UNIVERSITY-INDUSTRY COLLABORATION: A SCOPING REVIEW OF SUCCESS FACTORS

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Abstract. Collaboration processes between universities and companies are increasingly relevant for the generation of new knowledge and for promoting innovation. However, the literature highlights the need to delve into the factors that drive and favour these collaboration dynamics. Thus, the present paper aims to identify the success factors in university-industry collaboration processes. For this purpose, a scoping review was performed. We conducted a search in the Web of Science and Scopus databases, in order to find documents related to the subject until 2019. As a result of the scoping review, 17 success factors were identified, classified according to the four internal facilitators: structure, strategy, knowledge and relations.

1. Introduction

University research has been a key source of specialized knowledge of high value for the economy (Baruch, 1997; Tseng, Huang, & Chen, 2020) and also the basis for the formulation and execution of public agendas (Debackere & Veugelers, 2005), due to the fundamental role of knowledge to increase the competitiveness of nations (Nava-Rogel & Mercado-Salgado, 2011). In the last two decades, trends in research and development have privileged collaboration between the company and universities, under an ecosystem of mutual benefit in the generation and dissemination of knowledge (Fiaz, Yang, & Abbas, 2014; Santoro & Bierly, 2006).

The university-industry collaboration is considered an important mechanism to leverage innovation, since it ensures that knowledge is managed and transferred effectively (Mikhailov, Puffal, & Santini, 2020; Weerasinghe & Dedunu, 2020). Thus, the university knowledge disseminated in that type of relationship is positively associated to firms innovation performance (Puffal, Ruffoni, & Spricigo, 2020). For instance, research and development between universities and companies, despite their complexity, lead to higher levels of innovation in the firms (Mikhailov et al., 2020). In that way, collaboration strengthens the flow of knowledge of the organizations (Bulińska-Stangrecka & Bagieńska, 2020). For that reason, countries make efforts to create an innovative environment (Danko et al., 2020), from the active involvement

of universities, research institutes and the main actors of the national innovation systems (Seitzhanov, Kurmanov, Petrova, Aliyev, & Aidargaliyeva, 2020). The university-industry collaboration facilitates knowledge production that is transferred and accumulated in social actors (D'Este, Guy, & Iammarino, 2013; Santoro & Bierly, 2006). However, despite the large amount of literature related to the flow of knowledge created by the interactions between industries and universities, very little is known about the factors that drive the establishment of research collaborations between these actors (D'Este et al., 2013). In that vein, the literature highlights the need to identify the factors that contribute to this collaboration dynamic (Alpaydın, 2019; Fiaz et al., 2014). Previous studies analyse the importance of elements such as the individual characteristics of researchers (Banal-Estañol, Macho-Stadler, & Pérez-Castrillo, 2018), the organizational structure (Argueta López & Jiménez Terrazas, 2017; Baruch, 1997), the geographic proximity (D'Este et al., 2013; Tang, Motohashi, Hu, & Montoro-Sanchez, 2020), levels of trust between participants (Oliver, Montgomery, & Barda, 2020) and both formal and informal interactions between alliance members (Schaeffer, Öcalan-Özel, & Pénin, 2020).

Likewise, the density and heterogeneity of the network has a positive impact on the transfer of knowledge between universities and industries (Mao, Yu, Zhou, Harms, & Fang, 2020). Regarding geographic proximity, collaborations with intraregional universities are associated with incremental innovations, while interaction with transregional universities is associated with more radical innovations (Tang et al., 2020). Additionally, the literature addresses the motivations of researchers to transfer knowledge, highlighting the importance of applying knowledge in real situations, in order to generate innovations and contribute to environmental problems (García Ponce de León, Pérez Mora, & Miranda Zea, 2018). Literature also highlights that a critical understanding of the knowledge collaboration process is decisive for identifying business growth opportunities (Vauterin & Virkki-Hatakka, 2016) and favour innovation (Johnston & Huggins, 2017; Mao et al., 2020). Therefore, there is a growing interest in defining the determinants of collaborations between universities and the industry (Alpaydın, 2019). In that sense, further analysis is needed to analyse the development process of internal capacities of companies to effectively participate in cooperation agreements with universities, as a mechanism to produce innovations (Veugelers & Cassiman, 2005) and to improve the organizational learning process of the firm (Sherwood & Covin, 2008). This paper classifies the success factors for university-industry collaboration, from the conceptual framework of internal facilitators for innovation proposed by Pellegrini et al. (2019), which includes the organizational structure, strategy, knowledge and relations. Literature on technology transfer in interaction processes between the university and industry has focused mainly on the macro level of companies, so it is necessary to carry out more research on the key aspects for the success of these processes at the micro level (Jones & Coates, 2020). In that sense, this paper aims to identify the factors that facilitate university-industry collaboration, but with special emphasis on the perspective of business characteristics, since, up to now, much of the literature has addressed mainly the characteristics of the universities. For this purpose, the seminal framework proposed by Arksey y O'Malley (2005) was applied to carry out a scoping review. This review included documents of the Web of Science and Scopus databases, published between 2002 and 2019. Recent reviews analyse the four central measures of university-industry collaboration that have been identified previously in the literature: motivations, occupations, barriers and outcomes (Vick & Robertson, 2018). In contrast, this study delves into the characteristics necessary for companies to develop successful collaboration strategies with universities.

