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Barriers to university- industry collaboration in Algeria: Orientation-related barriers and Transaction-related barriers

Karima BENBOUZID [1], Smail DAHMANI[2]

[1] University of Algiers 3, (Algeria). Laboratory Globalization and Economic Policies
benbouzid.karima@univ-alger3.dz
[2] University of Algiers 3, (Algeria). dahmani.smail@univ-alger3.dz

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Abstract :

This study aims to explore the current situation of University-Industry Collaboration in Algeria and to identify the perceived barriers against effective collaboration from the researchers' point of view. This study is based on a survey of 543 researchers in Algeria carried out by CREAD. The findings reveal that there is a poor collaboration between University and Industry. The main barriers against effective collaboration are the lack of interest from companies and lack of confidence. Besides, universities and industries have a different culture. Lack of mutual understanding of priority expectations and needs is also another important barrier identified by researchers.

Keywords: *University-Industry Collaboration; Barriers to collaboration; Algeria; Researchers.*
JEL classification codes: *I23, L14, P14, P41.*

الملخص:

تهدف هذه الدراسة إلى استكشاف الوضع الحالي للتعاون بين الجامعة والقطاع الصناعي في الجزائر، وتحديد أهم العوائق التي تقف أمام التعاون الفعال من وجهة نظر الباحثين. استند هذا البحث على مسح أجري من طرف CREAD على 543 باحثًا. النتائج المتوصل إليها تكشف عن وجود تعاون ضعيف جدا بين الجامعة والقطاع الصناعي. بالنسبة للعوائق الرئيسية أمام التعاون الفعال فيمكن تلخيصها في عدم وجود اهتمام من قبل المؤسسات بالشراكة، انعدام الثقة واختلاف ثقافة الطرفين. كما أن غياب الفهم المتبادل لتوقعات واحتياجات القطاع الصناعي يعد أيضًا حاجزًا مهمًا قد تم الاشارة اليه من طرف الباحثين.

الكلمات المفتاحية: *التعاون بين الجامعة والقطاع الصناعي، عوائق التعاون، الجزائر، الباحثين.*

تصنيف JEL : *P41, P41, L14, I23* .

Corresponding author: Karima BENBOUZID, Email: benbouzid.karima@univ-alger3.dz

1. Introduction.

University-Industry Collaboration (UIC) refers to the reciprocal action between university and industry (Syed, 2019), that pool their resources in a bid to attain mutual goals and objectives that they could not materialize effectively all alone. Indeed, university and industry are two specific worlds that pursue different goals but they are complementary. If the industry produces goods and services and contributes to economic and social stability, the university is a structure for the production of knowledge and a pool of highly qualified and specialized labor.

UIC offers numerous benefits for both sides (Ankrah *et al.,* 2013). From the companies' side, UIC is seen as an excellent way to promote economic growth. By collaborating with the university, companies can increase their capacity to deal with complex problems and to improve their competitive position in the market from the modification of their goods and services or the development of new goods and services. In addition, through effective collaboration, Companies can access to a variety of research expertise, which allows them to have a broader and more in-depth vision of the basic discipline, their area of competence, and the profile of the training provided to their future employees. Moreover, forming collaborations with universities would also offer increased learning opportunities on the job. For a company, it is better to get involved in university training upstream in order to be able to recruit operational executives than to invest in a long period of additional training downstream in the same company. UIC allows the company to access specific skills and unique laboratory resources which it could not acquire on its own (Lajoux & Tunon de Lara, 2012).

On their side, universities around the world are facing new challenges: meeting the new needs of society, defining new development strategies, building partnerships with socio-economic actors, helping to revitalize the economy by training qualified personnel appropriate in the context of rapidly evolving technologies to enhance their visibility..etc. From this perspective, the university cannot function outside the UIC. Indeed, the UIC allows universities to adapt research projects to industry needs (Lee, 2000) and to improve the robustness of studies through the use of the empirical data (Santoro, 2000; Arza, 2010) because the company is considered as an empirical data provider (Mesny & Mailhot, 2010). When a university maintains relations with industry, researchers explained in these relations can

have access to the databases and testing empirically the results of their research and allow them to have an external opinion on their research (D'Este & Perkmann, 2011). In addition, the university can have the opportunity to see if the reflections of its researchers are at the heart of the current concerns of industry.

