided an approach to identify and relatively weigh the main components of the model, as well as the direction of the effect on intention. The myriad of factors identified in the literature was synthesized and grouped into a smaller set of factors, that is, attitudes, social norms, and perceived control over the collaboration. Regarding researchers' attitudes, the researcher-firm relationship was a significant positive factor affecting intention. Consistent with the literature (Arzenšek et al., 2018; Xu et al., 2018) researchers value the expected outcomes of the relationship between the researcher and the firm. Researchers expect to create a bond with firms. They expect to gain mutual benefits, exchange and accumulate knowledge, and establish good communication and a satisfactory relationship with firms.

The impact on students as a result of the collaboration was a significant positive factor affecting intention. As Gunasekara (2006) and Davey et al. (2011) suggest, researchers see collaboration with firms as a source of benefits for students. Researchers think that collaboration can provide elements for the development of the curriculum and skills of students, and students' employability (Gunasekara, 2006).

In line with previous studies (Ávila et al., 2017; Callaert et al., 2015; Chais et al., 2018; Fichter & Tiemann, 2018), the institutional support represented a significant negative factor influencing

researchers' intention to collaborate with firms. Unfortunately, researchers face a lack of culture and understanding of HEIs-Firm collaboration, the lack of an adequate linkage structure, and the lack of a comprehensive system that also considers the students (Nsanzumuhire & Groot, 2020). As their beliefs toward the institution tend to be negative, researchers can perceive their institutions as the main obstacle to collaborating with firms.

Similarly, findings of perceived control over collaboration were consistent with the literature. Government capabilities represented a negative factor to collaborate with firms. Researchers face a lack of funding, incentives, and a political frame supporting their research projects and collaboration with firms (Fichter & Tiemann, 2018; Zhimin et al., 2016).

Finally, in line with previous studies (Arzenšek et al., 2018; Davey et al., 2011; Debackere & Veugelers, 2005; Schartinger et al., 2002; Wright et al., 2008) the findings of social norms indicated that undergraduate and postgraduate students, and their colleagues (researchers from applied research), represented a positive factor of pressure. This indicates that their feedback, comments, and/or requisitions stimulated them to collaborate with firms.

In summary, the intention of researchers to collaborate with firms went beyond an individual initiative or a professional goal, that is, researchers considered different elements that allowed them to create beliefs that drive their intention toward collaboration with firms.

6.2. Applied implications

Despite the fact that this research was conducted in a specific country and setting, some reflections and implications on HEI-firm collaboration are put forward. Findings from this study can have implications for different stakeholders involved in the HEI-firm collaboration. One, somewhat obvious, applied implication for establishing collaborations with firms, it is essential to have internal and external facilitators, as well as physical, economic, and human resources favoring this relationship. Here we want to highlight government capabilities and institutional support as negative factors for collaboration. To be a facilitator, governments and institutions need: 1) to understand the meaning of HEI-Firm collaboration, 2) to appreciate the outcomes and benefits, as well as 3) to acknowledge the needs and requirements to effectively carry out this partnership. In addition, HEIs need to prioritize this activity and give importance to the researchers' projects. We want to take the opportunity to highlight that in the context of a developing country, researchers face a lack of different resources. Therefore, they might perceive the collaboration as a source for expanding in some cases their "limited capabilities or resources", that is, firms can provide knowledge, equipment, infrastructure, and contacts, typical of these actors. Likewise, HEIs and government need to consider that researchers perceive collaboration with firms as an opportunity to benefit students. We want to take the opportunity to highlight that in the context of a developing country, for researchers, the HEI-Firm collaboration might represent an important source of professional strengthening for students.

In this sense, HEIs can 1) increasingly seek to include students in projects with firms, and 2) plan feedback sessions with the purpose of obtaining relevant information to update and improve the curriculums, as well as focus on student's development of skills and knowledge, according to the outcomes, requirements and/or findings of the collaboration with firms. On the other hand, in addition to increasing support and resources for collaboration, the government can promote the importance of including students in HEI-Firm projects. In countries with limited opportunities for employment, the government can see the HEI-firm collaboration as a path to strengthen students' professional capabilities, and as an opportunity to be hired. In terms of the community, due to the influence on the researcher's intention to collaborate with firms, HEIs can do a greater effort in communicating, promoting, and recognizing the researchers' collaboration with firms. This might create a positive environment in which colleagues support researchers' collaboration with firms.