2. Methodology
This paper uses the seminal framework proposed by Arksey y O'Malley (2005) to carry out an scoping review, which includes the following stages: (1) identify the research question; (2) identify relevant studies; (3) select studies; (4) data charting and collation; (5) collating, summarising and reporting the results.

2.1 Identify the research question
According to the methodology proposed by Arksey y O'Malley (2005), the first stage in the literature review is to identify the research question. This research question was posed as follows: What organizational factors, characteristics or attributes favour university-industry collaboration?

2.2 Identify relevant studies
In the second stage, the relevant studies are identified. In this case, a search was carried out in the Scopus and Web of Science databases. The search was carried out according to the equations described in table 1. The descriptors were selected from the bibliometric analysis carried out by Olvera et al. (2018).

Table 1. Key search terms

Database	Search terms
Scopus	TITLE-ABS-KEY(("University Business" AND "Collaboration ") OR ("University-Business University-Industry" AND "Cooperation") OR (("University-Industry" OR "University Industry Industry-Science") AND "Partnership") OR (("Industry-Science" OR "Industry Science") AND ("Link")) OR (("Science to Business" OR "Science 2 Business") AND ("Technology Transfer")))
Web of Science	TI = (("University Business" AND "Collaboration ") OR ("University-Business University-Industry" AND "Cooperation") OR (("University-Industry" OR "University Industry Industry-Science") AND "Partnership") OR (("Industry-Science" OR "Industry Science") AND ("Link")) OR (("Science to Business" OR "Science 2 Business") AND ("Technology Transfer"))). Specifically, the search in was carried out in the following indexes: *SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC.*

Source: Own elaboration

2.3 Selected studies

Considering the third stage of the methodology, the following inclusion and exclusion criteria were considered in this scoping review: First, only peer-reviewed articles were included. Books, book chapters, conference papers, reports, review papers, and other type of materials were excluded. Second, articles published only in English were included. In third place, we included articles published between 2002 and 2019. In the fourth stage, duplicated records were eliminated. Finally, the full text documents were read to determine their relationship with our research question. Consequently, the way in which the research papers were included in the literature review is illustrated below (Figure 1)
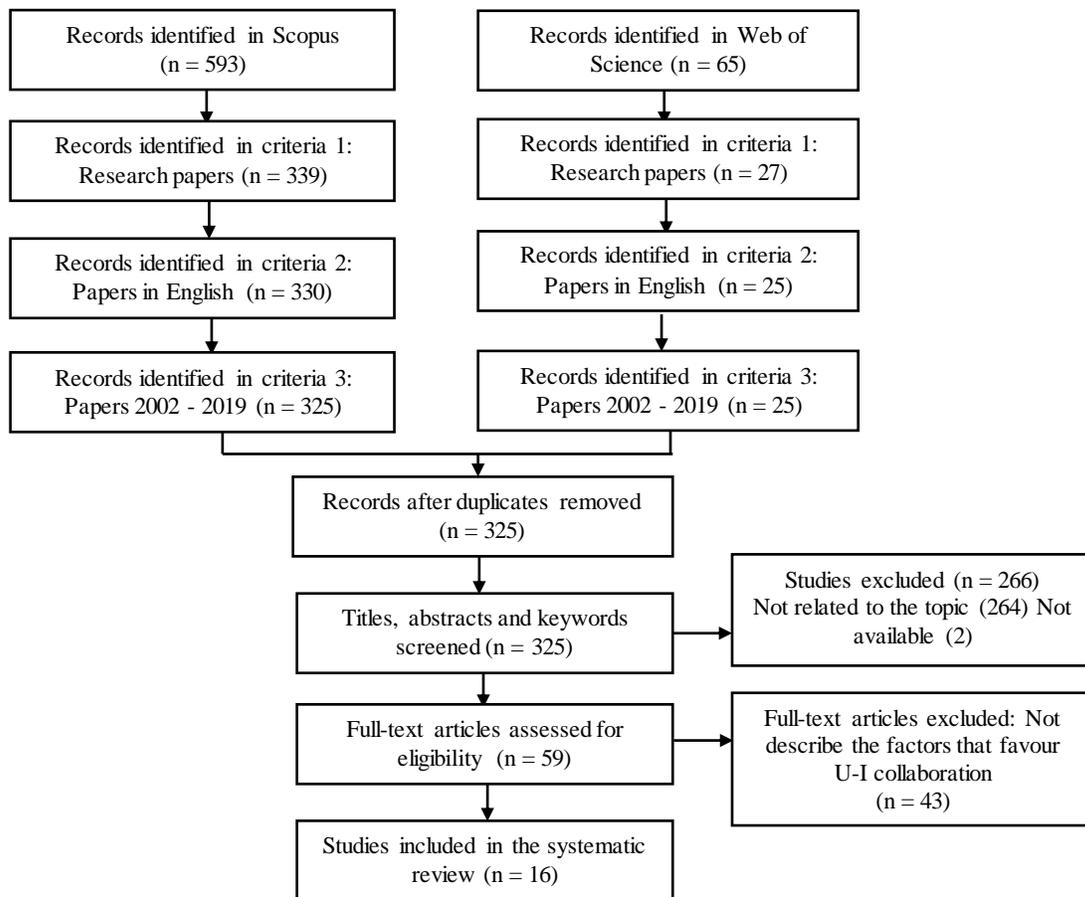

