



HAL
open science

Influential factors of initiating open innovation collaboration between universities and SMEs: Systematic Literature Review

Hezam Haidar, Karine Evrard Samuel, Jean-François Boujut

► **To cite this version:**

Hezam Haidar, Karine Evrard Samuel, Jean-François Boujut. Influential factors of initiating open innovation collaboration between universities and SMEs: Systematic Literature Review. Exploring the Future of Management, Jun 2019, Lisbon, Portugal. hal-02184337

HAL Id: hal-02184337

<https://hal.science/hal-02184337>

Submitted on 15 Jul 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



INFLUENTIAL FACTORS OF INITIATING OPEN INNOVATION COLLABORATION BETWEEN UNIVERSITIES AND SMES: SYSTEMATIC LITERATURE REVIEW

Hezam HAIDAR
INSTITUT POLYTECHNIQUE DE GRENOBLE, France
Karine Samuel
UNIV. GRENOBLE ALPES, CERAG, FRANCE , France
Jean-Francois Boujut
UNIV. GRENOBLE ALPES, G-SCOP, CNRS, FRANCE, France

Access to this paper is restricted to registered delegates of the EURAM 2019 (European Academy of Management) Conference.

ISSN 2466-7498 and ISBN 978-2-9602195-1-7

Influential factors of initiating open innovation collaboration between universities and SMEs: Systematic Literature Review

Abstract— Academia-Industry collaboration is increasingly seen as an essential engine of local economic development and the open innovation model is a key element in such collaboration. The aim of this paper is to explore the existing literature in a systematic way to identify the factors that influence decision makers to start an open innovation collaborations between universities and SMEs. The review shows that open innovation' in the context of university-Industry is receiving more and more attention. The majority of the existing research focus on knowledge and technology transfer. We used the Content Analysis method to analyze the final sample, the findings fall into four categories of factors: Organizational Structure, External Resources, Performance Indicators and Proximity. The article concludes with suggestions for future research.

Keywords: university-Industry collaboration, open innovation, early-stage development knowledge and technology transfer, systematic review, SMEs

Introduction

Developed states have implemented different policies to bring Academia and industry to collaborate, which ensure dynamic innovation environment and improve economies based on fostering local and countrywide competitiveness (Vega-Jurado et al, 2015). The benefits of closing the gap between academia and industry are reducing the development risk, increasing the efficiency of knowledge sharing , gaining the trust which leads to additional network linkages (Wang et al, 2006) and acknowledging the positive role of academia in the research and development (Wang & Shapira, 2012) (Festel, 2015). These benefits are bi-directional knowledge flow and learning gains (Pinheiro & Lucas, 2015). However it is very difficult to maintain the collaboration mechanisms since organizations will have to interact with multiple and external actors (Liliana, 2013).

In highly competitive environment, the innovation model is evolving rapidly in which the sources of sustainable competitive advantage could be new ideas, shorter product

development and company's capacity to innovate (Liliana, 2013). Open innovation is one of the recent trends of innovation practices. Open innovation model is defined as "the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation respectively" (Chesbrough, 2006, p.2). The essence of open innovation is that, the ideas come from external source which means of cross-disciplinary, cross-border and cross-institutional innovation (Mayer, 2010). Open innovation practices are very useful as competitive strategies for small and medium-sized enterprises (SMEs) and have positive impact on Knowledge flow (Cleveland et al, 2015). Open innovation practices also help in closing the gap between academia and industry to collaborate and profit together from the state funds and other forms of support (Petroni, Venturini, & Verbano, 2012).

Most studies regarding university-industry collaboration focus on describing the downstream processes associated with technology transfer and commercialization (Pinheiro & Lucas, 2015). The upstream part of the process is poorly studied, particularly few is known about the factors that lead decision makers to initiate the collaboration project. This paper proposes a systematic review to explore this upstream process in open innovation collaboration between universities SMEs and aims to identify influential factors that help to initiate open innovation collaboration. These factors will help in convincing the decision-makers to invest in the potential collaboration project and increase the possibility of commercialization.

The paper is structured as follows: Firstly, we present the theoretical framework of our research, secondly the methodology of the systematic review, and then we present our findings, finally the conclusion and suggestion for further research.

Theoretical background

In recent years, public policy supports the university-industry collaboration to accelerate knowledge and technology transfer since it has a positive impact on innovation processes

(Sellenthin, 2011), particularly in the emerging fields and the creation of new high-technology enterprises (Wang & Shapira, 2012). University–industry collaboration acts as a mean to foster economic growth and provides an additional revenue for the university and employment opportunities for academic researchers and students for the industry (Caldera & Debande, 2010). The role of industry–university collaboration is to close the gap between industry and academia to accelerate the collaboration and innovation process, accumulate knowledge, and construct intellectual property rights (Lai, 2011).

The process of collaboration involves multiple and diverse actors, that requires a great deal of efforts to manage the interests of these actors. Process is critical in managing inter-organizational relationships but also it has important implications for performance. Ring and Van De (1994) highlighted the fact that the process influences the inter-organizational relationships in which they can emerge, grow and dissolve over time. The collaboration interaction pattern in different fields is not uniform. In science-based fields, university departments have a distinct focus on basic research and the major interest of industry is the observation of science, however in less science-based fields, the solution of technical problems is a major concern of industry (Meyer-Krahmer & Schmoch, 1998).

An effective university-industry collaboration involves knowledge transfer however, knowledge characteristics will have direct impact on the university-industry collaborations itself (Schofield, 2013). Resistance of external knowledge within the organization is a common issue in such collaboration, but by expanding the capacity for internal knowledge transfer organization can favor external knowledge integration (Segarra-Ciprés et al, 2014). The process of creating, sharing, using and managing knowledge is still limited in SMEs (Durst & Edvardsson, 2012) but an important element of success in managing knowledge within networked innovation is to be able to understand the motivations, interests, intents and the benefits of the partners (Valkokari et al, 2012).

Formal technology transfer takes forms of patenting and licensing of academic inventions to third parties for the purpose of commercialization while informal process known as complementary step for formal technology transfer includes academic presentation, scientific publication, scientific consulting, internships, informal meetings, personal contacts and research contracts (Agrawal, 2001).

In the literature, the link between open innovation and university-industry collaboration has traditionally concentrated on knowledge flowing from one organization to another and the university role as a knowledge and technology supplier (Roshani et al , 2015). In open innovation model, enterprise should take advantage of external resources (Chesbrough, 2006, p.2), enterprises boost their ability to learn in strategic settings by tapping into the experience of others through sharing knowledge (Berends, 2005). Industry has several motivations to be involved in an open innovation collaboration with the university. Some of these motivations are, accessing new knowledge, reducing cost, acquiring competencies and talents (Roshani et al , 2015). Another important motivation is reducing the risk, universities and public research perform basic research with high risk (Saito & Sumikura, 2010) in which academia act as external partner for companies. For that reason, most companies no longer maintain their own in-house, early-stage, exploratory scientific research organizations, hence universities play a crucial role within this institutional framework (Razak, Murray, & Roberts, 2013).

The open innovation model is substantially more complex than the closed innovation, that is because there are different actors involved in the collaborations and each has different motivations and expectations (Gould, 2012; Ankrah & AL-Tabbaa, 2015). It is important to coordinate the academia's mission for science and the industry's mission to make products (Saotome et al 2012). Timeline for each actor is different, and the technology transfer time is an important issue (Heinonen, 2015). Another issue for academia is that, they have teaching responsibilities and external activities (Caldera & Debande, 2010). In addition identifying open

innovation partners is far from straightforward and includes several aspects to be analyzed before making a decision (Guertler & Lindemann, 2016).

SMEs differ from large enterprises in their use of open innovation since they do not have the in-house capabilities to detect, assimilate and integrate external knowledge (Spithoven, et al., 2013). Research and development investment strategies of large and SMEs are different (Saito & Sumikura, 2010). SMEs decision to be involved in a new collaborations with academia depends on the current value of the expected future profits (Calcagnini et al, 2016).

In the literature, university–industry relationships have been extensively studied however, there is little systematic understanding of organizational practices of the different actors considering the differences in motivations, behaviors and environment (Freitas, Geuna, & Rossi, 2013; Siegel, Waldman, Atwater, & Link, 2003; Ankrah & AL-Tabbaa, 2015). The organizational characteristics of open innovation is studied in general but these characteristics are never analyzed at each early micro phase of the inbound open innovation process (Liliana, 2013). There is a lack of investigation done to improve the efficiency of a process of open innovation (Buganza et al, 2011) even though some tools were developed in order to bring known products into the supply chain which is different from acquisition of earlier-stage technologies since the risk is very high (Ford, Mortara, & Probert, 2012). Furthermore most early studies as well as current work focus on highlighting the downstream processes associated with technology transfer and commercialization (Pinheiro & Lucas, 2015).

