Strategic Innovation Search by Firms in Weak National Systems of Innovation: The case of the Jordanian Generic Drug Industry

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ABSTRACT

This paper examines why and how some firms embedded in weak National Systems of Innovation out-perform others in their innovation performance. It investigates how strategic practices associated with participation in international collaboration, specifically strategic search, contribute to different types and degrees of innovation. The research is an exploratory study. It is based upon an innovation survey of 17 local pharmaceutical firms in Jordan, and detailed case studies of the four leading firms. It identifies how the firms perform strategic search for international collaboration, and how this influences the innovation performance. A key factor influencing the degree of participation in international collaboration is management pro-activeness in the search and sense-making process. Informal and direct sense-making appear to be more important than formal sense-making in explaining differences in terms of the firms' participation in international collaboration. Informal and direct sense-making facilitate firms to participate in highly integrated deals such as joint ventures and RandD acquisition, which are associated with higher innovation performance. In addition, the research identifies specific organizational practices that support greater senior employee involvement and integration during strategy decision- making contribute to improved international collaboration and innovation performance.

Keywords: Open Innovation, Pharmaceuticals, International Collaboration, Sense Making, Innovation Management, Emerging Economy.

INTRODUCTION

Many studies have proposed generic prescriptions for good practices to support collaboration and open innovation, in particular strategies for searching for external sources of and partners for innovation (Chesbrough, 2004; Dodgson, 2000; Henttonen, Ritala, and Jauhiainen, 2011; Afuah and Tucci, 2013; Suh and Kim, 2012; Teece, Pisano, and Shuen, 1997; Tidd and Bessant, 2009). However, most of this work has emerged from research in the industrialized economies. This paper examines the relevance of strategic search and collaboration for firms in the context of an emerging economy, characterized by a weak National Systems of Innovation (NSI)[1].

The central idea of open innovation is that firms search outside their own boundaries to gain access to external ideas, knowledge, and technology (Blau, 2006; Farrington, Crews, and Blenkle, 2013). A strategy of open innovation requires firms to realign innovation strategies to extend beyond the boundaries of the firm, while creating mechanisms for appropriating value from the combined innovation (Poot, Faems, and Vanhaverbeke, 2009; West and Gallagher, 2006). Pavitt

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Received on 1/1/2013 and Accepted for Publication on 30/10/2013.

[1] Scholars of NSI (eg, Freeman (1987); Edquist (1997); Lundvall (1992) and Nelson (1993)) focus on "national" boundaries as a main unit of analysis, and define this approach in terms of determinants of, or factors influencing, the innovation process.

(2003) argues that these processes have two dimensions for innovation as they help a firm (1) to leverage existing assets into new and/or related business, and (2) to combine and recombine assets to establish new business and address new markets. Firms in emerging economies context cannot rely solely on their own resources or the resources embedded in their national context (Hobday, 1995; Kim, 1997). Pursing open innovation through participation in international networks is one path to innovate and to move up the value chain (Battistella and Nonino, 2012; Forbes and Wield, 2002).

The importance of this study comes from its context. Jordan is poised between developing and middle-income country status, and characterized by a weak National Systems of Innovation (NSI) (Jeflat, 2002). Despite its national policy to facilitate export/import promotion, Jordan still has a weak scientific-technological infrastructure and no explicit national innovation policy for science and technology (Sultan and Soete, 2012). However, despite the weak NSI, some Sectoral Systems of Innovation (SSIs) are stronger than others, especially in the generic drug sector. Moreover, within this sector there is a significant variation in firms' innovation performance. It was found that Jordanian generic manufacturers adjust their innovation strategies to be able to innovate not only at the local or regional level, but also at the international level (Abuhamad and Tidd, 2008). More specifically, it was found that the adoption of open innovation and participation in international markets are playing an increasingly important role for Jordanian generic drugs producers. This paper is motivated by a desire to understand better why and how some firms out-perform others in their innovation performance, despite being embedded in the same sectoral and national system of innovation. The focus is to explore how the firms' strategic search practices toward pursing open innovation are associated with the different levels of participation in international collaboration and the different types and degrees of innovation.