In his empirical study, Lee (2000), with 427 American researchers in the natural sciences and engineering, notes that the interactions of universities with companies stem from a need for access to financing and to guarantee certain necessary funds for students and laboratories, and have access to additional facilities at a lower cost. The professional integration of graduates also remains a strong expectation of universities. As part of its collaboration with the industry, the university will have access to numerous job offers; the researcher can become aware of the existence of vacant positions in a company (Lee & Win, 2004), moreover, students involved in a research partnership with industry may have to be hired. In addition, collaboration improves the competitiveness and the reputation of the university and the researcher. In this sense Siegel *et al* (2003b) state, that industry-support allows researchers to lead researchers who contribute to their academic eminence. Recognition within the scientific community and non-financial rewards are other things among the motivations of researchers to collaborate with companies, the advantages include the promotion and a better position in society.

According to the aforementioned, it is clear that it is in the mutual interest of universities and companies to collaborate, in this sense, many countries, especially in the developing world, have tried hard to build viable UIC. In Algeria, we observe a multiplication of efforts which aim to intensify collaboration between the world of research and the world of industry, it was the subject of several national and international projects, bilateral cooperation projects with European countries or European Union and multilateral, but it is not always easy to establish a collaborative relationship between universities and companies. We distinguish « orientation-related barriers » that are related to differences in the orientations of industry and universities from « transaction-related barriers » barriers related to conflicts over IP and dealing with university administration. Below these two types of barriers are described further.

According to above we judged important to ask what is the current situation of UICs in Algeria, and which are the main barriers against a healthy relationship between both institutions? from this question pursues the following sub-questions:

- Does orientation-related barrier hamper the UIC in Algeria?
- Does the transaction-related barrier hamper UIC in Algeria?

To answer these questions we developed the following hypothesis:

- H_1: From the researcher's perspective, the orientation-related barriers hamper the UIC in Algeria.
- H_2: From the researcher's perspective, the transaction-related barriers hamper the UIC in Algeria.

In general, there are several facets of dealing with the subject of UIC. By observing the literature concerning the research on the area of University-Industry, we note considerable care for UIC, we notice that the research on UIC in the Arab countries is limited to the role of the collaboration in innovation and economic growth[*]; but till now, the numbers of studies related to barriers to UIC are proportionately limited, especially in Algeria, Therefore, the present study is an attempt to address existing gaps in the literature by exploiting the Algerian environment to search the actual state of UIC and to determine the barriers facing powerful collaboration.

The rest of the article is organized into four sections. The first section presents a review of existing literature related to barriers to UIC and the research hypotheses. The second section describes the research design methodology. The third section discusses the data analysis and presents the results. The final section offers some concluding remarks.

2. Barriers to University-Industry Collaboration.

As advantages of UIC are numerous for both partners, the challenges and obstacles hindering collaboration are increasingly analysed in the literature, we distinguish « orientation-related barriers » from « transaction-related barriers ».

2.1. Orientation-related barriers.

Based to previous studies, these types of barriers are caused by different orientations of collaborating partners and in the different ways of research activity implementation (Tartari & Breschi, 2012a). One of the main characteristics of the academic researchers is autonomy and open diffusion of information, the collaboration with industry can

[*]Studies of : Khelfaoui, 2006; Saad *et al.*, 2008; Ouchallal & Ferfara, 2014.

create a potential problem to researchers which are related to cultural differences. This difference involves the secrecy issue, which refers to the extent to which collaboration with companies imposes restrictions on disclosure of research findings and the diffusion of research results. The loss of academic freedom, concerns related to the secrecy of results, and restrictions on the dissemination of those results can discourage collaboration between universities and companies (Bruneel *et al.,* 2010).