One Important aspect of the university-industry collaboration is the organization structure. The organizational structure is a key in stakeholders' identification and analysis where the power, interests, motivations, attitudes and legitimacy influence the stakeholder's actions. Mitchell, et al., (1997) and Might & Fischer, (1985) discussed the role of structural factors in determining project management success. Furthermore, different R&D organizational

structures have different practices in transferring knowledge or integrating capabilities (Chen, 2014). Sharing knowledge between units within an organization and or with other organizations depends on four sets of factors according to Rashman et al.,(2009): features of the source organization, features of the recipient organization, the characteristics of the relationship between organizations and the environmental context. Knowledge flowing in and out the organization represents one essential element of open innovation model.

External resources is another important aspect in the university-industry collaboration. The external resources of organizations do not just maximize their power but also affect the behavior of the organization (Davis & Cobb, 2010). Some stakeholders still question the openness and to which limit to be open? there are different interpretations of the openness when it comes to sourcing, acquiring or providing access, (Dahlander & Gann, 2010). This openness mindset is a major key in open innovation model. Moreover, the openness will have a direct impact of the quality and progress of the collaboration

Neely et al., (2005) highlighted the importance of performance Indicators has long been for academics and practitioners from a variety of functional disciplines. In university–industry knowledge transfer performance indicators should include wide range of activities and reflect a variety of impacts to accurately represent their performance (Rossi & Rosli, 2014). Enhancing companies' performance is one of the reasons in the shift towards open innovation model.

Based on these preliminary key themes in the literature, the organizational structure, external resources and performance indicators will be our pre-determined themes for further analysis.

Methodology

We employed a systematic review to answer our question: what are Influential factors of initiating open innovation collaboration between universities and industry?. A systematic review is a study that seeks to answer a clearly formulated question by identifying relevant

studies and evaluating their quality then summarizing the evidences by use of explicit methodology to answer that question (Khan et al, 2003). Systematic literature reviews are recognized methods for conducting evidence-based policy for medical research (Victor, 2008, Black, 2001). However, there is growing interest in methods of systematic research review as a means to accumulate a solid evidence for social science and management (Pittaway & Cope, 2007).

Systematic reviews differ from traditional narrative reviews in several ways. One difference is that, systematic reviews, typically involve a detailed steps defined a priori, to avoid any bias in selecting the relevant studies on a particular topic. Another difference is that, traditional reviews unlike systematic reviews where they do not seek generalizations or cumulative knowledge of what is reviewed (Ankrah & AL-Tabbaa, 2015)

The main objective of this systematic review is to explore upstream process in open innovation collaboration between universities and industry to identify influential factors that help to initiate open innovation collaboration. We selected some keywords to establish state of the art from articles held by Business Source Complete (EBSCOhost) database. These keywords were: Open innovation, University-industry collaboration, Technology Transfer, Investment incentives and Stakeholders. We conducted the research using all possible combinations between two keywords with all possible arrangements of combination of two keywords from the five keywords in titles, abstracts and author keywords as shown in table 1.

For a better understanding of table 1, in the first part of the table each keyword is given a number 1 to 5. In the second part, we listed all possible combinations of two keywords (10 possible combinations). For the third part, we searched whether these two words (for example keyword 1 and keyword 2) can be found together in the title (Title(1)+Title(2)); or one in the title and second in the abstract (Title(1)+Abs(2)); or one in the author keywords and second in the abstract (KW(1)+Abs(2)), and so on which leads to 9 possible arrangements. We carried out this procedure for all keywords combinations. As part of the identification process, our search was limited to within peer-review journal articles written in English for the period of January 2003 to November 2017.

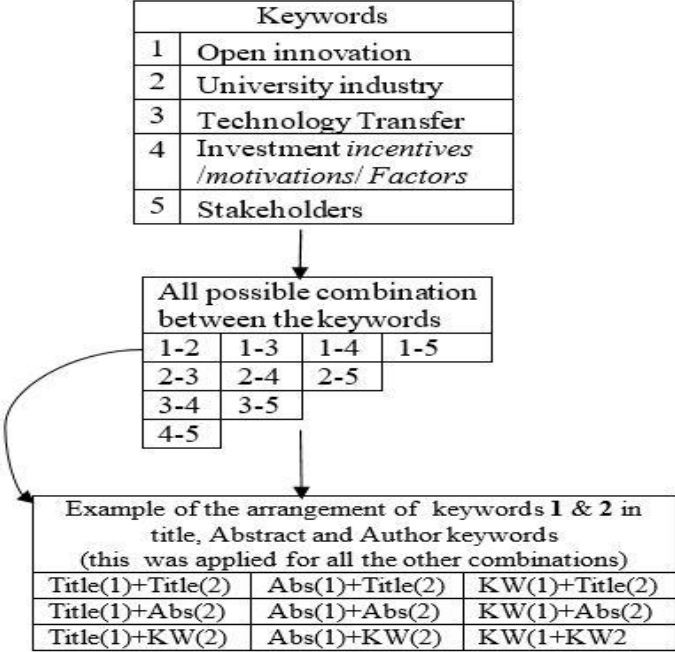


Table 1- Identification process

For keyword 4 (*Investment incentives*), we have noticed that, whenever it is combined with other keywords the research result was very low, therefore we replaced the word *incentives* with *motivations* and again with *factors* and we added all results of these words. The research retrieved 1988 articles, we excluded the duplicated ones and we introduced our first excluding

criteria, we excluded all articles that discuss open source collaboration and Industry-industry collaboration in general, at this stage, we had 224 articles.

We gathered all author keywords of the 224 articles to perform statistical analysis, to check the recurrence of the authors' keywords; we found the following 10 most frequent keywords as shown on figure 1.

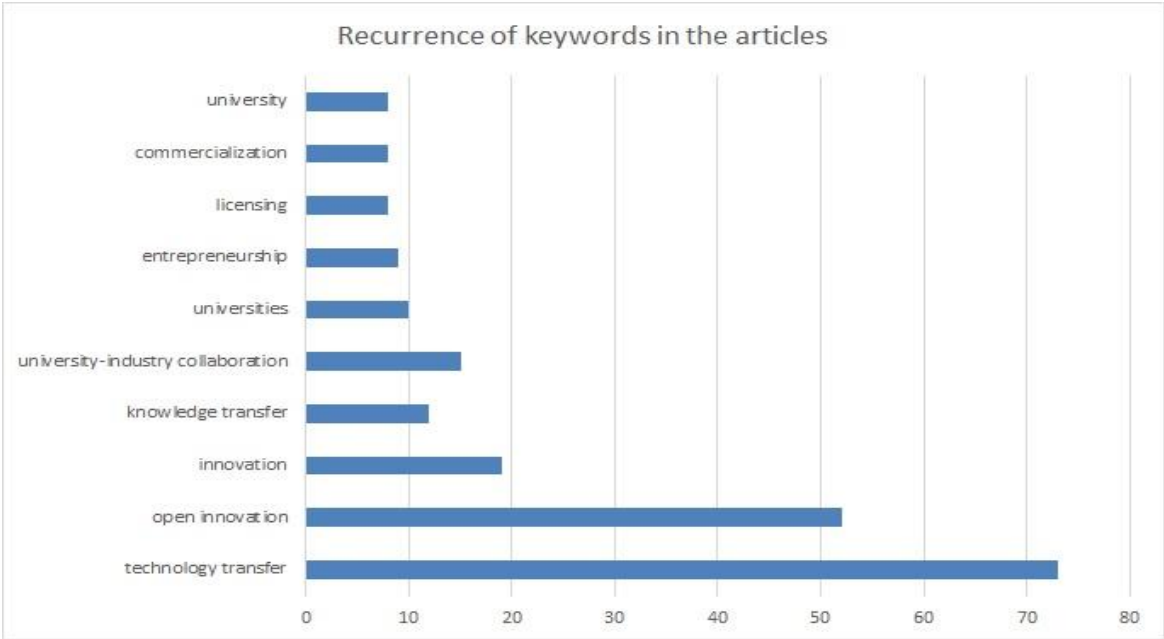


Figure 1- Recurrence of keywords in the articles

We decided to take into consideration the first five most frequent keywords, but before that, it was obvious that there are words, which are considered broader for example (innovation) is used for open innovation, or repeated such (universities and university). Therefore our first five most frequent keywords are: Technology transfer, Open innovation, Knowledge transfer, University-industry collaboration and entrepreneurship.

As part of the screening process, we went back to the 224 articles resulted from the identification process and check the author's keywords of each article, we included the articles have at least one of the most frequent keywords, the screening process results in 157 articles for the eligibility process.

These studies are based on interviews and surveys of key university-industry stakeholders (i.e., university administrators, academics, industry scientists, business managers, and entrepreneurs) as well as case studies of collaboration projects and qualitative studies from the literature. For the eligibility process, we screened the aims and main topics of the 157 articles to exclude the articles that are distant from our study but at the same time, we tried to ensure high quality relevant work is included. As shown in figure 2, we excluded the articles that are beyond the scope of our study. The final sample is 49 articles.