This paper is organized as follows. Section 2 reviews the relevant literatures and potential explanations for the observed variation in firms' innovation performance and participation in international collaboration. Section 3 describes the research objectives and the research questions. The methodology, the sample used in the study and the research conceptual framework are described in section 4 and section 5. Section 6 presents the research results. Section 7 discusses and concludes the major findings. Finally, limitations of the research and implications for future research are suggested in section 8.

2. Strategic Search, International Collaboration (IC) and Innovation

Open innovation is a powerful framework encompassing several core strategies that facilitate learning processes and enhance firm's innovation performance. It involves the acquisition of a partner's knowledge or technology, interpreting and spotting new opportunities for participation in international markets, and integrating the new knowledge within the firm's internal existing knowledge (Salge, Farchi, Barrett, and Dopson, 2013; Cohen and Levinthal, 1990; Kirschbaum, 2005; Lichtenthaler, 2008). Yun-Hwa and Kuang-Peng (2010) argue that accessing knowledge from a limited number of external channels, i.e. open search depth, can facilitate incremental innovation performance, while accessing knowledge from a broad range of external channels, i.e. open search breadth, can enhance radical innovation performance. Henttonen and Ritala (2013) introduce the concepts of focused search strategy and multi-focus search strategy as differentiating factors for performing open innovation. Those strategies are normally associated with external technology acquisition or exploitation such as sense-making,

and integration and involvement processes (Kirschbaum, 2005).

Laursen and Salter (2006) argue that the way firms performs search strategy and go about sensing the external environment and organizing the search for new ideas, technology and collaboration, plays a main role in influencing a firm's innovation performance. They found that a firm may attain a strategic information advantage or disadvantage depending on how sense-making is conducted. The literature identifies several modes of sense-making for collaboration (Aguilar, 1967; Morrison, Renfro, and Boucher, 1984; Nastanski, 2004) and argues that these sense making processes for external environment influence the openness of the firms to external knowledge and also have a large impact on the firm's innovation behavior (Chiesa and Manzini, 1998; Supphellen, Haugland, and Korneliussen, 2002).

Nijssen et al.(2001) argue that the scanning process could be either active or passive depending on firms' intention to actually find new partners. A passive sense-making mode for collaboration occurs when no active effort is made to scan for a potential partner. In this case, the new potential partner takes the initiative and the criteria of passive scanning are obscure, unspecified, and only *ad hoc* decisions are made as a result (Morrison et al., 1984). An active sense-making process implies active information scanning, interpretation and action processes about the internal and external environment e.g. partner, customers, competitors, suppliers and technology (Thomas, Clark, and Gioia, 1993). Active sense-making provides a firm with the external intelligence that policy-makers use in planning, decision-making and strategy formulation (Daft, Sormunen, and Parks, 1988). It also helps the firm to remain up-to-date with any new technology or market needs, and spot new market opportunities (Galunic and Rodan, 1998; Kogut and Zander, 1996).

Frishammar and Horte (2005) identify two forms of active sense-making and evaluation processes including formal and informal sense- making. A formal sense-making process involves formal techniques such as market research, a competitor analysis system, or a formalised intelligence-gathering system. Informal active or directed sense-making mode is an active scanning but relying more on the firm's top management personal contacts and sources of information (e.g. top management networks, political back ground, international or regional experience, informal gatekeepers, etc) and pro-activeness. In informal sense-making for collaboration, the criteria for the selection of a specific partner and a specific collaboration form are known and well clarified in advance especially for the top management.

Thus, it is expected different search processes to contribute in various ways to the level and type of international collaboration, which in turn influence the type and degree of innovation. In addition, it is expected organizational practices which involve and integrate senior staff in these processes to contribute directly and indirectly to innovation.

3. The Research Objectives and Research Questions

This study is an exploratory study that deals with a relatively unexplored topic through the use of in-depth case studies. The overall objectives of this study are to investigate the main factors influencing the innovation performance variances across some leading Jordanian generic drug producers. In other words, to explore how and why some Jordanian firms embedded in the same weak NSI and SSI differ in the way and rate they perform innovation, and whether there is an association between participation in international collaboration and firms' innovation performance.

