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# University-Industry Interaction in Tunisia: Exploring Benefits for the University from a Firm Level of Analysis

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**Abstract:** During the last three decades, university–industry interaction (U–I) has appeared as a specific field of study. In this context, research which study benefits that these relationships can bring to university remain insufficiently explored. Specifically, studies on developing countries remain fewer. The aim of this paper is to examine the extent of interactions by exploring benefits that firms can bring to university from a firm level of analysis. The importance of such relations has been discussed in many studies but studying benefits from a firm level are still poor, especially in African context. The methodology includes a qualitative research based on the use of content analysis. Data was collected from semi-structured interviews conducted within four Tunisian pharmaceutical firms. The results show similarities between the firms. Benefits include practical knowledge transfer, learning, joint research, accessing laboratory equipment and infrastructure, training opportunities, hiring graduates or postgraduates. But benefits don't include securing funds because of the limited pharmaceutical firms' resources. Moreover, interaction is concentrated in the short term and in the trainee and researchers' level. This study also indicates that, like other African countries, U-I relations should be supported by political policy. Such policies contribute to involve legislation revision, implementing support mechanisms that enhance U–I interaction and stimulate connections between universities and firms.

**Keywords:** U-I interaction, Benefits, African Countries

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## 1. Introduction

Interaction between university-industry-government is crucial for improving the role of each of these spheres at the regional and economic level. These cooperations which are instituted by individuals and/or organizations are recognized as essential to accomplishing the potential of a knowledge-base [15, 26]. Besides its traditional functions, each sphere of the triple-helix assumes the other spheres' role [7]: The government role is to offer a regulatory environment and to persuade innovation universities to develop an entrepreneurial role. While firms are developing an academic dimension, improving knowledge share with each other spheres and leading the employees to high skill levels [26]. The new mission of the university is recognized through the increasing and proactive engagement with firms, networks and institutions [7]. This mission encompasses knowledge exchange in its wider perception that incorporates research commercialisation, university–industry cooperations, and all

associated enterprise engagement [5]. University in developed economies play a central role in the creation and dissemination of knowledge, conducting to the evolution of innovation capability and growth [5, 34]. This evolution is dependent on the types and extent of relations that can exist between university and industry [5]. Previous research has focused on the benefits that the relationship can bring to both parties. These researchers have identified various mechanisms that function as paths through which information, knowledge and other resources are exchanged and coproduced by these two spheres [4, 12]. In this context, research which study benefits that these relationships can bring to university remain insufficiently explored with fewer research especially on developing countries. According to African countries, despite considerable diversity, many of them are marked by two characteristics even now: a strongly centralised system of education and weak links between university and industry [34].

This paper investigates the extent of interactions by

exploring benefits that firms can bring to university. Framed in these premises, this study is conducted from a firm level of analysis. To achieve this objective, this study adopted a qualitative approach. The results of a case study carried out within four Tunisian pharmaceutical firms will be presented and discussed, in order to explore benefits that can be generated to the university. The remainder of this article is organised as follows: Sections 2 and 3 contains the literature review. Section 4 describes the research design, while Section 5 illustrates the main findings and the discussions. Section 6 concludes the paper by highlighting some implications for practitioners and researchers.

## 2. University-Industry Interaction: An Evolutive Relation

The triple-helix model focus attention on the increased role of the university in the transition from industrial to knowledge-based society and which accomplish an essential contribution within systems of innovation for basic research generation, technology transfer and knowledge diffusion to firms [7]. Entrepreneurial university corresponds to a process started with the introduction of new services that engenders new features and roles for the university to develop its social, regional, and economic environment. This new mission of the university is to be actively related to the industry which profits socially and economically from university research while the university benefits from the knowledge acquired by its closeness to the entrepreneurial environment [16]. Links with the Business world are created through these contacts to share knowledge and for students to benefit from an experiential way of learning [25].

In the last three decades, interest in this field of study has appeared as part of the increase in policies that highlight the commercialization of research and the ties between basic research and social needs. The literature highlights the importance of connections and institutional arrangements, observing universities as actors that can participate to economic development in knowledge-based economies. University-Industry cooperation represents an important vehicle for knowledge and innovation transfer, which stimulate the production of new knowledge, technology, and products as essential elements in a competitive business environment, regional and/or national [27].