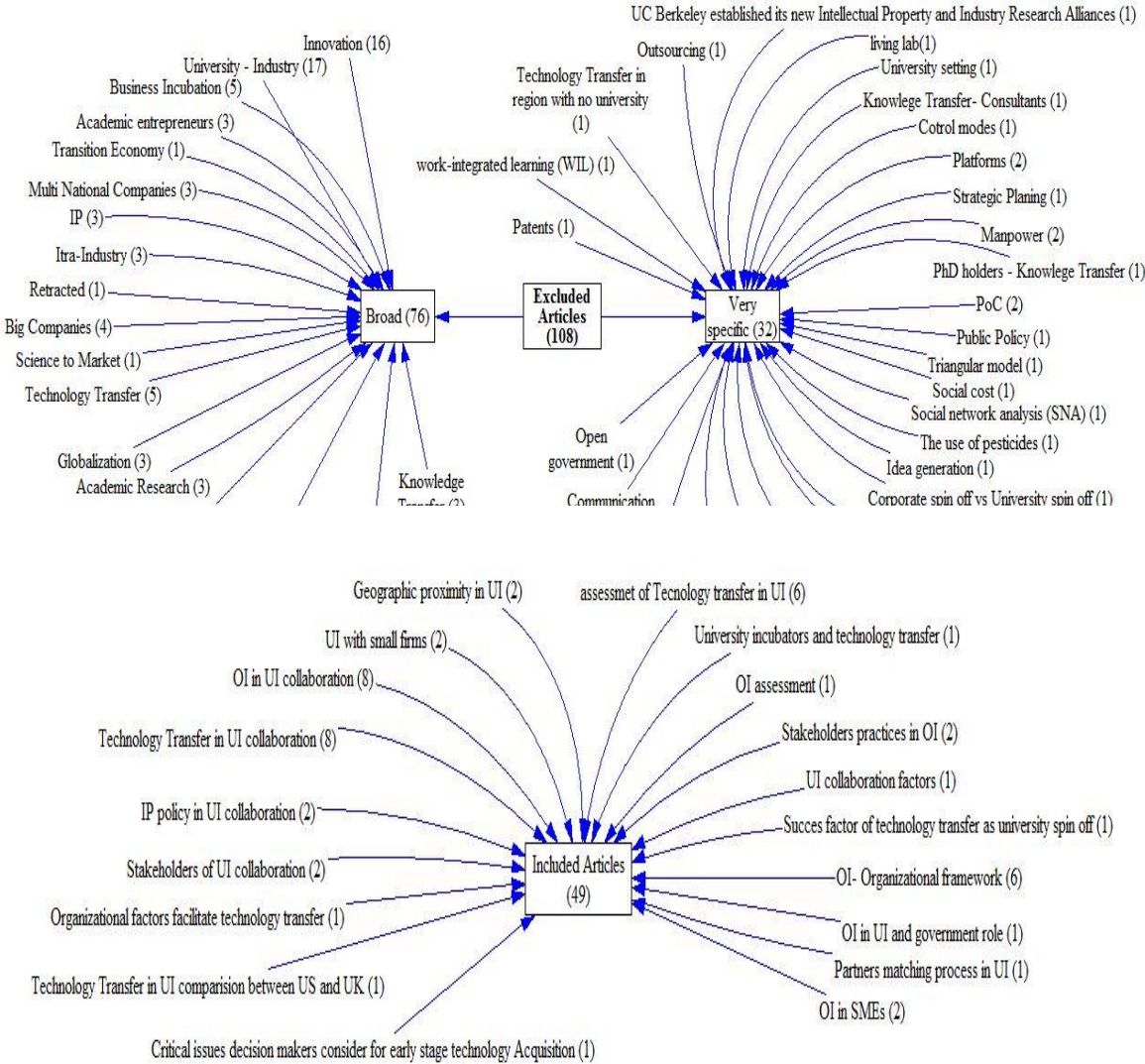


Figure 3 - Main topics covered in the final sample

We decided to use Qualitative Content Analysis (Hsieh, 2005) to code and analyze the final sample. Directed Content Analysis is applied by using existing theory or prior research (Hsieh, 2005). We started by identifying the general themes of the factors that influence the stakeholders, as predetermined categories for initial coding (Potter & Levine-Donnerstein, 1999; Hsieh, 2005). The predetermined factors categories were the following: *Organizational Structure, External Resources and Performance Indicators* as introduced in the theoretical

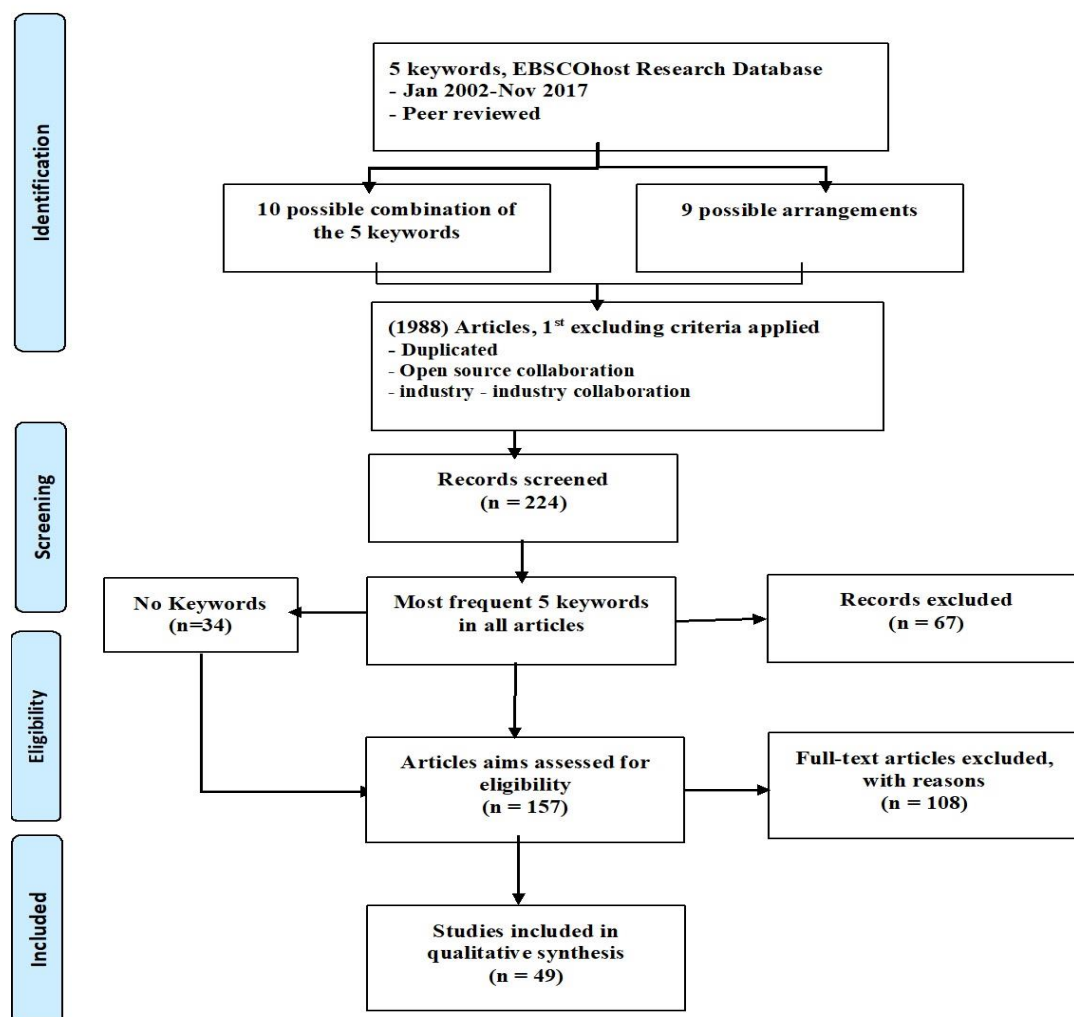


Figure 4 - PRISMA Flow diagram of the methodology

background.

After defining the predetermined categories, we started analyzing the findings of each article from our final sample and searched the data for text that matches the themes of the predetermined categories (Renner, 2000). The amount of data was big hence, it was necessary to introduce the subcategories (Hsieh, 2005) for a better subsequent analysis. As we continued analyzing the data, we found texts that could not be categorized with the initial coding scheme (predetermined categories) hence it was given a new code (Hsieh, 2005). As a result we added another category (*Proximity*).