Figure 1. Flow diagram of papers included in the scoping review
Source: Own elaboration

2.4 Data charting and collation

In the fourth stage of the scoping review, the papers were reviewed in full text in order to extract the following data: author, name of the journal, methodological approach and sample of each paper included in the scoping review (Table 2).

2.5 Collating, summarising and reporting the results

In the fifth stage, the internal factors of the company that favour collaboration with universities were identified and discussed (Table 3).

3. Results

The following is a description of the papers included in this scoping review (Table 2)

Table 2. Description of the papers included in the scoping review

Author(s)	Source title	Methodological approach	Sample
(Sherwood & Covin, 2008)	*Journal of Product Innovation Management*	Quantitative	104 business managers participating in technology transfer partnerships with universities.
(Veugelers & Cassiman, 2005)	*International Journal of Industrial Organization*	Quantitative	1,335 Belgian manufacturing companies
(Santoro & Bierly, 2006)	*IEEE Transactions on Engineering Management*	Quantitative	173 managers of companies of various sizes, out of a total of 1,250 firms in the United States
(Vauterin & Virkki-Hatakka, 2016)	*Industry and Higher Education*	Qualitative	Case study of collaboration between SMEs in the cleantech sector and universities in Finland
(Mindruta, 2013)	*Strategic Management Journal*	Quantitative	447 collaboration contracts between companies and university scientists, from 1995 to 2004 on the East Coast of the United States
(Wynn, 2018)	*International Journal of Knowledge Management*	Qualitative	Sample of 3 SMEs selected from an initial review of 14 university-industry technology transfer projects in the UK
(Chang & Hsu, 2002)	*International Journal of Advanced Manufacturing Technology*	Qualitative	Population: 69 university-industrial projects classified into 2 groups: successful and unsuccessful. Successful project case study: 20 projects in Taiwan.
(Johnston & Huggins, 2017)	*Papers in Regional Science*	Quantitative	Population: 568 formal collaborations between KIBS companies and UK universities
(D'Este et al., 2013)	*Journal of Economic Geography*	Quantitative	Population: 2210 U-I research associations funded with public funds by EPSRC during 1999-2003 in the UK
(Lakpetch & Lorsuwannarat, 2012)	*International Journal of Organizational Analysis*	Mixed methods	Population: 850 actors participating in collaboration agreements, derived from the Thailand Research Funds office and the Higher Education Commission Office. Final response rate of 29%.
(Al-Tabbaa & Ankrah, 2019)	*European Management Review*	Qualitative	Population: in each case, the informants were at least one representative from the university, one from the company and two from society. Total: 37 interviews. Location: United Kingdom
(Gertner, Roberts, & Charles, 2011)	*Journal of Knowledge Management*	Qualitative	Population: 3 case studies of University-industry knowledge transfer projects developed between 2007-2010
(Araújo & Teixeira, 2014)	*Journal of Technology Management and Innovation*	Quantitative	Population: 71 technology association agreements funded by the European Business Network (EEN)
(Johnston & Huggins, 2016)	*Regional Studies*	Quantitative	Population: 568 KIBS rural businesses that participated in knowledge transfer partnerships (KTPs) between 2001 and 2008 in the UK.
(Alves, Marques, & Saur-Amaral, 2007)	*European Planning Studies*	Qualitative	Population: Case of university-industry collaboration that has been developing since 1999
(Sarpong, AbdRazak, Alexander, & Meissner, 2017)	*Technological Forecasting and Social Change*	Qualitative	Population: 27 strategic actors of the triple helix model (12 universities, 9 industries and 6 government officials) in Malaysia

Source: Own elaboration

Table 3 presents the success factors of the university-industry collaboration process identified in the scoping review, and classified according to the conceptual framework of internal facilitators proposed by (Pellegrini et al., 2019).