Crescenzi et al. [10] addressed several fundamental research questions on U-I cooperation. In particular, they find that they are less likely to happen in comparison with firm-firm or university-university collaborations. These cooperations also represent a model of inter-institutional agreement between organizations that are characterised by different natures, different purposes and which adopt quite different formats [24, 29]. Studies related to U-I cooperation are focusing on the benefits that the relationship can bring to both parties through a variety of functioning channels [1, 4, 9, 19]. Cooperation can stimulate learning and drive advances in new technologies [35], contribute to the

development of new capabilities and so the implementation of long-term innovation strategies [13]. This collaboration can also help firms to increase understanding of the basis related to a specific phenomenon and generate new opportunities. This is especially relevant when the results of research directly affect innovation [3]. The firm capability to exploit new and/or existing knowledge and the flow of ideas can be developed. Most studies are focusing on various benefits that firms can obtain [10]. Studying U-I interaction was mostly realised by representing just the point of view of the university although this relation involves two partners (the university and the firm). According to [17], there are many works that study of U-I interaction. One of the techniques was researching from the perspective of actors. By conducting the study from a firm level, we are focusing on benefits that the relationship can bring to university.

## 3. U-I Interaction: Benefits for the University

University is involved in partnerships, networks, and business activities with firms for various objectives. These objectives include linking education, research, and activities with technological, social and economic development [20]. From the perspective of universities, a wide range of benefits for engagement and collaboration with firms can be identified. [11, 24, 25]:

1. Commercial exploitation of knowledge or seeking business opportunities. This involves commercialization benefits.
2. Learning is also recognized as an important benefit. Learning can be related to the realization of joint academic research, the opportunity of putting theory and research into practice, as well as more knowledge into research.
3. Access to various resources such as funding, supplementing public research with private funding, equipment, materials, and research data.
4. Dissemination of the university's mission.
5. For students, benefits involve creating internships and placement opportunities.

These cooperations can be built on a micro-social level between researchers and firms from other professional background and are guided by a transfer logic as well as of knowledge and know-how [28]. The academic partner finds the possibility to work on functional programs and to be engaged in the learning process. According to [21], research between these two spheres is initiated mostly by R&D researchers who are facing problems for which they do not always have answers and by the need for integrating recent knowledge. During cooperation, human resources, training, methods and knowledge are pooled for specific issues' investigation formulated by the firm or also to formalize new problem-solving methods. Sutarto et al. [36] argue that training involves improving knowledge, skills, attitude and seeks to transfer knowledge and skills to academic trainees.

Training, as a learning experience for academics can be seen as a tool for knowledge transfer [40].

In the knowledge-based economy, innovation is becoming increasingly based on skills and complementarities across different disciplines. Some industries' characteristics affect the decision to initiate R&D agreement. These are closely related to the factors that guide the propensity to innovate. Cooperation in R&D projects are more likely initiated by firms undertaking process and product innovation. The type of R&D cooperation with the university is related to the size of the enterprise. The larger ones primarily are using collaborations for joint research projects [31].

U-I relationships also provide resources, capabilities, and infrastructures to support the university community's (students, academics, graduates) [38]. Industry contributes to ensure support for researchers, to promote research projects, to facilitate joint research and to be familiarized with the industry needs [19]. They are also a considerable source of revenue and new knowledge for some universities [29]. They can be also extended to the research programs orientation. As [4] specify it, certain orientations aim at bridging the gap between the universities basic research and the R&D short-term industry projects. Firms can find working possibilities with the university research laboratory to better target research projects. So, results can be gained through different activities. These ones can be related to projects with firms as well as through participation in research that may inspire new ideas and possibilities in scientific fields [25]. In addition, interaction with industry present the advantage to feed teaching and research activity. This benefit is explicitly recognized by researchers. These interactions lead to a better orientation between business practices and academic knowledge [23, 25].

In [11], authors distinguish those benefits and emphasize from one side academics' utility-maximizing commercialization behaviour. In this sense, academics collaborate with industry to pursue commercialization. From another side, they distinguish that the academics environment is specific. In fact, the academics operate in a strongly institutionalized environment sporting science-specific norms

and values. In this sense, academics aim to collaborate with industry primarily to support their research rather than being entrepreneurs.

## 4. Research Methodology

This study involves a qualitative approach. This approach is the most suitable for analysing the phenomenon that we propose to investigate and gives a deeper analytical and reflective comprehension of the specificities implicated in U-I interaction [32]. Moreover, a qualitative approach seeks to comprehend how individuals make sense of their social world as it is formed through social connections of individuals with the world around them [30]. This research also takes an explanatory character. Explanatory research aims to detect aspects that participate in the manifestation of certain phenomena [30]. In this study, we seek an in-depth and detailed study of benefits that firms can bring to university. In line with the exploratory nature of this research, a case study method is adopted. Moreover, within qualitative research, the case study method is frequently used. A case study requires a limited number of cases to be investigated, which permit a more in-depth study and with more details [39].

This study is conducted from the industry level. From first data collection focused on Tunisian industries that maintain interaction with the university, the interest is moved to the pharmaceutical industry. According to the Ministry of Higher Education and Scientific Research, some Tunisian pharmaceutical laboratories have conducted cooperation with the university (Organisations and Research Laboratory). According to this ministry, cooperation with industry is still at low level. In line with African countries, weak links characterise U-I relations [34].