6.3. Limitations and future research

Our study had several limitations. First, as we followed an exploratory approach, we did not posit specific hypotheses, instead, our study focused on exploring the attitudes, perceived control over the collaboration, and social norms affecting researchers' intention to collaborate with firms. Second, as mentioned previously, the HEI-Firm collaboration requires different stakeholders. However, the findings of this study correspond only to the perception of researchers that have collaborated with firms. Future studies could continue expanding the factors affecting this relationship from a deeper level of analysis, including government institutions, firms' staff, and HEIs members, for example, students, deans, and managers, among others. The following questions could guide future research: Why does an educational manager or administration hinder the HEI-Firm collaboration? Why do firms resist collaborating with HEIs? What are the perceptions of different stakeholders? Do they assume the wrong things? Is it related to ignorance? Or are there legal issues?

7. Conclusions

The exploration of researchers' attitudes, social norms, and perceived control over the collaboration, allowed us to find evidence of the main factors influencing their intention to collaborate with firms. The results indicated that the main researchers' attitude factors were: impact on students, institutional support, and researcher-firm relationship. The main researchers' perceived control over the collaboration factor was government capabilities. Last, the main researchers' social norm factor was the community. These findings contributed to the 1) HEIs-firm collaboration literature by highlighting some elements in need of attention in this relationship and to the 2) TPB research by offering behavioral findings of researchers' intention to collaborate with firms. Particularly, this study can be useful for contexts where HEI-Firm collaboration still requires greater efforts at the individual and organizational levels, as well as for strategy and policy purposes.

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Appendix A.

HEI–Firm collaboration intention questionnaire (Source: Puerta et al., 2022).

Please indicate the potential outcomes that you have experienced during your collaboration with firms.

Item		1	2	3	4	5	6	7
S1	Solving problems of society through HEI—Firm collaboration is:	Very difficult						Very easy
S2	Focusing our research activities on the needs of society is:	Very difficult						Very easy
F1	Solving problems of firms through HEI—Firm collaboration is:	Very difficult						Very easy
RL1	Identifying new research lines in collaboration with firms is:	Very difficult						Very easy
F2	Focusing our research activities on the needs of firms is:	Very difficult						Very easy
RFR1	The collaboration between HEIs and firms often results in:	Great losses						Great benefits
RFR2	The personal satisfaction arising from the collaboration with firms is:	Very low						Very high
RFR3	The distribution of collaboration benefits between HEIs and firms is:	Very unequal						Very equal
RFR4	The learning of new things during the collaboration is:	Very low						Very high
RFR5	The interest of firms to collaborate with HEIs is:	Very low						Very high
RFR6	The communication of expected results from HEI—Firm collaboration is:	Very difficult						Very easy
RFR7	The propensity of firms to invest in collaborative projects with HEIs is:	Very low						Very high
RFR8	To gain continuity in collaboration projects with firms is:	Very difficult						Very easy
SI1	Updating students' professional curriculum via HEI—Firm collaboration is:	Impossible						Possible
SI2	Involving students in HEI—Firm collaborative projects is:	Impossible						Possible
SI3	Obtaining feedback from firms on the knowledge and skills professional profile for students is:	Impossible						Possible
SI4	The impact of HEI—Firm collaboration on HEIs performance indicators is:	Very bad						Very good
SI5	Hiring students to work in collaborative projects with firms is:	Impossible						Possible
IS1	The administrative procedures for collaboration with firms in my organization is:	Very inefficient						Very efficient
IS2	Access to state of the art equipment for my research in my organization is:	Very difficult						Very easy
IS3	Research infrastructure in my organization is:	Totally inadequate						Excellent
IS4	Support from my organization to manage intellectual property and the transfer of knowledge and technology is:	Totally inadequate						Excellent
IS5	In my organization, the supply of research infrastructure and support is:	Very irrelevant						Very relevant
GS1	Access to incentives for HEI—Firm collaboration is:	Very difficult						Very easy
GS2	Obtaining public funding for collaborative HEI—Firm projects is:	Very difficult						Very easy
GS3	Government funding for different research themes is:	Very unequal						Very equal
GS4	The impact of science, technology, and innovation policy on HEI—Firm collaboration is:	Very unfavorable						Very favorable

Please indicate the influence of the following individuals or institutions on engaging in collaborative projects with firms.

