

The Effect of Foreign Owned Firms and Licensed Manufacturing Agreements on Innovation: Case of Pharmaceutical Firms in Developing Countries

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Abstract—Given the fact that the pharmaceutical industry is a commonly studied sector in the context of innovation, the majority of innovation research is devoted to the developed markets known by high research and development (R&D) assets and intensive innovation. In contrast, in developing countries where R&D assets are very low, there is relatively little research to mention in the area of pharmaceutical sector innovation, characterized mainly by two principal elements which are the presence of foreign-owned firms and licensed manufacturing agreements between local firms and multinationals. With the scarcity of research in this field, this paper attempts to study the effect of these two elements on the firms' innovation tendencies. Other traditional factors that influence innovation, which are the age and the size of the firm, the R&D activities and the market structure, revealed in the literature review, will be included in the study in order to try to make this work more exhaustive. The study starts by examining innovation tendency in pharmaceutical firms located in developing countries before analyzing the effect of foreign-owned firms and licensed manufacturing agreements between local firms and multinationals on technological, organizational and marketing innovation. Based on the related work and on the theoretical framework developed, there is a probability that foreign-owned firms and licensed manufacturing agreements between local firms and multinationals have a negative influence on technological innovation. The opposite effect is possible in the case of organizational and marketing innovation.

Keywords—Developing countries, foreign owned firms, innovation, licensed manufacturing agreements, pharmaceutical industry.

I. INTRODUCTION

REALIZING that the pharmaceutical industry is a sector where technology, regulation and competition dynamics are continuously changing, a sector based on science and innovation and known by intensive R&D investment, it is interesting to conduct a research on innovation in this sector. In addition, it is important to study this sector in order to clarify what are the mechanisms of innovation in the context of the developing countries.

With the rise of generics, patent extinction, rigorous regulations and the arrival of biotechnology drugs, innovation

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is becoming the “lifeblood” of pharmaceutical firms [1]. Developing countries are not spared from the changes affecting this sector in the world. This is due, among other things, to the strong presence of foreign owned firms in these markets, which are generally concentrated in science-based industries. In addition, these markets are connected to multinationals by the conclusion of licensed manufacturing agreements, which implies a technology, and organizational practices transfer [2]. However, the majority of academic research concerning innovation in this sector is oriented toward high-income countries known by a strong innovation intensity. The same results cannot be adopted in developing countries because of the firms' size, the resources devoted to R&D, the regulation and the demand capacity are largely different from the ones in big markets [3], [4].

To our knowledge, there is relatively little research to mention in the area of innovation in this case and still less in the pharmaceutical sector. This is due principally to the lack of data in these countries as well as to the absence of coordinated systems to disseminate it [5], [6].

The two principal elements that characterize the pharmaceutical industry in developing countries are the dominance of multinational affiliates and the licensed manufacturing agreements between local firms and multinationals. This comes down to the technological catch-up policies launched by these countries after their decolonization and their desire to reclaim technologies in order to integrate them into their production activities [7]. The main objective of this research is to know how these two elements influence innovation in pharmaceutical firms, in developing countries. In other words, we seek to know if the foreign owned firms and the licensed manufacturing agreements allow the transfer of technology, management and marketing knowledge that can boost innovation in pharmaceutical firms in developing countries.

This paper presents firstly, related work that examines the factors influencing innovation, especially foreign owned firms and licensed manufacturing agreements. Next, we attempt to draw a theoretical framework that shows the relationship between foreign-owned firms and innovation on the one hand, and on the other, the relationship between licensed manufacturing agreements and innovation.

II. RELATED WORK

A. Innovation Definition

Based on the Oslo Manual, innovation is “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” [8]. This definition shows that the innovation phenomenon is “multidimensional” and the analysis of this phenomenon should not be limited to the product or to the process novelty. It is better to encompass different aspects such as organizational and marketing practices [8]. This is because the innovation process is multidimensional and mobilizes the whole functions in the firm [9], [10]. Liouville [11] emphasizes this idea and recommends leaving the "dichotomous" vision that distinguishes between incremental and radical innovation and considering other dimensions such as the novelty for the market, for the firm, and in the management practices within the firm. Other authors endorse the same view and recommend that the firm has to embrace simultaneously technological and non-technological innovation [12].