The study was conducted during the year 2019-2020 within four pharmaceutical laboratories which represent the only firms who have initiated relations with academic organizations.

This table shows each Firm-University relation and the interviewed person.

**Table 1.** University organisations in relations with firms.

Firm	University organizations	Responds
Alpha	Higher Institute of Medical Technologies, Faculty of pharmacy, 2 Research Laboratories	CEO, Quality Control Manager, Industrial Pharmacist Responsible
Beta	Higher Institute of biotechnology, Faculty of pharmacy, 1 Research Laboratory	CEO, Human Resources Manager
Gamma	Institute of biotechnology, Faculty of pharmacy, 2 Research Laboratories	CEO, Quality Control Manager,
Omega	Institute of biotechnology	CEO, Industrial Pharmacist Responsible

The interviews were semi-structured. A total of 9 interviews were done, whose average duration was one hour. Interviews were conducted with the CEO who is the first responsible of the U-I relations management in each laboratory and other manager implicated in these relations.

Interviews were conducted in person, but they are not recorded because interviewees refused that. After data collection, a detailed analysis and interpretation of the interviews and consequently the transcription of them were done. Therefore, a content analysis was performed.

## 5. Results and Discussion

This section offers an analysis and research findings. Results show that transfer of knowledge and know-how between pharmaceutical firms and the university are guided at the level of training (undergraduate, graduates, master students and doctoral students). The trainees are the future engineers and doctors in the pharmaceutical domain and industrial pharmacy. Through these training, they benefit basically from the opportunity to develop learning related to the production process and profit from practical knowledge and know-how and have the possibility of access to equipment and infrastructure. The CEO of Alpha stated: *“From an industrial view, students should develop competencies and be better prepared. Training represents an opportunity to take into practice their knowledge and know-how and to develop learning related to their specialities and using specific equipment, infrastructure for their formation and research needs. In addition, to realise a research in this domain involves use of specific infrastructure and equipment”*. Training within the firm is perceived as a basic form of supporting the development of academic trainee competences and skills. Besides, training is also considered as a tool necessary in the process of generating new knowledge and its transfer and to anew the process of learning skills and knowledge [40].

Another apparent result is set through seminars and workshops which can then engender further collaboration. It appears that it is a common practice. With different organization frequencies, all firms organize seminars and workshops events jointly with their academic partner. Responds confirm the importance of these events that offer a saving of time and an occasion to exchange theoretical and practical knowledge and know-how. Through these events, informal contacts will be frequent and each partner needs and capabilities are well known. Such interventions allow the identification of problematics that lead sometimes to initiate research projects and provide foundations for experimenting with concepts. Opportunities can be generated, and which can result in innovations that would not have otherwise been accessed mainly for researchers. The following statement illustrates this point: *“we are the first firm that have organised such events with our academic partners. Some problems are discussed with them. Sometimes with the faculty of pharmacy joint research project is initiated to find solutions that can lead to incremental innovation in some cases. This is beneficial for both of us. Our academic partners find opportunities not only to develop their theoretical knowledge but also to better integrate their students in markets”* CEO Alpha. Collaborative research led to the development of theses and dissertations for Beta and Gamma also. They are conducted in situations where firm needs align with the subjects proposed, as demonstrated by the following excerpt: *“We accept people whose subjects are related to our needs to generate mutual profit for them and for us at the same time”* (CEO Gamma). Although prioritization of universities and the firm depend on the context of each institution and the logic that governs them, mutual benefits can be generated from this difference [25]. The firm is

centred on the market, which needs immediate results. Whereas the university is focused on the production of scientific knowledge characterized by a cumulative character and are relying on multiple experiments and analysis. Many of the firms forming cooperation with the university developed special needs or have special difficulties that cannot be unravelled through internally held knowledge [25].

For Beta, when the firm is highly satisfied by the research result, the candidate will receive a hiring proposal as highlighted by the Human Resources Manager: *« when results of a research are positively evaluated, sometimes the candidate have an opportunity to be recruited, this is in general a suitable and desirable occasion for him”*. For the students, benefits are related to their development and integration into the market. These benefits are directly linked to learning opportunities that are not normally obtained with educational activities in the strict sense. One factor that supplements student development is the possibility of being close to market realities [10]. In accordance with [3], firms have the possibility of developing or improving products and processes, to resolve problems and to allow the hiring of competent personnel.

A specific result related to Omega appears another benefit for university. A course is assured by the Industrial Pharmacist manager to students at biotechnology institute. According to him this course is a channel to transfer not only practical technical knowledge and know-how to students, but also those who are most needed by the industry.