Another element that can handicap University-Industry Collaboration is skewing problems which are defined as the apprehension that collaboration with industry could create because of constraints on the autonomy of researchers to set their own research agenda. (Tartari & Breschi, 2012a), Additionally, lack of understanding can appear from engagement with industry. While universities' mission is to create reliable, public knowledge and thus expand the pool of useful knowledge, the companies seek to privatize existing knowledge to gain a competitive advantage (Bruneel *et al.*, 2010). Such barriers are often known to the actors involved in the collaboration, especially the differences in universities' long-term orientation versus companies' short-term orientation (Bjursell & Engstrom, 2017). As supported by Zaky & El-Faham (2004), research activities in university are more relaxed and intellectual compared to research activities in companies. This because research activities in companies are constrained with time, while research activities in universities are usually carried out in long duration.

Besides, some studies have mentioned that the differences in goals between universities and companies, would lead to barriers in collaboration. The main goal for universities is to create new knowledge and educate students. Knowledge is useful for companies if it can be transformed into problem solving and if it leads to competitive advantage. It is because the main goal of industry to improve their products and services in order to generate and increase the profits.

2.2. Transaction-related barriers.

This type of barriers refer to conflicts regarding complex proprietary issues such as Intellectual Property (IP) ownership and different incentive systems (Garcia *et al.,* 2018; Azman *et al.,* 2018).

Questions related to intellectual property (IP) rights are commonly identified as one of the most problematic areas of UIC. Such as IP ownerships, confidentiality, lack of mechanisms to protect IP, and the issues of incentives for researchers.

As reported by Tartari & Breschi (2012) Lack of flexible policies on IP ownership and Technology Transfer Officer (TTO) are often cited by researchers as important handicapping factors in building their attitude towards commercialization activities. Some studies argue that policies designed to encourage universities to commercialize their research are blocking rather than facilitating collaboration (Siegel *et al.,* 2003a). Indeed, authors argue that IP and contracting barriers have become more frequent as university administration takes more aggressive stances during negotiations, causing academics to circumvent TTOs and engage directly with industry partners (Siegel *et al.,* 2003b).

University Bureaucracy may also hamper collaboration with industry (López-Martínez et *al.,* 1994), in a series of 80% of industrial respondents noted Bureaucracy and inflexibility of university administrators as a key barrier to collaboration. It imposes procedures that are too rigid to match the nuances of particular technology transfer processes (Siegel *et al.,* 2004).

The table (1) collects the most frequently identified barriers. The ranking or prioritization of barriers according to impact is not possible given the diversity of analysis and research settings included here.

Table 1. Summary of the main barriers to University-Industry Collaboration

Type	Barrier
Orientation-related barriers	Industry research is characterized by Short-term orientation
	Difficulty in finding companies
	Absence of continuity in companies research strategies
	Research interests and / or needs are different

	Lack of mutual understanding
	Nature of academic research isn't linked with industry interests and /or needs
	Lag in dissemination of research outcomes
	Restriction to publications
	University research is extremely oriented towards pure science
Transaction-related barriers	Regulations imposed by university of funding agencies
	Policies adopted by university's technology transfer office (TTO)
	Potential conflicts with industry regarding intellectual property (IP) rights
	Absence of establishment procedures for collaboration with industry
	Low profile of University's technology transfer offices (TTO)
	University bureaucracy
	Conflicts about perceived bias

Source: Developed by the researcher

Little is known about barriers of UIC, especially in the Arab world. This study is, therefore, an attempt to fill this gap. So, to learn more about these barriers, this paper aims to identify the factors that hamper the collaboration form the researchers' point of view.