Adopting the same approach, we seek to investigate the relationships between innovation and the two important elements, which are foreign owned firms and licensed manufacturing agreements, distinguishing between technological innovation that is closely linked to the product and the process innovation, and non-technological innovation, covering organizational and marketing innovation [8].

B. Factors That Influence Innovation

The literature review reveals many factors that influence innovation within the firms. Many authors focus on the R&D activities as the principal factor that drives innovation within the firm [13], [14]. However, examining R&D as a determinant of innovation seems more relevant in developed countries than in developing countries. In fact, the financial assets of pharmaceutical firms in developing countries are very limited to invest in R&D and to take on risk of failure [15].

Additional research shows also that the market, the sector structure and the institutional environment affect innovation [16]. Moreover, much research uses the size and the age of the firm as controlled variables because they influence the relationship among the previous variables and innovation [17]-[19]. Examining these mentioned factors as determinants of innovation is recommended but not enough in the case of developing countries where the context is more constraining. Therefore, we suggest that the reasoning should be linked to the characteristics of these markets, which are, the predominance of foreign-owned firms and the conclusion of licensed manufacturing agreements between local pharmaceutical firms and multinationals.

C. Role of Foreign Owned Firms and Licensed Manufacturing Agreements

Foreign-owned firms are also studied as a factor that influences innovation in the previous works conducted in

developed countries. Love et al. [20] demonstrate that the presence of foreign owned firms influence positively the innovation propensity in Scotland. Falk [21] examines the effect of foreign ownership on innovation in 12 European countries, and found that foreign affiliates are more innovative than domestic firms. They explained this result by the fact that owned firms are generally concentrated in science based industries. However, this result is not the same for firms in Eastern and in Western European countries, because the relationship between innovation and firm ownership is also influenced by other factors like the size and the age of the firm. In other study, authors find that the higher degree of involvement in innovation of foreign-owned firms is driven by the facilitating access export market, encouraging them to invest more in the firm's technology [2]. In contrast, the little research conducted in developing countries, especially in the field of the pharmaceutical industry, does not analyze the role it plays in both foreign owned firms and licensed manufacturing agreements in innovation. An empirical study conducted in the Tunisian market shows that foreign-owned firms innovate much less than domestic ones but it does not show the impact of this factor in each sector and in each type of innovation [22].

III. THEORETICAL FRAMEWORK

In the absence of a theoretical model that examines the effect of the foreign-owned firms and licensed manufacturing agreements on innovation in pharmaceutical industry, especially in the context of developing countries, we try in this section to draw a theoretical framework that helps us to examine this effect.

It is important to emphasize that the technology and knowledge transfer by multinationals to their affiliates is not systematic. It depends on the cost of the transfer, the absorptive capacity of the affiliate and the innovation ecosystem in the host country [4]. In the same line, it is demonstrated that the technological transfer process from multinationals to their affiliates depends on the degree of implication of the affiliates in this process [23]. It depends also on multinationals' real motivation behind the affiliate creation. Is it an autonomous entity in terms of its technological level or just a means to penetrate markets?

In the case of developing countries, many authors show that there is a delay in the development of innovation caused principally by the structural constraints and by the absence of an innovation ecosystem in these countries. In fact, the educational system and the gap between the university and the industry are not facilitating the development of the firms' absorptive capacities [24], [25]. Moreover, R&D activities, in developing countries' context may be limited to the assimilation of foreign technologies and to the adaptation of its manufacturing process to the newly acquired technologies [26].

Another research concerning “Newly Industrialized Countries” reveals that domestic firm probability to innovate is much higher than foreign owned firms'. This is probably because the main objective of the latter firm is not to increase

the technological capabilities of its affiliates. This research also shows that the technology transfer may take place through licensing agreements because of the strategic information included in these agreements. However, this fact is not systematic because it can contain some restrictive clauses that may limit the technology transfer. In addition, it can create a kind of dependency within domestic firms, willing to focus more on the launch of the activity without taking any care of bettering their product output [27].

In order to examine the effect of foreign-owned firms on innovation in pharmaceutical companies located in developing countries, we formulate the following hypotheses:

- H1: In developing countries, foreign-owned firms have a negative relationship with product innovation.
- H2: In developing countries, foreign-owned firms have a negative relationship with process innovation.
- H3: In developing countries, licensed manufacturing agreements have a negative influence on product innovation.
- H4: In developing countries, licensed manufacturing agreements have a negative influence on process innovation.