		1	2	3	4	5	6	7
Item		Very negative influence						Very positive influence
INS1	Government							
INS2	National Council for Science and Technology							
INS3	Your organization							
INS4	Firms							
COM1	Postgraduate students							
COM2	Undergraduate students							
COM3	Colleagues working in applied research							

Please answer this question with the option that best reflects your experience in collaborative projects with firms.

		1	2	3	4	5	6	7
IC1	In my organization the administrative process and policy for collaborative projects with firms are:	Very inefficient						Very efficient
IC2	The organizational culture and attitude toward business in my organization is:	Very passive						Very active
IC3	My organization actively seeks contact with firms to do collaborative projects:	Strongly disagree						Strongly agree
IC4	In my organization the incentives for collaboration with firms are:	Very inadequate						Very appropriate
IC5	My organization's effort to adapt to firm's research scheduling and timing of results is:	Very low						Very high
IC6	My organization is aware of the research and innovation needs of firms:	Strongly disagree						Strongly agree
IC7	The administrative support that I receive in research activities is:	Very inadequate						Very appropriate
IC8	In my organization, the processes for the acquisition of materials needed for research are:	Very inadequate						Very appropriate
GC1	Government funding available for HEI—Firm collaborative projects are:	Very inadequate						Very appropriate
GC2	Government calls for proposals for collaborative projects with firms are:	Very inadequate						Very appropriate
GC3	The effect of current economic and political situation on HEI—Firm collaborative projects is:	Very inadequate						Very appropriate
GC4	Governmental incentives provided to HEIs to collaborate with firms are:	Very inadequate						Very appropriate
GC5	The effect of current science and technology policy of government in HEI—Firm collaboration is:	Very inadequate						Very appropriate
FC1	The level of investment by firms in collaborative projects with HEIs is:	Very inadequate						Very appropriate

(Continued)

<i>(Continued)</i>								
		1	2	3	4	5	6	7
FC2	The allocation of human resources and infrastructure by firms to collaborate with HEIs is:	Very inadequate						Very appropriate
FC3	The predisposition of firms to collaborate with HEIs is:	Very inadequate						Very appropriate

Please indicate the level of agreement or disagreement with the following statements.

		1	2	3	4	5	6	7
Item	Currently	Strongly disagree						Strongly agree
INC1	I participate in HEI-firm collaborative activities							
INC2	I frequently contact firms to collaborate with them							
INC3	I take additional efforts to collaborate with firms							
INC4	I apply for funding to collaborate with firms							
INC5	I accept offers from firms to collaborate with them							

		1	2	3	4	5	6	7
Item	In the past three years	Strongly disagree						Strongly agree
INP1	I participated in HEI-firm collaborative activities							
INP2	I frequently contacted firms to collaborate with them							
INP3	I made additional efforts to collaborate with firms							
INP4	I made additional efforts to collaborate with firms							
INP5	I accepted offers from firms to collaborate with them							

		1	2	3	4	5	6	7
Item	In the next two years	Strongly disagree						Strongly agree
INN1	I will participate in HEI-firm collaborative activities							
INN2	I will contact firms to collaborate with them							
INN3	I will take additional efforts to collaborate with firms							
INN4	I will apply for funding to collaborate with firms							
INN5	I will accept offers from firms to collaborate with them							

Information about you

Gender

Age

Affiliation

Number of years of affiliation

Expertise area

Years performing collaborative projects with your current affiliation

SNI member

SNI level

Indicate the number of collaborative projects with firms in the last 3 years.

Joint research and development projects

Contract research

Staff-exchanges from HEIs to firms

Students internships in firms

Personnel exchanges from firm to HEIs

Guest lectures given by firms

Projects conducted by students in cooperation with firms

Hosting thesis (BSc, MSc, PhD)

Industrial projects as part of studies in HEIs