3. Data and method.

To achieve the research objectives, We carried out a survey within the framework of the CREAD project (Research Center in Applied Economics for Development) with a sample of 50 Universities (spread over 32 regions), entitled "the current state of relations between the

Algerian university and its economic and social environment", during the period from May to June, 2019. The survey aims to obtain key indicators and bring out conclusions on the current state of the UIC in Algeria. It provides information on the relations of the Algerian university with the socio-economic sector, its motivations for establishing links with the industry, and the barriers to this collaboration. In our case, we are interested only by the determination of the factors that hinder participation in UIC agreements in Algeria from the researchers' point of view.

The factors that have been assumed to have been the source of barriers in UIC from a researcher's perspective are listed below:

Table 2. Variables and measures

Orientation-related barriers: Please indicate the extent to which you think each statement represents
A barrier to UIC (1 = Not important at all; 5 = Very important).

1. Culture differences.
2. Mutual lack of understanding Nature of academic researchers isn't linked with industry interests or needs.
3. Lack of demand from the industry.

Transaction-related barriers: Please indicate the extent to which you think each statement represents
A barrier to UIC (1 = Not important at all; 5 = Very important).

1. Lack of confidence.
2. University bureaucracy.
3. Absence of establishment procedures for collaboration with industry.

Source: Adapted from Bruneel *et al. (*2010) and Tartari *et al. (*2012b)

3.1. Population and study sample.

The study sample includes:

- Rector / director
- Vice-rector / assistant director
- Dean of Faculty
- General secretary
- Laboratory Director
- President of Department
- Research teacher
- PhD student
- Administrative staff

3.2. The questionnaire has been sent to the 600 researchers, but the returned questionnaires were 543 with a response rate equal to 90%. The survey was conducted by direct and online interview on Google forms.

3.3. The sampling method.

In order to decide the sample size, the method called "uniform sampling rate" was preferred. It consists in dividing the population into "strata" categories according to a certain number of characteristics, and in fixing a priori the sampling rate (Feroukhi, 2005). The variables according to which we carried out stratification are qualitative and previously known for each establishment. There are four of them: Position occupied Region, Department, and Specialty. The first stratification criterion was the position occupied which allowed us to divide the population into 04 strata each of these subpopulations is, in turn, the object of a subdivision into new strata according to the region. Similarly, the stratification continued according to the order of the established criteria, so that each individual interviewed could belong to only one stratum. The drawing of the sample is carried out at each stage, independently in each stratum.

3.4. Statistical processing method and tools.

In order to carry out statistical analysis and obtain results and recommendations that would help in making decisions and solving problems in the research, we used SPSS program that allowed us to extract:

- Frequencies and percentages: to describe the characteristics of the target population data.
- Descriptive statistics : Means and standard deviation
- Cronbach's alpha: To measure the reliability of the questionnaire.

3.5. The reliability and validity of the questionnaire.

As a first step, before distributing the questionnaire, we sent it to the experts and, in particular, to the CREAD researchers for evaluation, we took into account all their suggestions and made the necessary adjustments. After that, In order to test the validity and the reliability of the variables, the Cronbach's alpha has been measured for each variable, as seen in table 3, both variables' alpha exceeded 0.6, which indicates sufficient reliability according to Nunnally (1978). As for the total stability, it was estimated at: 0.82 which is also very high, and this means that the questionnaire has a good degree of stability.

Table 3. Reliability assessment results

Variable name	Number of items	Cronbachs'α
Orientation-related barrier	4	0.72
Transaction-related barrier	3	0.64
The general direction of the study tool	7	0.82