Results & analysis

A. General analysis

The final sample of our data shows that there is an increase research attention over the last ten years to the open innovation collaboration between universities and SMEs. The general topics treated by these researches are knowledge transfer, technology transfer. An interesting finding is the particularities of geographical context where the majority of the studies (59% of our final sample) have been done in certain countries such the US, Italy, UK and Spain as shown

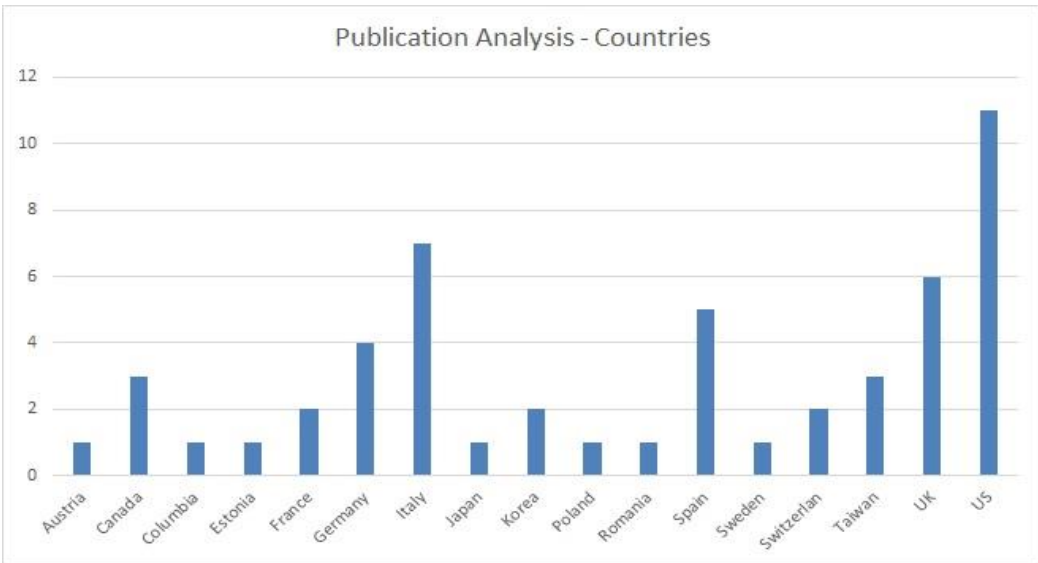


Figure 5 - Final sample analysis – Countries vs Number of Papers

in figure 5. In some studies, there is a comparison of university-industry collaboration between two countries.

In figure 6, there are five articles in the period 2002-2006 all of these articles were from the US. These articles covered two main topics, firstly the organizational aspects of university-industry collaboration, the ways in which university interacts with SMEs differ from those with large established companies. Second topic discussed in these articles was technology and knowledge transfer in the university-industry framework. Identifying the key issues in promoting successful technology and knowledge transfers.

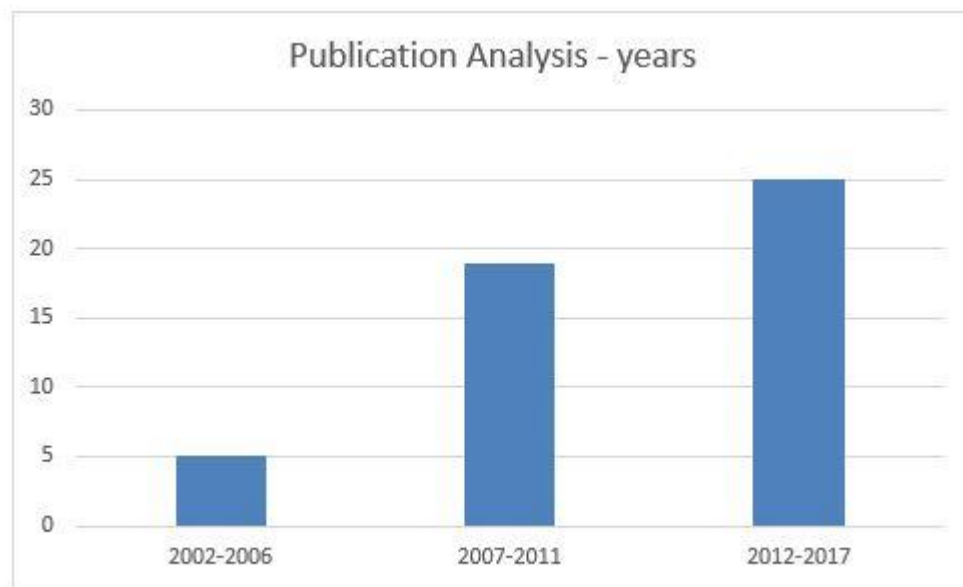


Figure 6 - Final sample analysis – Years vs Number of Papers

In the period, 2007-2011 there were 19 articles in our final sample that shows an increase attention in the literature. These studies were from different countries which include the US, Spain UK, Italy, Canada, Switzerland, Germany, Sweden, Austria, Japan, Korea and Taiwan. It is worth mentioning that the US and Spain have the majority of the studies where each has four articles.

The articles studied the following main topics: the university-industry relationships, the complexity of intellectual property and exclusivity of licensing and identifying the factors for success or failure of these collaborations. Another main topic discussed in these studies was technology and knowledge transfer activities between science institutions and private corporations through university-based incubators. Some of these articles have examined the impact of public policies on the emerging model of open innovation and the effects of open innovation on SMEs performance.

As for the final period 2012-2017, 25 articles are included in our final sample, and a majority of these studies was from Italy and the UK (5 and 4 respectively). These studies covered a wide range of topics such as the early-stage technology acquisition, the critical issues of the external technology acquisition and the effects of collaboration on the enterprises performance. Another topic covered in these studies is analyzing technology transfer through resource spill over, which captures the various ways in which enterprises can benefit from collaborations with university's scientists. The studies also investigated how geographical proximity affects the determinative factors for collaboration between universities and private sector.

B. Review

To identify the influential factors, we started by identifying key concepts in the existing literature as initial coding categories (as explained in our methodology). The predetermined factors categories were Organizational Structure, External Resources and Performance Indicators. As we proceeded with the data, we found new subcategories that did not fit in the predetermined categories, therefore we introduced new category: proximity. In this section, we present the factors that we found under the predetermined categories.

1) External Resources

Stakeholders believe that, adopting open innovation model will increase profitability and mostly accelerates the process of technology transfer (Calcagnini et al., 2016). SMEs need innovation to compete with large enterprise, which requires them to access different facilities and mature technologies therefor finding partners with these facilities is an important factor (Welsh, Glenna, Lacy, & Biscotti, 2008). Launching new services or product would be faster thanks to the creation of the partnership and use of various tools and facilities from different partners (Sherwood & Covin, 2008).

The collaborators try to achieve their organization objectives and avoid conflicts of interest with other partners (R.McAdam et al, 2012). There is a consensus that the firms will opt in favor of a partnership when there is an alignment of goals between partners (Guertler & Lindemann, 2016; Lakatos et al, 2015). Pursuing a common innovative objective is among the elements that make a collaborative project successful (Bianchi et al, 2011; Padilla-Meléndez & Aguila-Obra, 2012).

Cost reduction is another influential factor, small firms do not bear the huge cost of development research and market introduction (Saito & Sumikura, 2010). Cooperating with academic institutions in the model of open innovation alliances by converting scientific findings into marketable products can significantly reduce the cost of research (Sherwood & Covin, 2008).

Governments promote innovation through funding research and development, that makes funding very important factor especially in patenting activity, university that receives higher amount of public research funding generates more patents and commercialize their products (Lopez et al, 2009; Hayter, 2013). It is very important to acquire the talented people (scientific personnel) (Han & Heshmati, 2016; Puślecki & Staszaków, 2015) and exchanging key people between partners (Festel, 2015).

The university-industry collaboration can be done through intermediaries that support university researchers during their patenting and commercialization efforts, these intermediaries could be technology transfer offices (De Beer et al, 2017; Sellenthin, 2011) or science and technology parks which have an influence on university–industry interaction (Shane, 2002; Muscio & Vallanti, 2014). However, lack of communication and bureaucracy in intermediaries are huge concerns for the partners (Padilla-Meléndez & Aguila-Obra, 2012), but some intermediaries such as incubators play a role in addressing several of the conflicts between partners and moderate the relationship (Maxwell & Levesque, 2011).

According to Arvanitis, et al., (2008) state policy intervention is essential for bringing universities and business closer. State policies and programs help in stimulating the interaction between innovation actors and encourage the collaborative projects (Mayer, 2010). Going through the whole process from basic research to market introduction independently is highly risky even for large companies (Saito & Sumikura, 2010) hence sharing the risk optimally between parties involved in the collaboration is always the choice for partners and influence the decision makers to collaborate (Caldera & Debande, 2010).

Research partnerships between universities and firms increase the efficiency of knowledge sharing (Di Tommaso & Schweitzer, 2010; Wang & Shapira, 2012). Knowledge sharing is an attraction for the industry to have an access to the existing knowledge (Ford et al., 2012). In addition, open innovation is effective when organizations have sufficient capability to integrate the information obtained from the external sources (Gould, 2012). It is worth mentioning that geographical advantage is an important element in facilitating knowledge exchange and motivating actors for collaboration (Myoken, 2013)).

2) Performance Indicators

A partner with high number of patents, products, projects or services is usually considered as an attractive partner to be engaged in SMEs partnership (Al-Ashaab et al, 2011).

Universities have a key role in encouraging university–industry cooperation by developing patents and licenses as they are an important factor in determining promotions and awards for university personnel’s (Siegel et al., 2003; Feng, Chen, Wang, & Chiang, 2012). One of the key performance indicators which attracts university–industry collaboration is the number of applied environmental-friendly methods in the company per year (Al-Ashaab et al., 2011). In public funding agreements, the scientific publications are important elements of performance evaluation (Simeth & Raffo, 2013) since academics tend to concentrate more on publications than on the patent production (Lopez et al., 2009).