Table 3. Success factors of university-industry collaboration process

Internal drivers	Success factor in University-Industry collaboration process	No. of studies	Authors
Structure	Size of the firm	4	(Veugelers & Cassiman, 2005), (Mindruta, 2013), (Chang & Hsu, 2002), (Johnston & Huggins, 2017)
	Internal structural characteristics and institutional support for the development of collaborative processes	7	(Lakpetch & Lorsuwannarat, 2012), (Gertner et al., 2011), (Alves et al., 2007), (Sarpong et al., 2017), (Veugelers & Cassiman, 2005), (Vauterin & Virkki-Hatakka, 2016), (Wynn, 2018)
	Existence of intellectual property policies	3	(Santoro & Bierly, 2006), (Chang & Hsu, 2002), (Al-Tabbaa & Ankrah, 2019)
	Capacity and technological intensity of the company	4	(Santoro & Bierly, 2006), (Lakpetch & Lorsuwannarat, 2012), (Al-Tabbaa & Ankrah, 2019), (D'Este et al., 2013)
	Geographic proximity to university partners and location of the firm in areas of high business density	3	(Johnston & Huggins, 2017), (D'Este et al., 2013), (Johnston & Huggins, 2016)
	Existence of clear governance mechanisms in collaboration processes	4	(Lakpetch & Lorsuwannarat, 2012), (Alves et al., 2007), (Sarpong et al., 2017), (Vauterin & Virkki-Hatakka, 2016)
	Management and motivation of human talent and collaboration teams	5	(Sherwood & Covin, 2008), (Santoro & Bierly, 2006), (Vauterin & Virkki-Hatakka, 2016), (Lakpetch & Lorsuwannarat, 2012), (Araújo & Teixeira, 2014)
Strategy	Articulation of collaboration agreements with the organization's strategy	3	(Veugelers & Cassiman, 2005), (Wynn, 2018), (Chang & Hsu, 2002)
Knowledge	Implementation of knowledge management procedures	5	(Santoro & Bierly, 2006), (Vauterin & Virkki-Hatakka, 2016), (Wynn, 2018), (Gertner et al., 2011), (Sarpong et al., 2017)
	Absorption capacity	6	(Veugelers & Cassiman, 2005), (Santoro & Bierly, 2006), (Wynn, 2018), (Lakpetch & Lorsuwannarat, 2012), (Araújo & Teixeira, 2014), (Gertner et al., 2011)
	Social capital	6	(Santoro & Bierly, 2006), (Lakpetch & Lorsuwannarat, 2012), (Al-Tabbaa & Ankrah, 2019), (Gertner et al., 2011), (Araújo & Teixeira, 2014), (Johnston & Huggins, 2016)
Relations	Previous experience in collaborative processes and R&D	8	(Santoro & Bierly, 2006), (Chang & Hsu, 2002), (Johnston & Huggins, 2017), (D'Este et al., 2013), (Al-Tabbaa & Ankrah, 2019), (Araújo & Teixeira, 2014), (Johnston & Huggins, 2016), (Sarpong et al., 2017)
	Trust between members of the collaboration	8	(Sherwood & Covin, 2008), (Santoro & Bierly, 2006), (Vauterin & Virkki-Hatakka, 2016), (Chang & Hsu, 2002), (Lakpetch & Lorsuwannarat, 2012), (Al-Tabbaa & Ankrah, 2019), (Araújo & Teixeira, 2014), (Alves et al., 2007)
	Effective communication between members of the collaboration	5	(Sherwood & Covin, 2008), (Santoro & Bierly, 2006), (Lakpetch & Lorsuwannarat, 2012), (Gertner et al., 2011), (Alves et al., 2007)
	Shared objectives and mutual understanding of the needs and relevant aspects of the collaboration process (shared meanings)	9	(Sherwood & Covin, 2008), (Vauterin & Virkki-Hatakka, 2016), (Chang & Hsu, 2002), (Lakpetch & Lorsuwannarat, 2012), (Al-Tabbaa & Ankrah, 2019), (Gertner et al., 2011), (Araújo & Teixeira, 2014), (Alves et al., 2007), (Sarpong et al., 2017)
	Ability to share resources and costs in the cooperation process	6	(Veugelers & Cassiman, 2005), (Vauterin & Virkki-Hatakka, 2016), (Chang & Hsu, 2002), (Lakpetch & Lorsuwannarat, 2012), (Al-Tabbaa & Ankrah, 2019), (Gertner et al., 2011)
	Capacity and encouragement to joint scientific production with universities	3	(Mindruta, 2013), (Santoro & Bierly, 2006), (Johnston & Huggins, 2017)