Source: Developed by the researcher using SPSS

4. Data analysis and results.

4.1. Type of existing UIC.

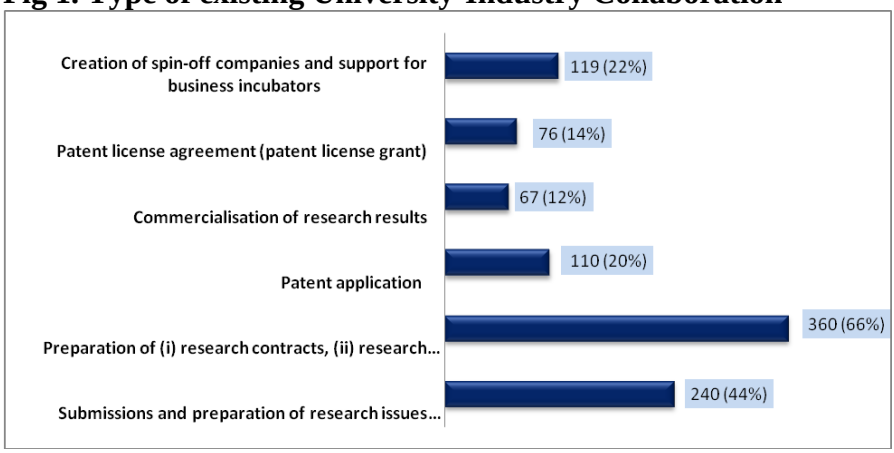
The first part of the questionnaire asks about the existence or non-existence of relations between universities and companies in Algeria. Based on the researchers' responses, it has been discovered that there is a poor collaboration agreement between universities and companies in Algeria.

When we asked the researchers if the researchers already have involved in a formal collaboration project with the industry. More than half (61%) of respondents say they have never been involved in the collaboration project « see appendix.1 ». Most of the time, it involves by the preparation of (i) research contracts, (ii) research collaboration agreements, (iii) consultancy contracts «selected by 66% survey population»; a 44% of researchers report that there are activities of submission and preparation of research issues to obtain external funding . We find that only 12% respondents who have activities to

commercialize research results; this rate is considered to be fairly low for the promotion of scientific research.

No other type collaboration like collaborative Research and Development (R&D), co-publications, training...etc. were mentionned.

Fig 1. Type of existing University-Industry Collaboration



Source : Developed by the researcher using SPSS

4.2. Statistic descriptive.

Table 4. Mean and standard deviation

Variable name	Mean ±SD	Level of importance
Orientation-related barrier	4.61 ± 0.84	Important
Transaction-related barrier	4.40 ± 0.33	Important
The general direction of the study tool	4.50 ± 0.98	Important

Source: Developed by the researcher using SPSS

The table above reports, the importance of different barriers for the total sample of respondents. The mean of the two items is esteemed at 4.61 and 4.40 respectively, this value is in the range of "important, very important" of the Likert scale.

The total mean of the study is esteemed at 4.50, with a standard deviation 0.98; this reflects a significant homogeneity in the responses of the surveys, which indicates that the respondents perceive

orientation-related barriers and transaction-related barriers as significant barriers to UIC.

4.3. The barriers against UIC.

In order to understand the main barriers that hinder successful collaboration between universities and companies, related questions were asked of the researchers. It has been revealed that the lack of demand from the industry constitutes the most important barrier against effective collaboration between the two actors with a rate of (82%). It seems that an important reason which is reflected by the lack of collaboration initiative on the part of companies is the lack of confidence of companies in the capacities of universities (80%). Generally, there is a lack of mutual trust between universities and companies, This barrier bring conflicts between both partners during collaboration.

Over 75 % of researchers suggest that collaboration is a complex process to manage due to the cultural differences and lack of mutual understanding between universities and companies. The primary mission of the university is the creation and sharing of knowledge. As a result, the public nature of university knowledge does not satisfy the ambitions of companies. Indeed, industrialists tend to protect their intellectual capital in order to maximize their profit, which results, in the context of waiting with the university, by the privatization of knowledge.

In addition, the academic researchers believe that the University bureaucracy remains a strong barrier against effective collaboration in Algeria, around 69% of the survey population cited this type of barriers as very important. 62% of researchers expected that the nature of academic researchers is not linked with industry interests or needs Only 57% of researchers think that the absence of established procedures for collaboration with industry constitutes a barrier against University and industry.