In the pharmaceutical sector, the transfer of organizational and marketing practices is ensured among the multinational and its affiliate. The affiliates invest more in their marketing and promotion strategies to facilitate and deepen market access of new imported pharmaceutical products from the parent company. This decision is aligned with the global strategy of the parent company. In the pharmaceutical product lifecycle, it is relevant to mention that after R&D activities, the parent company’s main objective switches to market access and sales activities, which become a priority [28]. A huge expenditure is devoted to support the sales force and to consolidate the firm’s market share [29], [30].

Affiliates also invest in their internal structure to align it with the parent company's overall strategy. Therefore, even if the innovation of the new molecule took place in the parent company, changes in the organizational and marketing process can be imposed to the affiliate and can probably activate a non-technological innovation.

In the case of licensed manufacturing agreements, local firms, both domestic and affiliates, manufacture innovative drugs for multinationals that are usually dedicated to export. Technological assistance and training are provided to local firms in order to make their production meet the required standards. These agreements create a kind of link between domestic firms and occidental firms which can probably allow managerial and marketing knowledge transfer [27]. This leads us to the following hypotheses:

- H5: In developing countries, foreign-owned firms have a positive relationship with organizational innovation.
- H6: In developing countries, foreign-owned firms have a positive relationship with marketing innovation.
- H7: In developing countries, licensed manufacturing agreements have positive influence on organizational innovation.
- H8: In developing countries, licensed manufacturing

agreements have positive influence on marketing innovation.

The formulated hypotheses will be tested by using the model presented in the next section.

IV. PREDICTION MODEL OF PHARMACEUTICAL INNOVATION DETERMINANTS (PMPID)

In order to predict the relationship among innovation and the selected elements, which are foreign-owned firms and the licensed manufacturing agreements, we use an econometric model based on a logistic regression. We title the model “Prediction Model of Pharmaceutical Innovation Determinants (PMPID)” because it can help to reveal the most important factors that drive innovation in the pharmaceutical firms located in developing countries.

In this section, we present the model specification, the motives of the model selection and the methodology that we use in order to collect data.

A. Model Specification

It is important to emphasize that the studied phenomenon in this paper is innovation in the pharmaceutical firms in developing countries. In addition, the study analyzes innovation as a phenomenon that encompasses many forms, which are product innovation, process innovation, organizational innovation, and marketing innovation. These latter, represent the dependent variables in the proposed model and are presented in Table I below:

TABLE I
DEPENDENT VARIABLES

Product innovation	Y_{prod}	<ul style="list-style-type: none"> “1” if the firm makes a product innovation in the last three years “0” if not
Process innovation	Y_{proc}	<ul style="list-style-type: none"> “1” if the firm makes a process innovation in the last three years “0” if not
Organizational innovation	Y_{org}	<ul style="list-style-type: none"> “1” if the firm makes an organizational innovation in the last three years “0” if not
Marketing innovation	Y_{mark}	<ul style="list-style-type: none"> “1” if the firm makes marketing innovation in the last three years “0” if not

The explanatory variables are principally foreign-owned firms and licensed manufacturing agreements. However, other independent variables revealed in the related work as “traditional” factors that influence innovation within the firm, will be included in our model in order to be more exhaustive [22], [27], [31], [32]. It concerns, the age and the size of the firm, the R&D activities, the competition, and the market structure.

In order to measure the variable size, some studies use the turnover of the firm; others use the number of the permanent

employees [22], [27], [33].

The R&D activities show the engagement of the firm in such activities [22].

The Concentration Ratio (CR) can represent the market structure. It is equal to the market share of the four largest firms in the industry [27].

The pressure of the competition can be represented by the "imports" and "exports". The first one represents the pressure of imports in domestic markets and the second is the pressure in export markets [27].

As shown in Table II, the independent variables are gathered into three groups, which are control variables, internal variables and external ones.

TABLE II
EXPLANATORY VARIABLES

		Represented by the number of employees. It takes "1" if the employee's number is higher than 200, and "0" if not.
Control variable	Size	
	Age	It takes "1" if the age of the firm is less than 10 years and "0" if not
Internal variables	R&D activities	If the firm has conducted R&D activities in the last three years, this variable takes number "1", if not, it takes "0".
	Foreign owned firms	If the interrogated firm is a foreign owned this variable takes "1", if not, it takes "0".
	Licensed manufacturing agreements	If the interrogated firm has concluded a licensed manufacturing agreement in the last three years, this variable takes "1", if not, it takes "0".
External variables	Market structure	CR4
	Competition	Imports= the proportion of imports of drugs in the internal demand exports takes one "1" if the firm exports, and "0" if not.