3) Organizational Factors

According to Hung and Chou (2013), engineers and managers need to consider the changes and complexity in their environment before engaging in external technology acquisition or external technology exploitation. Some firms might need to have some structure changes in order to coordinate, integrate and manage external and internal knowledge (Buganza et al., 2011). Designing flexible university policies on technology transfer was suggested as a managerial implication by Siegel et al, (2004) to encourage personnel to participate in collaboration projects. As well, it is demonstrated that intellectual property policies facilitate knowledge transfer between university and industry (Santoro & Bierly, 2006).

There are some cultural challenges which may discourage partners from initiating a collaboration and work together (Maxwell & Levesque, 2011). Cultural barriers are pervasive in university–industry collaboration (Siegel et al., 2003). It is also argued that interactions which are not based on financial resource provisions do not require greater openness than those were at least a partial resource provision of the firms is involved (Simeth & Raffo, 2013).

Academics are demotivated by the universities procedures, mechanisms and environment from engaging in collaborative innovation activities (Miller et al., 2016). The processes of opening-in/out is very critical factor for the collaboration projects (Lapointe &

Guimont, 2015). Furthermore controlling the new technology is very sensitive issue when there are many partners in the collaboration especially intermediary's transfer process (van den Berghe & Guild, 2007; Lai, 2011).

Good relationship between partners help in facilitating the work among teams working on the collaboration project (Bernardos Barbolla & Casar Corredera, 2009; Ki H. Kang & Kang, 2009). Personal relation is very important in defining potential partners (Kwiatkowski et al., 2016). Decter, et al., (2007) indicated that companies need to establish good relation with universities in order to access universities knowledge and facilities, moreover the trust between partners is very important for establishing the relationship (Albors-garrigós et al., 2011; Gopalakrishnan & Santoro, 2004)

Structure of organization is another factor effects the decision of the partners to be involved in a collaboration (Petroni et al., 2012). SMEs interact with universities through personal contractual arrangements, whereas firms with high innovative and research competences interact institutionally (Freitas et al., 2013). Vega-Jurado et al., (2015) highlighted the importance of creating an organizational structure to support innovation activities by centralizing strategic decisions with flexible hierarchical supervision and coordination of the collaboration activities.

4) Proximity

The collaboration between university-industry happens in a cluster of a geographical distance (Kwiatkowski et al., 2016). Business funding is more likely to be obtained if the university is physically closer to the industrial district (Muscio, Quaglione, & Scarpinato, 2012). Arvanitis et al., (2008), indicated that engineering and natural sciences are strongly represented among institutes with an inclination to patenting which make them potential partners for those who work in the same industry. Finally, social proximity or the tendency to

collaborate based on previous relationship, is another factor which drives the collaboration projects (Myoken, 2013)

Organizational Structure	Performance Indicators	External Resources	Proximity
Organization Changes	Number of Patents /Products /Service	Profitability	Social
IP policy	Number of Projects	Facilities	Industry
Openness/Culture	Effectiveness	Alignment of goals	Geographical
Process	Environment impact	Cost Reduction	
Relationship Type	Number of Publications	Funding	
Structure		Human capital	
		Intermediaries	
		State Policy	
		Reducing The Risk	
		Knowledge	

Table 2 - Summary of influential factors

C. Descriptive Analysis of the factors

The categories of the factors have different levels of attention in the literature. Figure 7, shows that at least one factor from the organizational structure factors has been discussed in about 91% of our final sample of the articles. The external resources factors come second in

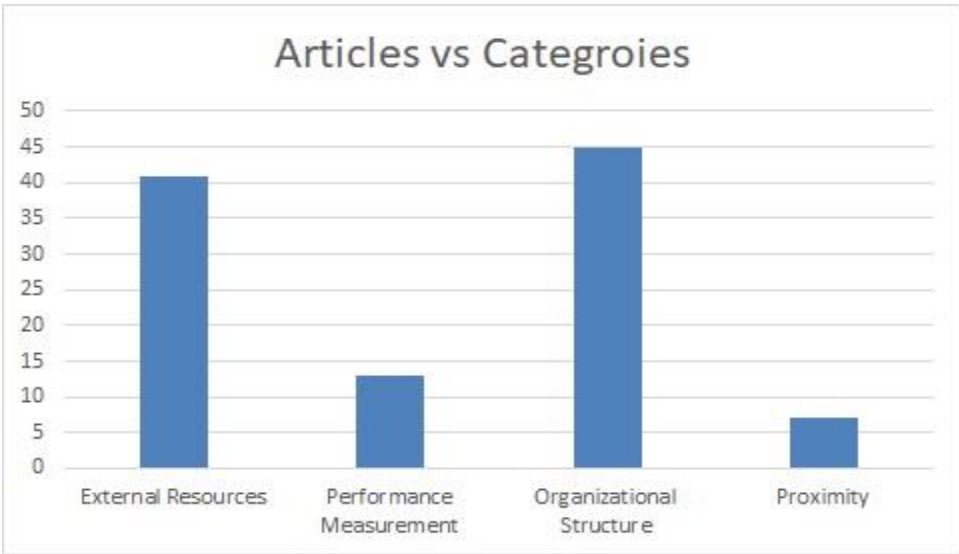


Figure 7 - Final sample analysis – Articles vs Categories

our final sample where at least one factor has been studied in 83% of the total articles. The performance indicators and proximity factors have less attention in these articles with 26% and 14% respectively. This shows some direction for further researches and studies for these two categories.

As shown in figure 8, the factors (sub-categories) that have been studied with different levels of attention. The following factors have received more attention in the literature: Relationship Type, Process, Structure, Knowledge, Intermediaries, IP policy, Funding, Alignment of goals, Culture of openness, and number of projects.

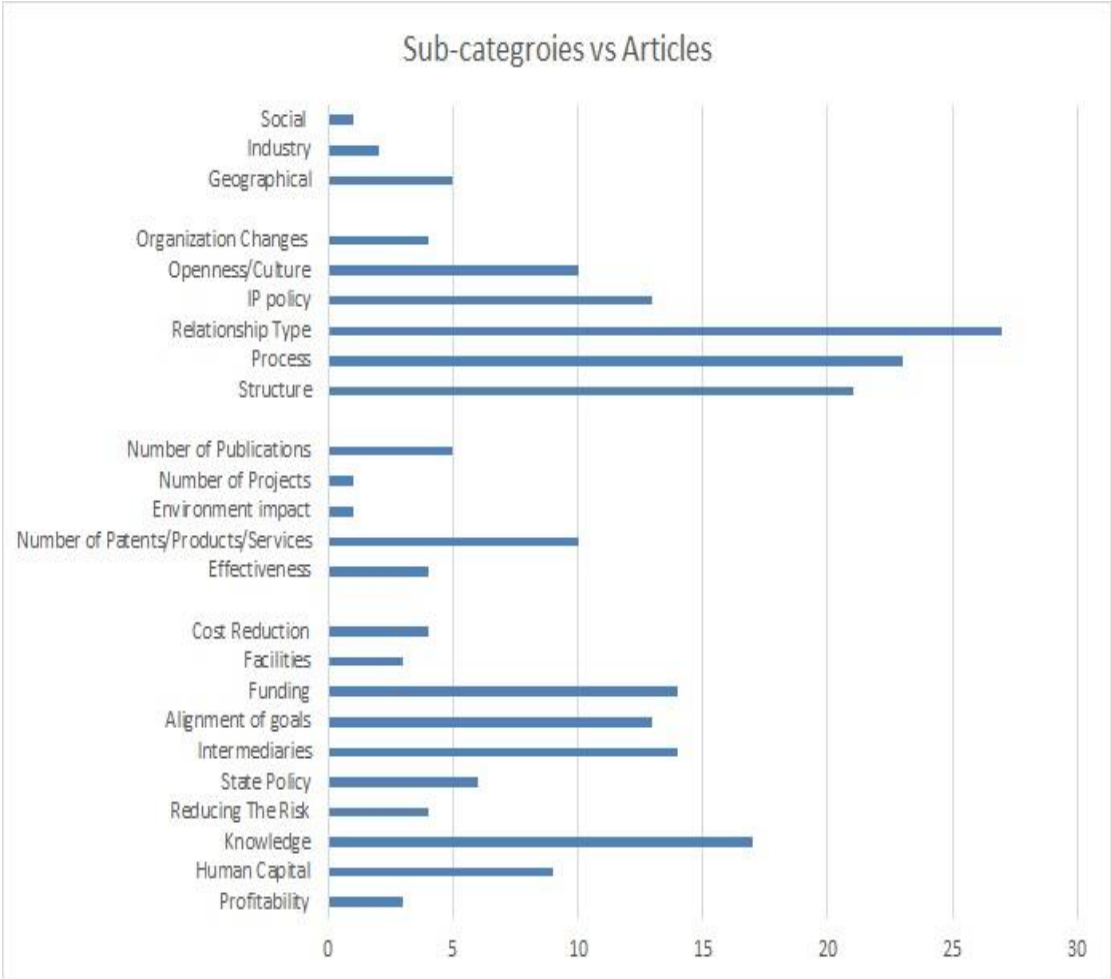


Figure 8 - Final sample analysis – Articles vs Sub-Categories (Factors)

The type of relationship between the actors of the collaboration is the most frequent factor that has been investigated in our final sample; over 55% of the total articles have focused this topic. The studies agreed on the importance of the relationship however, they differ in the reasons why it is difficult to establish the relationship. Industry have difficulties in developing strong and long-lasting relationships with universities due to the fact there is a need for professors and researchers to balance teaching obligations, research and collaboration activities (Kristel Miller , Maura McAdam, 2014). In contrast, universities scientists see the difficulties differently, working with industry is very complicated relationship, which can restrict communication among scientists (Welsh et al., 2008).