Source: Own elaboration

3.1 Structure

Faced with this internal organizational facilitator, one of the identified success factors corresponds to the size of the firm (Chang & Hsu, 2002; Johnston & Huggins, 2017; Mindruta, 2013; Veugelers & Cassiman, 2005). The study of Veugelers and Cassiman (2005) highlights that large companies are more likely to establish collaboration agreements with

universities. Because of this, larger companies are more likely to achieve higher quality in patents and publications made in conjunction with universities (Mindruta, 2013).

A study by Johnston and Huggins (Johnston & Huggins, 2017) showed that the size of the company is also a significant determinant in the geographical scope of the links between industries and universities; for example, micro-companies form links with geographically closer universities, compared to large companies (Johnston & Huggins, 2017). In contrast, the conclusions of Santoro and Bierly (2006) point out that size is not a significant factor in the collaboration process with universities, while the sector and the firm's previous experience are significant in this process (Santoro & Bierly, 2006).

Similarly, the internal structural characteristics and the institutional support for the development of collaboration processes of the companies correspond to a success factor for the cooperation with university partners (Alves et al., 2007; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Sarpong et al., 2017; Vauterin & Virkki-Hatakka, 2016; Veugelers & Cassiman, 2005). For example, Lakpetch and Lorsuwannarat (2012) highlight the importance of institutional support to promote cooperative relationships (Lakpetch & Lorsuwannarat, 2012), as well as the allocation of financial resources required for the development of joint activities (Alves et al., 2007; Lakpetch & Lorsuwannarat, 2012). In addition, leadership for the development of initiatives (Lakpetch & Lorsuwannarat, 2012; Wynn, 2018) and the ability to manage projects (Wynn, 2018) they are decisive in the university-industry collaboration processes.

According to the results, effective cooperation between companies and universities requires the existence of intellectual property policies (Al-Tabbaa & Ankrah, 2019; Chang & Hsu, 2002; Santoro & Bierly, 2006). Intellectual property policies are positively associated with knowledge transfer between companies and universities (Santoro & Bierly, 2006). These policies must be constantly evaluated to avoid possible obstacles in the technology transfer process between companies and universities (Santoro & Bierly, 2006). The above, considering that the intellectual property mechanisms that are implemented have a significant influence on the sustainability of university-industry collaboration (Al-Tabbaa & Ankrah, 2019).

The technological capacity of the company was also identified as a relevant factor for cooperation with universities (Al-Tabbaa & Ankrah, 2019; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006). Thus, communication with technology experts linked to partner organizations allows the company to obtain relevant knowledge for its processes (Sherwood & Covin, 2008).

Thus, the technological capacity of the company favours the transfer of knowledge with universities, especially with regard to tacit knowledge (Santoro & Bierly, 2006). Additionally, authors such as (D'Este et al., 2013; Santoro & Bierly, 2006) identify the technological intensity of the firm as a factor that favours cooperation with universities. In this regard, the study of Santoro and Bierly (Santoro & Bierly, 2006) validates that high-tech companies have generally accumulated more knowledge to face the transfer process with universities.

Geographical proximity to university partners, as shown above, and the firm's location in areas of high business density, also corresponds to a determining factor for cooperating with university partners (D'Este et al., 2013; Johnston & Huggins, 2016, 2017). For example, the study of D'Este et al. (2013) highlights that geographic proximity increases the likelihood of establishing research partnerships between university and industry. According to Johnston and Huggins (2017) the highest levels of industrial clustering promote links with geographically close university partners. In this way, both geographic and organizational proximity have a significant influence on the selection of partners to develop knowledge (Johnston & Huggins, 2016).

In addition, the literature highlights that companies must establish governance mechanisms in collaboration with universities, to guarantee the success of the process (Alves et al., 2007; Lakpetch & Lorsuwannarat, 2012; Sarpong et al., 2017; Vauterin & Virkki-Hatakka, 2016). Specifically, the procedures required for the development of a collaborative process are based on the needs of the organization and are driven by a learning agenda established jointly by the members of the alliance (Vauterin & Virkki-Hatakka, 2016).