More specifically, this study aims to analyse how strategy decision-making processes is associated with

different levels of participation in international collaboration, and the degree and type of innovation the firms performed. Also to examine to what extent the good practices and methods of innovation strategy[2] management developed in the advanced economies (UK, USA, etc) are valid and relevant in the Jordanian context. In dealing with these objectives, the study is trying to address:

1. How the firms' management practices in scanning process are associated with the different levels of participation in IC and the different types of innovation a firm performed.
2. How participating in different levels of IC are associated with the type and degree of innovation performed by a firm.

4. Research Design and Methods

Accordingly, the research employed a mixed methods approach (i.e., quantitative and qualitative). An innovation survey was conducted across 17 generic locally owned firms in order to justify the innovative firms, and to understand the nature of innovation in pharmaceutical firms. More specifically, the aim of the survey is to investigate the main characteristics of the Jordanian generic drug producers, e.g., size, market, ownership, etc, and their innovation behavior. The survey was developed based on the Community Innovation Survey – Manufacturing Sector (CIS III). In addition some innovation surveys used in developing countries such as Chile, Turkey and Malaysia, which focused on specific issues related to the research, were also used. The questionnaire considers the parts that help to evaluate the innovative behavior of the firm including basic economic information about the firm (e.g., exports of good and services, number of employees, etc), product innovation issues, process innovation issues, and innovation co-operation issues.

In addition, several databases, available in the Jordanian Association of Manufacturers of Pharmaceuticals and Medical Appliances (JAPM), Higher Council for Science and Technology, Ministry of Industry and Trade, and even in some pharmaceutical firms (e.g., administrative records, the annual reports, etc), were investigated to audit innovation outcomes (number of licensing agreements, number of patents, etc) in pharmaceutical firms (Afram, Lloyd, and Sayegh, 2004; Creswell, 2003; JNCT, 2003; Matalqua, 2001). This quantitative approach helped select the case studies of the research as well as provided a feedback about the innovation behavior of the Jordanian generic firms.

Since the research is exploratory in nature and involves an in-depth understanding of firm's behaviour and the reasons that govern its behaviour, the research employed mainly a qualitative approach in the research design. Several interviews with the key managers (e.g., CEOs, RandD managers, business development managers, etc) in the four case studies were conducted. Furthermore, some examples for projects that have already been completed and some that were still in progress were considered. The research also investigated the four case studies' databases, their archive records and websites. Case study strategy provides the opportunity for an extensive and in-depth study of the management practices and methods, and the effects of NSI and national culture on these practices. Yin (2003: 13) suggested that a case study is "*An empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clear*", in other words, between strategic decision practices and methods, and the context surrounding them such as national culture and NSI.

Multiple sources of evidence were used including firms' documentation, archival records, and interviews.

[2] That is defined as synthesizing dynamic corporate strategies in a turbulent and complex environment

For instance, several interviews with the key managers (e.g. CEOs, RandD managers, business development managers, etc) in a four case studies were conducted as shown in Appendix 1. Furthermore, some examples for projects that have already been completed and some that were still in progress were considered. Although each of those sources of evidence had specific weaknesses, combining and triangulating them maximized the benefits and helped to deal with the problems of establishing the construction validity (i.e. establishing correct operational measures for the concepts being studied) and reliability (i.e. demonstrating that the operations of a study such as the data collection procedures can be repeated with the same results)[3] of the case study. Issues such as subjective perceptions and interpretations of the interviewee were, to some extent, remedied by conducting several interviews with the people who were involved in decision-making in the company. Furthermore, their views were confronted with other more formal sources of information such as policy documents and annual reports. The triangulation of information, as shown in figure1, helped to clarify how the available information could be reduced; it also helped to decide what information derived from the interview could be used for constructing a proper view of the actual processes of the firm's decision-making. Multiple sources of evidence essentially "*provide multiple measures of the same phenomenon in the research and rise the advantage of discovering any contradiction or fresh perspectives*" (Creswell, 2003).