Collaboration processes is a challenge for collaboration and demotivate the teams to collaborate since the teams come from different organization. Around 46% of the final sample of the articles discussed the collaboration process. The analysis highlighted the importance of flexibility in the processes of completing activities rather than managing and taking control of procedures and mechanisms of the collaboration (Liliana, 2013). Contrary to this finding, centralization of tasks for the working groups is essential to meet the due dates and facilitate the communication to resolve conflicts between the collaborators (Muscio & Vallanti, 2014).

The structure in universities is seen as a barrier for the industry where teaching obligations have a negative impact of the collaboration (Arvanitis et al., 2008). In the industry side, the pre-existing R&D structure faces challenge in integrating the acquired knowledge and who within the organization will support this integration (Bocquet & Mothe, 2010) (Ford et al., 2012). Despite the fact that this factor was studied in almost 43% of our final sample, only few articles demonstrate the industry attempts to overcome this challenge by creating an organizational structure to support innovation activities rather than squeezing it within the pre-existing R&D structure (Hung & Chou, 2013; Schweitzer et al, 2011).

Universities which have long tradition of industry–university collaboration tend to establish good relationships with the industry and generate more patents (Gopalakrishnan & Santoro, 2004). However, in universities, openness in innovation requires the desire for the change and the necessary mindset. The shift to open innovation will have to be gradual where new procedures, patterns of behaviors, routines and maybe new structure to be implemented for the university-industry collaboration. Acquiring external knowledge is crucial factor for industry to find academia partners (Freitas et al., 2013). Government-funded programs encourage collaboration between industry and universities to ensure the capture and knowledge in this collaboration. However, knowledge transfer faces difficulties such as the capability to integrate the information obtained from the external sources into internal processes and structures, how the geographical advantage still plays a pivotal role in facilitating knowledge exchange (Gould, 2012) (Muscio et al., 2012).

Intermediaries can help to decrease barriers and ease the interaction between university researchers and industry (Aquilani, Abbate, & Codini, 2017). Intermediaries play a valuable and crucial role in collaborative innovation processes (Agogu , et al, 2013).

IP policy plays an important role in the collaboration however, scientists think of IP policies bittersweet. They believe the IP policy is needed to protect their work but at the same time, they do not want it to restrict them from communicating their research and findings with other scientists. This raise unanswered question for both industry and university, to which limit can they be open? It is important to note that IP policy is interrelated to other factors such as relationship between the collaborators where more flexibility in IP policy if the partners have a strong relationship (Padilla-Mel ndez & Aguila-Obra, 2012; Welsh et al., 2008).

Government funding or sponsored research is an influential factor in initiating collaborations and accelerating technology and knowledge transfer, small companies rely

heavily on funding programs similarly; university might need the access to private funding. The openness is required once there is a financial engagement (Simeth & Raffo, 2013).

Finding new potential partners is very complicated, decision makers consider several elements before considering the new partners, alignment the collaboration goals to the organizational goals is one of the crucial elements that makes a joint project successful (McAdam et al., 2012).

The collaborators work on eliminating cultural barriers that impede on the collaboration process (Siegel et al., 2004), this involve several aspects of the collaboration such as the openness for sharing knowledge, flexibility regarding R&D operations and mobility of human capital (Puślecki & Staszaków, 2015). Another key performance indicator for universities is the number of collaboration projects per year (Al-Ashaab et al., 2011).

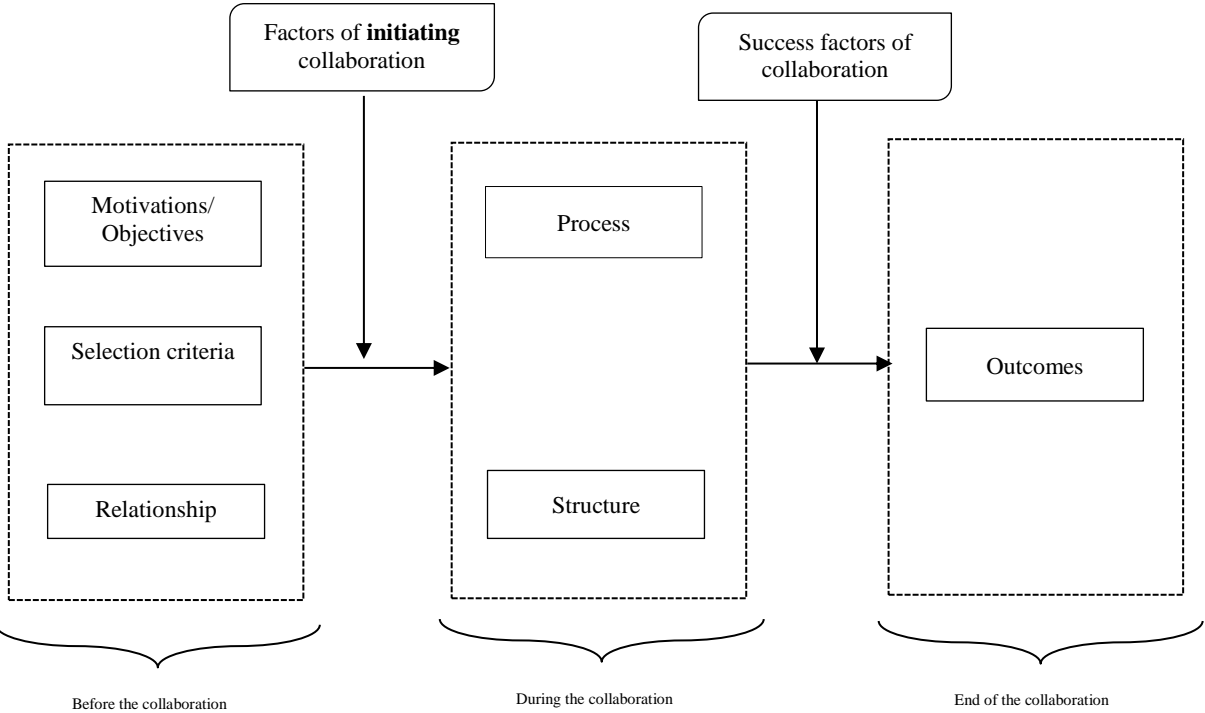


Figure 9 - Conceptual framework of the collaboration stages

Another outcome of this review is integrated in Figure 9 as a conceptual framework of the collaboration stages. We constructed this framework through the summary of the factors we found in this review Table 2. We divide the collaboration into three stages, before, during and end of the collaboration. Before the collaboration, the decision makers consider the objectives

and motivations of the potential partners. Selecting partners is far from straightforward and includes several aspects to be analyzed before making a decision (Guertler & Lindemann, 2016) which we indicated as selection criteria in figure 9.

During the collaboration, the collaboration moves to operational stage. The activities of the stage are influenced by the organizational structures as well as the collaboration process and interactions. At this stage, there could be different important factors which will facilitate or inhibit the collaboration success (Ankrah & AL-Tabbaa, 2015). In certain collaboration, the objective or the result generating knowledge or an idea or reach a proof of concept.

Evaluating the quality of the collaborations' results is a major issue at the end of the collaboration. Moreover, at the end of this kind of collaboration, there could be a possibility to extend the collaboration or involve more actors in the collaboration for further development.

This framework to be further expanded and analyzed for a twofold purpose. First, we will study the mechanisms and characteristics of the collaboration at the stage of generating, consolidating and testing ideas and identify the causes of the administrative and operational lengthy process. Second, we will propose a tool to measure the progress and evaluate the quality of the collaboration by studying the different types of projects conducted in the collaboration.

Conclusions

In this paper, we tried to explore the existing literature to summarize the factors that influence decision makers to be engaged in open innovation collaboration in the university-SMEs framework.

The results of this study clearly show that there are different influential factors of initiating open innovation collaboration between academia and SMEs. Some of these factors have been extensively studied especially organizational factors such as the relationship types, processes of collaboration and openness/culture of the organizations. Multiple partners do not have the same motivations and interests, which complicates the collaboration's mechanism.

The organization changes to support university-SMEs is studied at the SMEs side, further research is needed to explore the way organization changes at the university side may support open innovation collaboration.

There are many reasons for industry-university collaboration, but acquiring external resources, accessing new information, external knowledge, acquiring the people who develop the technology and funding programs always stimulate interaction between collaboration partners. Our results show that, in this category, two factors received less attention compared to the other factors and this opens a path for further analysis. The two factors are the public policy to encourage the open innovation and the importance of accessing universities facilities for SMEs.