In the cooperation process it is necessary to review the governance mechanisms of the alliance, which guarantees a balance in the contribution of the different partners, and which serves as a meeting point for the different interests that the two actors may have (Lakpetch & Lorsuwannarat, 2012). Among the mechanisms adopted by companies to favour collaboration with universities, the participation of managers in strategic meetings is included to facilitate an agile and flexible articulation between the members of the alliance (Alves et al., 2007).

Also, the motivation of human talent linked to the alliance and the effective management of the teams designated to the university-industry collaboration process, correspond to a success factor for the transfer of knowledge between university and industry actors (Araújo & Teixeira, 2014; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006; Sherwood & Covin, 2008; Vauterin & Virkki-Hatakka, 2016). It is important to establish a system of rewards and recognitions to increase the motivation and potential of the team to create synergies in the collaboration process (Lakpetch & Lorsuwannarat, 2012) and promote the training of the company's human talent in knowledge transfer processes (Araújo & Teixeira, 2014). Sherwood and Covin (2008) validate the importance of formal collaboration teams as an effective mechanism for the transfer of knowledge between the alliance partners, so it is essential to adjust the internal structures of the company to the collaboration processes (Sherwood & Covin, 2008).

3.2 Strategy

Another set of success factors for university-industry collaborations is related to strategy. In this aspect, the literature highlights as a key factor the articulation of collaboration agreements with the organization's strategy (Chang & Hsu, 2002; Veugelers & Cassiman, 2005; Wynn, 2018). The conclusions of Veugelers and Cassiman (2005) highlight that collaboration agreements with universities are generally part of the company's global innovation strategy.

3.3 Knowledge

In this review, success factors related to knowledge as an internal facilitator in organizations were identified. Specifically, the effective development of collaboration processes with universities requires the implementation of knowledge management procedures within firms (Gertner et al., 2011; Santoro & Bierly, 2006; Sarpong et al., 2017; Vauterin & Virkki-Hatakka, 2016; Wynn, 2018). It is relevant for organizations to establish and implement practices to capture the knowledge available within the limits of the organization and integrate it into the key competencies of the firm (Santoro & Bierly, 2006), identifying the responsibilities of the alliance partners and promoting shared knowledge in the technology transfer process (Sarpong et al., 2017). The foregoing requires identifying the knowledge of each of the members of the alliance and identifying how this could contribute to the achievement of organizational objectives, through shared discourse and continuous communication (Gertner et al., 2011).

In addition, a high absorption capacity favours university-industry collaboration (Araújo & Teixeira, 2014; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006; Veugelers & Cassiman, 2005; Wynn, 2018). Absorption capacity allows companies, for example, to develop capacities to exploit different competitive strategies (Veugelers & Cassiman, 2005).

Social capital corresponds to a key determinant for cooperation between universities and companies (Al-Tabbaa & Ankrah, 2019; Araújo & Teixeira, 2014; Gertner et al., 2011; Johnston & Huggins, 2016; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006). The study of Al-Tabbaa and Ankrah (2019) validates the importance of the three components of social capital (structural, relational and cognitive) in the collaboration processes between universities and companies.

The social connection (Santoro & Bierly, 2006) and connectivity through networks (Araújo & Teixeira, 2014) they are positively related to the successful transfer of knowledge between companies and universities. This element is relevant from the perspective of learning as a social process, influenced by the characteristics and interactions between the members of the alliance (Santoro & Bierly, 2006). Specifically, the study of Gertner et al. (2011) validates the importance of personal interactions to facilitate knowledge transfer within the framework of university-industry alliances. Thus, learning from external sources requires proactive measures on the part of organizations (Santoro & Bierly, 2006).

3.4 Relations

As a result of the review, relations are identified as an important internal facilitator. It stands out, for example, companies that have experience in collaborative processes tend to be more successful in cooperating with universities (Al-Tabbaa & Ankrah, 2019; Araújo & Teixeira, 2014; Chang & Hsu, 2002; D'Este et al., 2013; Johnston & Huggins, 2016, 2017; Santoro & Bierly, 2006; Sarpong et al., 2017). The conclusions of D'Este et al. (2013) establish that experience in R&D increases the probability of forming partnerships between companies and universities. Thus, companies with experience in collaboration processes with universities achieve a greater transfer of knowledge through alliances (Chang & Hsu, 2002; Santoro & Bierly, 2006). These experiences in turn create bonds of familiarity between partners (Al-Tabbaa & Ankrah, 2019; Sherwood & Covin, 2008).