Collaborative R&D projects were not mentioned by respondents. When they were asked about R&D projects and activities, all of them confirmed that Tunisian pharmaceutical firms cannot realise large-scale R&D projects which are characterised by high costs despite the presence of human resource capabilities in each firm. In accordance with [18], pharmaceutical companies in developing countries cannot lead large-scale R&D programs because of their limited resources. Unlike other studies, anterior findings that have been found in the developed economies may not essentially apply to the context of African nations [2]. Moreover, when responds are asked about funding, all of them explain that funding is accorded by the firm to researchers and are limited to financing the joint project research needs. In this context CEO Gamma mentioned: *“we have limited resources, so university should provide much more financial and physical support for academics like provision of financial incentives, scholarships and grants to stimulate cooperation with firms. Working together can lead to much better results and innovation if the university is supported by public funds and infrastructure”*. In this context, deployment of research results doesn't presuppose that academic researcher receive financial incentives tied to prosperous commercialization of their studies. U-I collaboration is here influenced by research-driven behaviour rather than commercialization behaviour [11].

Another noticeable aspect is the localised relations in the short term and in the researchers and student's level. Most of responds mentioned that to be extended in the medium and long-term, these corporations must be based on mechanisms of governance that preserve the logic of the university and

the firm and that develop trust. The risk of losing control over the amount of information shared with the academic partner is mentioned. This is because there is disparity in the way of operating involving the firm and the university. This disparity is related to structure, culture, decision making, and orientation toward results [6].

The firm and the university's way of operating are different, especially regarding structure, culture, decision making, and orientation toward results [6]. Cassiman et al. [9] argue that researchers need to publish research results while business professionals want to preserve them secret. From an industrial perspective, firms have to control the volume of information shared with the academic partner through certain strategic tools of protection in order to hence the propensity to cooperate. Regarding the responds, U-I cooperations can be much more profitable for both when they will be supported by the political policy. In this sense, Elahi in [14] confirms that There is need for public participation to provide the structures, systems, resources, and sometimes the means to enhance university engagement with their social and economic environment.

Regarding the benefits to the university, results show that aspects mentioned appear in literature (transfer of knowledge and know-how, learning, joint research; training; access to equipment, materials, creating placement occasions for students) [11, 24]. In [13], authors classified these benefits into intellectual (access to new ideas and projects, inspiration for future research), and economic benefits (access to equipment, instruments, laboratories).

Even though, the accomplishment of universities' missions in the 21st century is supported by a large variety of funding, sources and investments. U-I collaboration in the Tunisian context suffers from the lack of financial resources. However, U-I collaboration can be profitable in the future through implementing formal mechanisms of interaction and significantly developing cooperative culture and values of both parties.

## 6. Conclusion

This research is one of the few studies to have tried understanding how U-I cooperation can be beneficial for the university in Tunisia. The importance of such relations has been discussed in many studies, but studies focusing on benefits from a firm level are still poor, especially in African context. Besides, results related to the four cases present similarities. This was intuitively expected because the cases studied are located within the same sector and their tangible and intangible resources remain largely the same.

Benefits include practical knowledge transfer, learning, joint research, accessing laboratory equipment and infrastructure, training opportunities, hiring graduates or postgraduates. According to pharmaceutical firms-university cooperation, benefits don't include securing funds researchers because of the limited firms' resources.

With regard to the level of interaction, most of the relations between the university and pharmaceutical firms are maintained

in the short term and in the trainee and researchers' level. This aspect is mentioned by [28] in the sense that is making it easier to create interactions related to activities arising notably from research.

This study indicates also that U-I relations should be supported by political policy. Many countries have moved in this way and have implemented policies to reinforce interactions between universities and firms to reach better economic performance supported by academic research [37]. Such policies contribute to involve modifications in legislation, conceiving support mechanisms that enhance U-I interaction and through which interactions between universities and firms are created [22, 25]. Like other African contexts such as Ghana [2], Tunisian university should be provided by adequate funds and infrastructure to develop and sustain U-I collaboration and to construct a collaborative environment. This represents the 'triple helix' configuration of the university where people from university, industry and government collaborate strongly to create new cooperative environments [16]. Results of this research can represent a beginning to advance studying U-I in Tunisia. In terms of study limitations, a qualitative study could be affected by several limitations that can cause doubt according to the credibility of the results. There were only 9 interviews, and it is not possible to generalize the results, which is a characteristic of the case studies.

To better understand U-I interaction in the Tunisian context, future studies are needed to extend the exploration of the benefits realized between parties to both level of analysis (firm and university). Furthermore, according to the limited interaction between the university and the Tunisian pharmaceutical industry, future studies must also investigate barriers that negatively influence the formation of these relationship and how to overcome them. It is essential to recognize the benefits obtained from U-I interaction, as well as to be aware of the barriers that inhibit the establishment and the development of these relations.

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