The performance of the potential partners' plays a pivotal role to encourage other partners to be engaged into collaborations. The performance indicators could be the number of patents or technology developed per year, moreover the high number of collaboration projects with external partners shows the openness for collaboration (Su, Lin, & Chen, 2016).

The proximity between partners is considered as another facilitator of the collaboration even though proximity received less attention from the literature, Geographical, industrial or social proximity could be further explored as a key factor of success for collaborations.

Collaborations between academics and industry play an essential role in driving innovation processes. However, poor management of innovation processes between collaboration actors, these activities are seldom translated into commercialization success (Razak et al., 2013). Furthermore, more efforts have to be made to overcome certain obstacles such as managerial complexity of the collaboration and conflicts of culture.

We limited our investigation the influential factors extracted from peer-reviewed literature. Including papers from leading conferences could be fruitful for future studies to explore the interrelation between the factors, how factors can affect each other for example

relationship and IP policy or organization structure and openness. To conclude, we suggest that, collecting the studies based on a geographical cluster will be very useful in making systematic analysis based on geographical and culture aspects then comparing the findings of each geographical cluster

References

- AGOGUÉ, M., YSTRÖM, A., & LE MASSON, P. (2013). Rethinking the Role of Intermediaries As an Architect of Collective Exploration and Creation of Knowledge in Open Innovation. *International Journal of Innovation Management*, 17(02), 1–24.
- Agrawal, A. (2001). University-to-industry knowledge transfer: literature review and unanswered questions. *International Journal of Management Reviews*, 3(4), 285–302.
- Al-Ashaab, A., Flores, M., Doultsinoua, A., & Magyara, A. (2011). A balanced scorecard for open innovation: Measuring the impact of industry-university collaboration. *Production Planning & Control*, 22(July-September), 554–570.
- Albors-garrigós, J., Valencia, U. P. De, Mondragon, U. De, & Hervas-oliver, J. L. (2011). Outsourced innovation in SMES : a field study of R & D units in Spain Noemi Zabaleta Etxebarria Jaione Ganzarain Epelde, 55, 138–155.
- Ankrah, S., & AL-Tabbaa, O. (2015). Universities-industry collaboration: A systematic review. *Scandinavian Journal of Management*, 31(3), 387–408.
- Aquilani, B., Abbate, T., & Codini, A. (2017). Overcoming cultural barriers in open innovation processes through intermediaries: A theoretical framework. *Knowledge Management Research and Practice*, 15(3), 447–459.
- Arvanitis, S., Kubli, U., & Woerter, M. (2008). University-industry knowledge and technology transfer in Switzerland: What university scientists think about co-operation with private enterprises. *Research Policy*, 37(10), 1865–1883.
- Berends, H. (2005). Exploring knowledge sharing: moves, problem solving and justification. *Knowledge Management Research & Practice*, 3(2), 97–105.
- Bernardos Barbolla, A. M., & Casar Corredera, J. R. (2009). Technology Analysis & Strategic

- Management Critical factors for success in university–industry research projects Critical factors for success in university–industry research projects. *Technology Analysis & Strategic Management*, 21(5), 599–616.
- Bianchi, M., Cavaliere, A., Chiaroni, D., Frattini, F., & Chiesa, V. (2011). Organisational modes for Open Innovation in the bio-pharmaceutical industry: An exploratory analysis. *Technovation*, 31(1), 22–33.
- Black, N. (2001). Evidence based policy: proceed with care. *British Medical Journal*, 323, 275–279.
- Bocquet, R., & Mothe, C. (2010). Knowledge governance within clusters: The case of small firms. *Knowledge Management Research and Practice*, 8(3), 229–239.
- Buganza, T., Chiaroni, D., Colombo, G., & Frattini, F. (2011). Organisational Implications of Open Innovation: an Analysis of Inter-Industry Patterns. *International Journal of Innovation Management*, 15(02), 423–455.
- Calcagnini, G., Giombini, G., Liberati, P., & Travaglini, G. (2016). A matching model of university–industry collaborations. *Small Business Economics*, 46(1), 31–43.
- Caldera, A., & Debande, O. (2010). Performance of Spanish universities in technology transfer: An empirical analysis. *Research Policy*, 39(9), 1160–1173.
- Chen, H. H., Qiao, S., & Lee, A. H. I. (2014). The impacts of different R&D organizational structures on performance of firms: Perspective of absorptive capacity. *Journal of High Technology Management Research*, 25(1), 83–95.
- Chesbrough, H. (2006). *Open Innovation : A New Paradigm for Understanding Industrial Innovation*. Oxford: Oxford Univ. Press,.
- Cleveland, S., Mitkova, L., & Goncalves, L. C. (2015). Knowledge flow in the open innovation model the effects of ICT capacities and open innovation practices on knowledge streams. *Conference Proceedings - IEEE SOUTHEASTCON, 2015–June(June)*.
- Dahlander, L., & Gann, D. M. (2010). How open is innovation? *Research Policy*, 39(6), 699–709.
- Davis, G. F., & Cobb, J. A. (2010). Resource Dependence Theory: Past and Future. *Research in the Sociology of Organizations*, 1–31.
- De Beer, C., Secundo, G., Passiante, G., & Schutte, C. S. L. (2017). A mechanism for sharing best

- practices between university technology transfer offices. *Knowledge Management Research & Practice*, 15(4), 523–532.
- Decter, M., Bennett, D., & Leseure, M. (2007). University to business technology transfer-UK and USA comparisons. *Technovation*, 27(3), 145–155.
- Di Tommaso, M. R., & Schweitzer, S. O. (2010). Production and transfer of academic knowledge: policy targets and implications for the health industry. *International Journal of Healthcare Technology and Management*, 11(4), 227–240.
- Durst, S., & Edvardsson, I. R. (2012). Knowledge management in SMEs: A literature review. *Journal of Knowledge Management*, 16(6), 879–903.
- Feng, H.-I. H.-I., Chen, C.-S. C.-S., Wang, C.-H. C.-H., & Chiang, H.-C. H.-C. (2012). The Role of Intellectual Capital and University Technology Transfer Offices in University-Based Technology Transfer. *The Service Industries Journal*, 32(6), 899–917.
- Festel, G. (2015). Similarities of Successful Technology Transfer Through New Ventures. *International Journal of Innovation Management*, 19(02), 1550025.
- Ford, S., Mortara, L., & Probert, D. (2012). Disentangling the Complexity of Early-Stage Technology Acquisitions. *Research-Technology Management*, 55(3), 40–48.
- Freitas, I., Geuna, A., & Rossi, F. (2013). Finding the right partners: Institutional and personal modes of governance of university-industry interactions. *Research Policy*, 42(1), 50–62.
- Gopalakrishnan, S., & Santoro, M. D. (2004). Distinguishing between knowledge transfer and technology transfer activities: The role of key organizational factors. *IEEE Transactions on Engineering Management*, 51(1), 57–69. <https://doi.org/10.1109/TEM.2003.822461>
- Gould, R. W. (2012). Open Innovation and Stakeholder Engagement. *Journal of Technology Management & Innovation*, 7(3), 1–11.
- Guertler, M. R., & Lindemann, U. (2016). Identifying Open Innovation Partners: a Methodology for Strategic Partner Selection. *International Journal of Innovation Management*, 20(05), 1640011.
- Han, J., & Heshmati, A. (2016). Determinants of Financial Rewards from Industry-University Collaboration in South Korea. *Int. J. Entrepreneurship and Innovation Management*, 20(3/4), 235–257.

- Hayter, C. S. (2013). Harnessing University Entrepreneurship for Economic Growth: Factors of Success Among University Spin-offs. *Economic Development Quarterly*, 27(1), 18–28.
- Heinonen, T. (2015). Management of innovation in academia: A case study in tampere. *Journal of Technology Management and Innovation*, 10(2), 198–210.
- Hsieh, H. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, 15(9), 1277–1288.
- Hung, K. P., & Chou, C. (2013). The impact of open innovation on firm performance: The moderating effects of internal R&D and environmental turbulence. *Technovation*, 33(10–11), 368–380.
- Khan, K. S., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Jrsm*, 96(3), 118–121.
- Ki H. Kang, & Kang, J. (2009). How Do Firms Source External Knowledge for Innovation? Analysing Effects of Different Knowledge Sourcing Methods. *International Journal of Innovation Management*, 13(01), 1–17.
- Kristel Miller , Maura McAdam, R. M. (2014). The changing university business model: a stakeholder perspective. *R & D Management*, 44(3), 265.
- Kwiatkowski, M., Lorenc, K., Nowicka, D., Prosół, H., Sikora, M., & Pham, L. (2016). Lean Management as an Instrument of Sustainable Development of Enterprises. *Management Systems in Production Engineering*, 1, 31–36.
- Lai, W. H. (2011). Willingness-to-engage in technology transfer in industry-university collaborations. *Journal of Business Research*, 64(11), 1218–1223.
- Lakatos, E.-S., Bercea, O.-B., Moldovan, A., & Bacali, L. (2015). Partnership Between Industry and University From an Open Innovation Perspective. *Review of Management & Economic Engineering*, 14(1), 173–182.
- Lapointe, D., & Guimont, D. (2015). Open innovation practices adopted by private stakeholders: perspectives for living labs. *Info*, 17(4), 67–80.
- Liliana, M. (2013). How to Manage Open Innovation: Organizational Approach. *Review of Management Innovation & Creativity*, 6(19), 7–15.
- Lopez, S. F., Otero, L., Rodeiro, D., & Rodríguez, A. (2009). Entrepreneurial University, Transfer