In addition, the results highlight the trust between the collaboration actors as a determinant in the success of the university-industry collaboration processes (Al-Tabbaa & Ankrah, 2019; Alves et al., 2007; Araújo & Teixeira, 2014;

Chang & Hsu, 2002; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006; Sherwood & Covin, 2008; Vauterin & Virkki-Hatakka, 2016). Further, trust between partners is essential for organizational learning (Sherwood & Covin, 2008) and knowledge transfer (Santoro & Bierly, 2006). The effective communication between the partners is a forcefully highlighted success factor in the literature (Alves et al., 2007; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006; Sherwood & Covin, 2008). Effective communication allows the socialization of the interests of the alliance partners (Alves et al., 2007; Sherwood & Covin, 2008). Trust between members facilitates open communication between the parties that favours the transfer of knowledge (Santoro & Bierly, 2006).

In the current research, effective alliances between universities and companies imply the establishment of shared organizational objectives, based on the mutual understanding of the needs of the partners and the relevant aspects of the collaboration process (Al-Tabbaa & Ankrah, 2019; Alves et al., 2007; Araújo & Teixeira, 2014; Chang & Hsu, 2002; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Sarpong et al., 2017; Sherwood & Covin, 2008; Vauterin & Virkki-Hatakka, 2016). In this process, shared meanings are generated between the actors (Al-Tabbaa & Ankrah, 2019; Vauterin & Virkki-Hatakka, 2016) and the possibility of co-creating with alliance members is increased (Vauterin & Virkki-Hatakka, 2016). The personal interactions that are established between the members of the alliance generate a mutual commitment and a set of shared knowledge in the communities of practice (Gertner et al., 2011). Thus, effective alliances between universities and industry influence organizational objectives to support companies in creative processes or knowledge exchange (Alves et al., 2007; Chang & Hsu, 2002). Mutual understanding reduces the mismatch between the expectations and the results of the university-industry collaboration process (Vauterin & Virkki-Hatakka, 2016). The ability to share resources and costs is one element of effective collaborative partnerships between industry and universities (Al-Tabbaa & Ankrah, 2019; Chang & Hsu, 2002; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Vauterin & Virkki-Hatakka, 2016; Veugelers & Cassiman, 2005). Specifically, companies linked to successful alliances share complementary resources between the parties (Chang & Hsu, 2002), establish joint identities or procedures (Gertner et al., 2011), balance the strengths and weaknesses of partners (Chang & Hsu, 2002) and define a common perspective of the general R&D objectives (Chang & Hsu, 2002). University-industry collaboration agreements are motivated by the possibility of sharing costs in the innovation process (Veugelers & Cassiman, 2005). From this perspective, the size of the company can be related to a greater availability of the resources required to cooperate with universities, depending on the organizational strategy (Veugelers & Cassiman, 2005). Thus, knowledge collaborations are considered highly effective and valuable when they allow the creation of joint value and generate strategic value for the knowledge base of organizations (Vauterin & Virkki-Hatakka, 2016).

Finally, a set of studies analysed in this review (Johnston & Huggins, 2017; Mindruta, 2013; Santoro & Bierly, 2006) emphasize that scientific production that involves academics and industry personnel favours social connection among members and facilitates the exchange of highly relevant and pertinent knowledge to face real challenges in society (Santoro & Bierly, 2006). Further, the high levels of research activity of an institution are important facilitators of collaborative processes, even with geographically distant partners (Johnston & Huggins, 2017)(Mindruta, 2013).

4. Discussion

Technological development and the consolidation of knowledge-based economies have promoted collaboration between universities and industries, which is why different industries recognize the importance of university knowledge to generate competitive advantage (Tseng et al., 2020). From this scenario, partnerships between researchers and entrepreneurs are becoming more frequent today (Zalewska-Kurek & Harms, 2020). Such collaborations are an important source of creativity and knowledge generation for partners (Alexander, Martin, Manolchev, & Miller, 2020).

Previous research has analysed different aspects of the collaborative processes between the University-Industry, for example, the challenges in the technology transfer process (Daniel & Alves, 2020), the barriers (Chryssou, 2020; Jonbekova, Sparks, Hartley, & Kuchumova, 2020; Tootell et al., 2020), the benefits (Jonbekova et al., 2020), the U-I collaboration practices implemented by firms (Corsi, Fu, & Külzer-Sacilotto, 2020) and by the universities (Leischnig & Geigenmüller, 2020). Also, the determinants of the innovative impact in University-Industry collaborations (Messeni Petruzzelli & Murgia, 2020) and its impact on the productivity of academic research (Garcia, Araújo, Mascarini, Santos, & Costa, 2020). Additionally, recent systematic reviews (Nsanzumuhire & Groot, 2020) Regarding university-industry collaboration processes, three topics of interest stand out: interaction channels, mechanisms and barriers that these collaborations face. Likewise, it is highlighted that there is still a gap in research regarding this issue in developing countries, compared to developed ones (Nsanzumuhire & Groot, 2020). In contrast, university-industry collaboration is

increasingly considered a fundamental component of national innovation systems in both developed and developing countries (Chryssou, 2020).