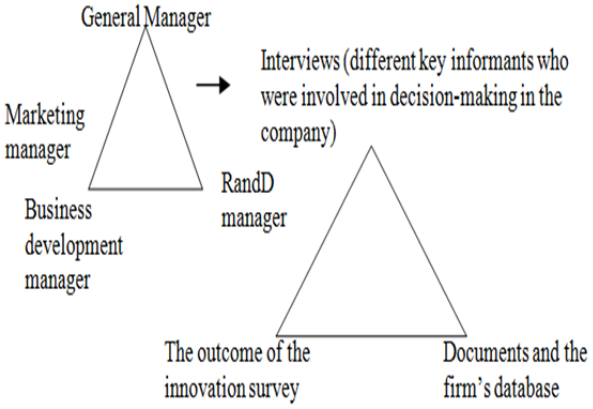

Figure 1. Maintaining triangulation of information

5. The Research Conceptual Framework

Based on the findings of previous research and in-depth interviews with the four case studies, a conceptual framework was developed for exploring the research core questions and explaining the variances across firms' innovation performance and participation in IC. Through this framework, the research argues that the participation in IC is an outcome of management's pro-activeness in the search processes for a potential partner. Furthermore, the research argues that firm's innovation performance is an outcome of the level of a firm's participation in IC. The research conceptual framework was built on four independent variables and two dependent, as shown in Figure (2).

[3]The reliability of the measure is preserved through using semi-structured interviews across the four case studies, through using case study protocol, and developing a case study database.

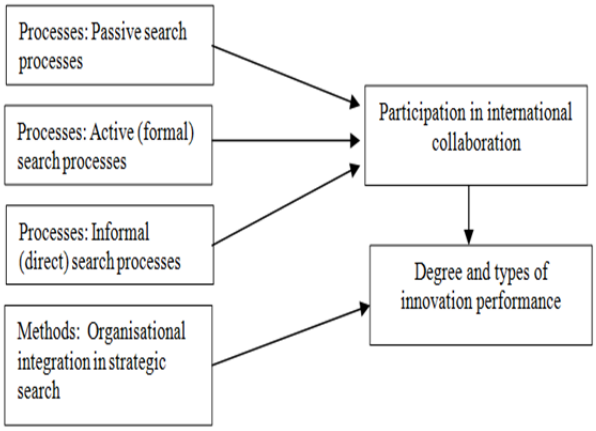

Figure 2. Research framework- the relationships explored in the study

While participation in international collaboration is operationalized as the level of integration associate with the collaboration deal as clarified in Figure (3), firm's innovation performance is operationalized in terms of the dominant type of innovation (process or product innovation) and degree of innovation (basic, intermediate and advanced level).

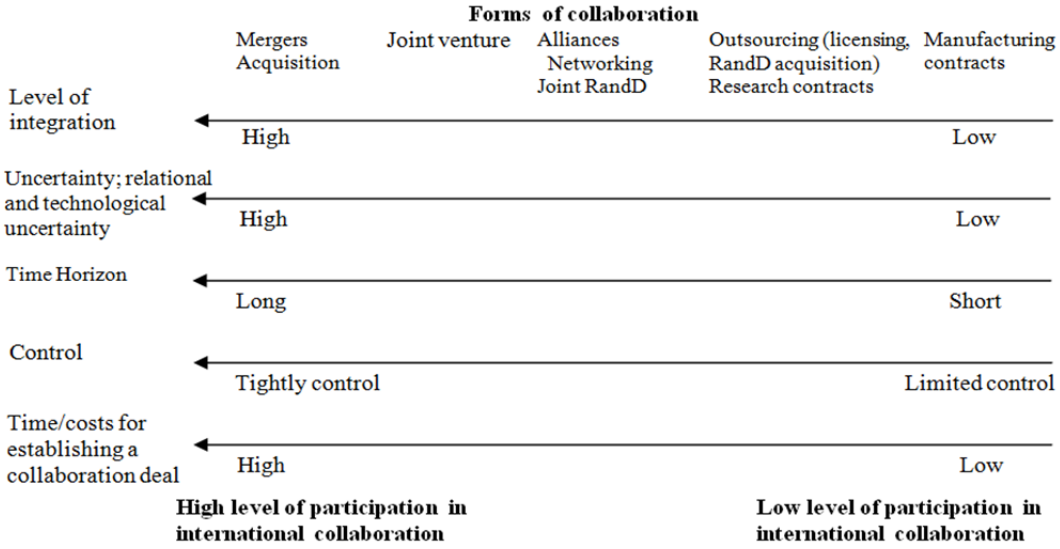

Figure 3. How the degree of participation in international collaboration was operationalized

6. Strategic Search and Integration Mechanisms for Open Innovation – The Research Results

The survey of pharmaceutical firms in Jordan, combined with industry and company data, revealed an association between the degree of 'openness' of innovation and performance, as illustrated in Figure (4). This formed the basis of the sub-sample of four leading firms chosen for more detailed case study.