- Technology and Funding: an Empirical Analysis. *Journal of Enterprising Culture*, 17(02), 147–179.
- Maxwell, A., & Levesque, M. (2011). Technology incubators: facilitating technology transfer or creating regional wealth? *International Journal of Entrepreneurship and Innovation Management*, 13(2), 122.
- Mayer, H. (2010). Catching Up: The Role of State Science and Technology Policy in Open Innovation. *Economic Development Quarterly*, 24(3), 195–209.
- McAdam, R., Miller, K., McAdam, M., & Teague, S. (2012). The development of University Technology Transfer stakeholder relationships at a regional level: Lessons for the future. *Technovation*, 32(1), 57–67.
- Meyer-Krahmer, F., & Schmoch, U. (1998). Science-based technologies: university–industry interactions in four fields. *Research Policy*, 27(8), 835–851.
- Might, R. J., & Fischer, W. A. (1985). The Role of Structural factors in determining Management Success. *IEEE Transactions on Engineering Management*, EM-32(2), 71–77.
- Miller, K., Mcadam, R., Moffett, S., Alexander, A., & Puthusserry, P. (2016). Knowledge transfer in university quadruple helix ecosystems: An absorptive capacity perspective. *R and D Management*, 46(2), 383–399.
- Mitchell, R., Agle, B., & Wood, D. (1997). Toward a Theory of Stakeholder Identification and Saliency: Defining the Principle of Who and What Really Counts. *Academy of Management Review*, 22(4), 853–886.
- Muscio, A., Quaglione, D., & Scarpinato, M. (2012). The effects of universities' proximity to industrial districts on university-industry collaboration. *China Economic Review*, 23(3), 639–650.
- Muscio, A., & Vallanti, G. (2014). Perceived Obstacles to University–Industry Collaboration: Results from a Qualitative Survey of Italian Academic Departments. *Industry and Innovation*, 21(5), 410–429.
- Myoken, Y. (2013). The role of geographical proximity in university and industry collaboration: Case study of Japanese companies in the UK. *International Journal of Technology Transfer and*

- Commercialisation*, 12(1/2/3), 43–61.
- Neely, A., Gregory, M., & Platts, K. (2005). *Performance measurement system design A literature review and research agenda* Andy. *International Journal of Operations & Production Management* (Vol. 25).
- Padilla-Meléndez, A., & Aguila-Obra, A. R. Del. (2012). Shifting sands: Regional perspectives on the role of social capital in supporting open innovation through knowledge transfer and exchange with small and medium-sized enterprises. *International Small Business Journal*, 31(3), 296–318.
- Petroni, G., Venturini, K., & Verbano, C. (2012). Open innovation and new issues in R & D organization and personnel management. *The International Journal of Human Resource Management*, 23(1), 147–173.
- Pinheiro, M. L., & Lucas, C. (2015). Social Network Analysis As a New Methodological Tool To Understand University – Industry Cooperation. *International Journal of Innovation Management*, 19(1), 1550013.
- Pittaway, L., & Cope, J. (2007). Entrepreneurship Education A Systematic Review of the Evidence Entrepreneurship Education : A Systematic Review of the Evidence. *International Small Business Journal*, 25(5), 479–510.
- Potter, W. J., & Levine-Donnerstein, D. (1999). Rethinking validity and reliability in content analysis. *Journal of Applied Communication Research*, 27(3), 258–284.
- Puślecki, Ł., & Staszków, M. (2015). New Cooperation Modes: An Opportunity for Polish Biotechnological Clusters. *Managing Global Transitions: International Research Journal*, 13(2), 171–188.
- Rashman, L., Withers, E., & Hartley, J. (2009). Organizational learning and knowledge in public service organizations: A systematic review of the literature. *International Journal of Management Reviews*, 11(4), 463–494.
- Razak, A. A., Murray, P. A., & Roberts, D. (2013). Open Innovation in Universities: The Relationship Between Innovation and Commercialisation. *Knowledge and Process Management*, 21(4), 291–298.
- Renner, M. (2000). Analyzing qualitative data, 39(3), 146–154.

- Ring, P. S., & Van De, A. H. (1994). Developmental Processes of Cooperative Interorganizational Relationships. *Academy of Management Review*, *19*(1), 90–118.
- Roshani, M. O. N. A., Lehoux, N. A., & Frayret, J. (2015). University-Industry Collaborations and Open Innovation : An Integrated Methodology for Mutually Beneficial Relationships, (June), CIRRELT.
- Rossi, F., & Rosli, A. (2014). Indicators of university–industry knowledge transfer performance and their implications for universities: Evidence from the United Kingdom. *Studies in Higher Education*, *40*(10), 1970–1991. <https://doi.org/10.1080/03075079.2014.914914>
- Saito, H., & Sumikura, K. (2010). An Empirical Analysis on Absorptive Capacity. *International Journal of Innovation Management*, *14*(3), 491–509.
- Santoro, M. D., & Bierly, P. E. (2006). Facilitators of knowledge transfer in university-industry collaborations: A knowledge-based perspective. *IEEE Transactions on Engineering Management*, *53*(4), 495–507.
- Saotome, C., Abe, S., Teranishi, Y., & Narumiya, S. (2012). Managing a strategic industry-academia alliance for drug discovery: a case study of the Astellas Pharma Inc.-Kyoto University Project. *International Journal of Technology Transfer and Commercialisation*, *11*(3/4), 156–176.
- Schofield, T. (2013). Critical Success Factors for Knowledge Transfer Collaborations between University and Industry. *Journal of Research Administration*, *44*(22), 38–56.
- Schweitzer, F. M., Gassmann, O., & Gaubinger, K. (2011). Open Innovation and Its Effectiveness To Embrace Turbulent Environments. *International Journal of Innovation Management*, *15*(06), 1191–1207.
- Segarra-Ciprés, M., Roca-Puig, V., & Bou-Llugar, J. C. (2014). External knowledge acquisition and innovation output: an analysis of the moderating effect of internal knowledge transfer. *Knowledge Management Research & Practice*, *12*(2), 203–214.
- Sellenthin, M. O. (2011). Factors That impact on university - Industry collaboration : empirical evidence From Sweden and Germany. *BRUSSELS ECONOMIC REVIEW*, *54*(1), 81–101.
- Shane, S. (2002). Executive forum: University technology transfer to entrepreneurial companies. *Journal of Business Venturing*, *17*(6), 537–552.

- Sherwood, A. L., & Covin, J. G. (2008). Knowledge Acquisition in University–Industry Alliances: An Empirical Investigation from a Learning Theory Perspective. *Journal of Product Innovation Management*, 25(812), 162–179.
- Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. (2003). Commercial knowledge transfers from universities to firms: Improving the effectiveness of university-industry collaboration. *Journal of High Technology Management Research*, 14(1), 111–133.
- 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.
- Simeth, M., & Raffo, J. D. (2013). What makes companies pursue an Open Science strategy? *Research Policy*, 42(9), 1531–1543.
- Spithoven, A., Vanhaverbeke, W., & Roijakkers, N. (2013). Open innovation practices in SMEs and large enterprises. *Small Business Economics*, 41(3), 537–562.
- Su, C.-Y., Lin, B.-W., & Chen, C.-J. (2016). Knowledge co-creation across national boundaries: trends and firms' strategies. *Knowledge Management Research & Practice*, 14(4), 457–469.
- Valkokari, K., Paasi, J., & Rantala, T. (2012). Managing knowledge within networked innovation. *Knowledge Management Research and Practice*, 10(1), 27–40.
- van den Berghe, L., & Guild, P. D. (2007). The strategic value of new university technology and its impact on exclusivity of licensing transactions: An empirical study. *The Journal of Technology Transfer*, 33(1), 91–103.
- Vega-Jurado, J., Juliaio-Esparragoza, D., Paternina-Arboleda, C. D., & Velez, M. C. (2015). Integrating Technology, Management and Marketing Innovation through Open Innovation Models. *Journal of Technology Management & Innovation*, 10(4), 85–90.
- Victor, L. (2008). Systematic Reviewing in the Social Sciences: Outcomes and Explanation. *Enquire*, 1(1), 32–46.
- Wang, J. K., Ashleigh, M., & Meyer, E. (2006). Knowledge sharing and team trustworthiness: It's all about social ties! *Knowledge Management Research and Practice*, 4(3), 175–186. h

Wang, J., & Shapira, P. (2012). Partnering with universities: A good choice for nanotechnology start-up firms? *Small Business Economics*, 38(2), 197–215.

Welsh, R., Glenna, L., Lacy, W., & Biscotti, D. (2008). Close enough but not too far: Assessing the effects of university-industry research relationships and the rise of academic capitalism.

Research Policy, 37(10), 1854–1864.