The adopted model PMPID is presented as the following functions:

$$\begin{aligned}
 Y_{\text{prod}} &= F_{\text{prod}}(X1, X2, X3) + \epsilon_{\text{prod}} \\
 Y_{\text{proc}} &= F_{\text{proc}}(X1, X2, X3) + \epsilon_{\text{proc}} \\
 Y_{\text{org}} &= F_{\text{org}}(X1, X2, X3) + \epsilon_{\text{org}} \\
 Y_{\text{marke}} &= F_{\text{mark}}(X1, X2, X3) + \epsilon_{\text{mark}}
 \end{aligned}$$

F_{prod} , F_{proc} , F_{org} , and F_{mark} are the logistic regression functions corresponding to the product, process, organizational and marketing innovations. It takes the following form:

$$\begin{aligned}
 Fi &= \alpha_{0i} + \alpha_{1i} \text{ Size} + \alpha_{2i} \text{ Age} + \alpha_{3i} \text{ R\&D activities} \\
 &+ \alpha_{4i} \text{ Foreign owned firm} + \alpha_{5i} \text{ licensed agreements} \\
 &+ \alpha_{6i} \text{ market structure} + \alpha_{7i} \text{ imports} + \alpha_{8i} \text{ exports}
 \end{aligned}$$

α_i are parameters to be estimated, $X1 = (\text{age, size})$, $X2 = (\text{R\&D activities, foreign owned firms, licensed manufacturing agreements})$, $X3 = (\text{market structure, competition})$, ϵ_{prod} , ϵ_{proc} , ϵ_{org} , and ϵ_{mark} are the error term of Normal Distribution.

B. Motives of the Model Selection

We develop the PMPID in order to be a model devoted to analyze innovation determinants in pharmaceutical firms in developing countries. The PMPID is based on a logistic regression, which is the most appropriate method to expose the relevant variables that influence innovation. Much

research use logistic regression in order to study innovation in different area such us tourism and agri-food sector [33], [34]. However, these studies are limited to only one form of innovation, which is the product innovation. The model that we suggest is broadest because it encompasses the four types of innovation presented in the Oslo Manual [8]. Moreover, it is important to mention that the logistic regression is the appropriate method that allow analyzing the effect of explanatory variables, as shown in Table II on the dependent variables presented in Table I [22], [31]. The following points motivate our approach of applying this method in this case:

- 1) Innovation is a qualitative variable presenting a characteristic. It can be binary (yes or no), ordinal if we analyze innovation in terms of degree (weak, medium or strong) or nominal if we need to analyze innovation in terms of forms (product, process, organizational and marketing);
- 2) Innovation is not a continuous variable;
- 3) The explanatory variables do not need to ensure the condition of normal distribution.

C. Methodology

The empirical study will be conducted in the Moroccan market. A research questionnaire is being prepared and being administered to the local pharmaceutical firms in order to explore the relationships among foreign-owned firms and different forms of innovation, on the one hand, and the relationship between licensed manufacturing agreements and innovation with all its aspects, on the other. The questionnaire is designed in such a way that allows the collection of all the information required to conduct a binary logistic regression. To qualify the behavior of the targeted firms in terms of innovation, we use innovation items recommended in the Oslo Manual [8]. Binary questions will be addressed in the questionnaire to assess how, among other variables, foreign-owned firms and licensed manufacturing agreements influence innovation in developing countries. One of the important steps to carry out before the administration of the questionnaire is to plan several interviews with the experts in the industry in order to place the developed model in the studied context and bring out other latent variables that make the model more adequate.

V. CONCLUSION

In developing countries, the pharmaceutical sector is principally characterized by the predominance of foreign-owned firms and licensed manufacturing agreements between local firms and multinationals. Studying the effect of these two elements on innovation will provide academic research with important insights into the degree of implication of local firms in technology, management and marketing knowledge transfer. Moreover, the model that we propose to apply will help to examine the role of the "traditional" determinants of innovation in our context as well. Finally, with the multinomial logistic regression, we can explain not only one form of innovation, but all the dimensions of innovation which are product, process, organizational and marketing.

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