Considering the above, this scoping review identify the success factors of university-industry collaboration, specifically from the industry perspective. According to the results of the scoping review (Table 3), the success factors of the University-Industry cooperation processes most referenced in the literature are: the shared objectives and mutual understanding of the needs and relevant aspects of the collaboration process (Al-Tabbaa & Ankrah, 2019; Alves et al., 2007; Araújo & Teixeira, 2014; Chang & Hsu, 2002; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Sarpong et al., 2017; Sherwood & Covin, 2008; Vauterin & Virkki-Hatakka, 2016), and the trust between members of the collaboration (Al-Tabbaa & Ankrah, 2019; Alves et al., 2007; Araújo & Teixeira, 2014; Chang & Hsu, 2002; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006; Sherwood & Covin, 2008; Vauterin & Virkki-Hatakka, 2016). These two factors are associated with relations, according to the conceptual framework of internal facilitators proposed by Pellegrini et al. (2019).

Subsequently, the literature highlights the importance of structure of the firm, specifically of the internal structural characteristics and institutional support for the development of collaborative University-Industry process (Alves et al., 2007; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Sarpong et al., 2017; Vauterin & Virkki-Hatakka, 2016; Veugelers & Cassiman, 2005; Wynn, 2018). Next, the scoping review presents as success factors of the cooperation process the absorption capacity (Araújo & Teixeira, 2014; Gertner et al., 2011; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006; Veugelers & Cassiman, 2005; Wynn, 2018) and social capital (Al-Tabbaa & Ankrah, 2019; Araújo & Teixeira, 2014; Gertner et al., 2011; Johnston & Huggins, 2016; Lakpetch & Lorsuwannarat, 2012; Santoro & Bierly, 2006). These two factors are associated with knowledge as an internal facilitator of the company, according to the framework proposed by Pellegrini et al. (2019).

Finally, the strategy facilitator registers fewer citations when reviewing the success factors of collaboration processes between universities and industries. Specifically, this scoping revision includes the articulation of collaboration agreements with the organization's strategy as a facilitator of the collaboration process (Chang & Hsu, 2002; Veugelers & Cassiman, 2005; Wynn, 2018).

5. Conclusions

Collaboration between companies and universities corresponds to a growing trend in recent years. In that sense, this paper identifies the success factors in collaboration processes between universities and companies, through a literature review. The factors included in 16 papers indexed in Scopus and Web of Science, published in 2002 and 2019, are considered, and which establish companies that participate in collaboration processes with universities as the unit of analysis. As a result of the review, 17 success factors were identified in the university-industry collaboration processes, classified according to four internal organizational facilitators: structure, strategy, knowledge, and relations.

In the first place, the success factors related to the structure were identified, namely: the size of the company, the internal structural characteristics and institutional support for the development of collaborative processes, the existence of intellectual property policies, the capacity and technological intensity of the company, geographic proximity with university partners and location of the firm in areas of high business density, the existence of governance mechanisms for collaboration processes and the management and motivation of human talent and collaboration teams

Second, in terms of innovation strategy, the articulation of collaboration agreements with the organization's strategy is identified as a success factor in University-Industry collaboration processes. Third, in relation to knowledge as a facilitator of the innovation process, this review describes the implementation of knowledge management procedures, absorption capacity and social capital, as success factors in the cooperation processes between companies. companies and universities.

Finally, regarding organizational relationships, the literature review presents the following success factors: previous experience in collaborative processes and R&D, trust among the members of the collaboration, effective communication between the members of the collaboration, shared objectives and mutual understanding of the needs and relevant aspects of the collaboration process, the ability to share resources and costs in the cooperation process, and the encouragement of joint scientific production with universities.

In sum, the main contribution of this study, both to the literature on inter-organizational cooperation and to business management, is that it synthesizes and analyses the factors that could facilitate collaboration between universities and

industries, but from the perspective of the latter, which had been little attended in the previous literature. We suggest that future studies empirically explore how and with what intensity the success factors identified in this review could affect collaboration processes between industry and universities, and how the success or failure of these initiatives can affect the performance of these organizations.

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