Table 5. Type of barriers to University-Industry Collaboration ***(Percentage of researchers indicated that they think each statement represents important or very important barrier to collaboration)***

Type	Barrier	%
	Culture differences	76

Orientation-related barriers	Mutual lack of understanding about expectations and working practices.	76
	Nature of academic researchers isn't linked with industry interests or needs	62
	Lack of demand from the industry	82
Transaction-related barriers	Lack of confidence	80
	University bureaucracy	69
	Absence of establishment procedures for collaboration with industry	57

Source : Developed by the researcher using SPSS

4.4. Barriers to UIC from collaboration and non- collaborating researcher's perspective.

The following figure shows the proportion of collaborator and non-collaborator researchers who rated a set of barriers as important.

As shown in the graph, non-collaborator researchers are more likely to consider most barriers to be important compared to collaborator researchers. Statistically significant differences between these two groups are found in the barriers:

- Lack of mutual understanding of the expectations, priorities, and needs of the economic and social sector,
- Absence of establishment procedures for collaboration with industry,
- Lack of confidence in the national and local economic and social sectors in the capacities and skills of the university.

Fig 2. Barriers from the point of view of collaborating and non-collaborating researchers

Source : Developed by the researcher using SPSS

4.5. Summary of study results.

At this point, we will try to summarize the results of the study, in order to test the study hypotheses.

The first hypothesis stipulates that, from the researcher's perspective, orientation-related barriers hamper UIC in Algeria.

The second hypothesis indicates that, from the researcher's perspective, transaction-related barriers hamper UIC in Algeria.

A Student's distribution was used at the 5% level of significance. The results of the hypothesis test are summarized in the following table:

Table 6. Student's t-Test results

Variable name	T	Sig
Orientation-related barrier	85.92	.000*
Transaction-related barrier	76.43	.000*

Significant at 0.05

Source: Developed by the researcher using SPSS

By using t-test for one sample, whose value was positive and estimated at 85.92 and 76.43 respectively, in order to know the significance of the difference between the total average and the theoretical average, it was found that there were significant differences between the mean and the statistic in favor of the total mean of the axis at the level of significance of 0.000 which is less than the assumed

significance level 0.05. According to the data represented above, the research hypotheses could be accepted.

5. Conclusion.

This study aimed to analyze the current situation of UIC in Algeria and to identify the barriers against effective collaboration from researcher's perspective.

Most of the investigated researchers point out that they have never been involved in a collaborative project and even if some researchers participate into collaborative research with companies, the effective collaboration with the industry still cannot be achieved.

The results of the survey show that, there is poor collaboration between universities and companies, the relationships between the actors are limited just in Preparation of (i) research contracts, (ii) research collaboration agreements, (iii) consultancy contracts.

Although it has been widely known that there are barriers to UIC, few studies have attempted to measure such barriers, especially in the Maghreb countries. According to the current study, the Algerian environment suffers from both Orientation-related barriers and Transaction-related barriers. Lack of demand from industry, culture differences and lack of mutual understanding between universities and industry were the most commonly identified barriers against strong and effective collaboration in Algeria. Comes next university bureaucracy and the nature of academic researchers is not linked with industry interests or needs.

Also, it was found that the most frequent barriers faced non collaborating researchers is lack of mutual understanding between both partners, while collaborating researchers indicated lack of demand from industry as the main barrier to collaboration.

The findings of this paper can provide relevant information for collaborating partners (academic researchers, industrialists and government) in understanding the barriers in collaboration. These results can be used to find the best solution to diminish the barriers in order to develop effective UIC. According to the findings of this research, several ways to overcome problems exist that can make collaboration easier and more productive; the following actions could be suggested to improve the current situation in Algeria:

- The government should establish rules and procedures that conduct the relationship between university and industry,

- The application of these procedures should be controlled,
- Universities and companies must take into account the contradictions and differences in their interests,
- Ensure that collaboration with companies does not take place at the expense of main mission of universities, which is education,
- Carry out studies that correspond to the needs of the industry.

For future research, a similar study should be realized on the industry side about the barriers against effective collaboration.

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