These observed variations in participation in international networks and innovation outcomes can to a

large extent be explained by differences in the strategic search practices adopted and organizational processes to involve and integrate senior staff from different functional groups. Henttonen and Ritala (2013) found that applying one focused search strategy intensively generally enhances the firm-level innovation performance. Moreover, they found that emphasizing multiple search strategies intensively improves performance even more, and that the effect becomes stronger, the greater the number of knowledge sources used. Bucic and Ngo (2012) found that inbound open innovation activities and internal search processes contribute to collaborative innovation and help increase the innovativeness of the firms by monitoring the operating environment and enabling them to source knowledge from collaborative partners. This research reviews each case in turn and identifies the search practices and integration processes.

FIRM A

FIRM A's strategic sense-making processes for collaboration are characterised by a passive sensing mode. FIRM A performed only three collaboration deals; two manufacturing contracts with two regional firms and one packaging deal with a Korean firm. FIRM A promotes its profile through many e-marketing pharmaceutical websites as a way of attracting other foreign partners. However, no real active efforts are made to approach any other partner. Based on the other partner's proposals, FIRM A set up the criteria to negotiate a collaboration deal. However, it does not have autonomy to set its own objectives, but to adapt its objective to win the deal.

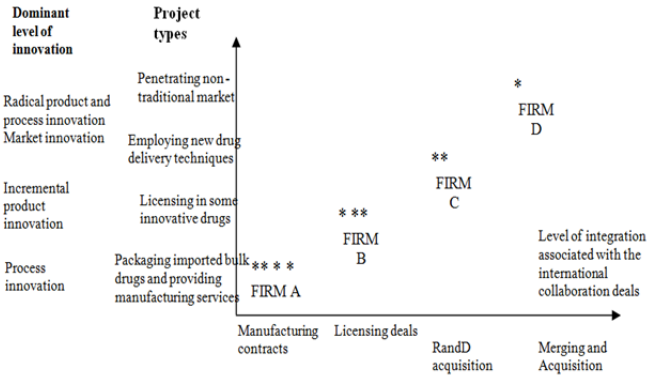

Figure 4. Variation in firm participation in international collaboration and innovation performance - adapted from (Abuhamad and Tidd, 2008)

With regard to how it carried out the Korean partnership, the marketing planning manager contends that "*the collaboration arrangement started when a British company, the dealer of some Korean drugs approached FIRM A through one local drug store distributor. As the potential market of some of these drugs is a tender market, and to give these drugs a Jordanian privilege*[4]*, the British company contacted us along with many local pharmaceutical companies in Jordan. They provided us with some samples of the potential drugs, around 15, enquiring as to whether or not a manufacturing or packaging deal could be agreed*". In describing the strategy decision-making process used to perform this deal, the marketing planning manager adds that "*Meanwhile, our marketing department conducted several studies for the feasibility of their offer. In parallel, the technical issues and the possibility of conducting that deal were also examined, assessed and analysed by the deputy manager-assistant general manager for technical issues…. The legal division also investigated the intellectual property of*

[4] The Jordanian government usually gives priority, when offering the tenders, for local manufacturers as a kind of support for local industry.

these drugs and possibility of registering it with the Jordanian FDA and the possibility to market it in the target market." In assessing any new opportunity for collaboration, FIRM A's deputy manager maintains that "*the process always starts in the marketing department, in particular the business planning division….. If the analysing and assessing processes require the involvement of any other departments, contacting them follows the firm's hierarchal structure".*

Regarding the people who were involved in the final decision to perform the project, the marketing planning manager states that "*when the company signed the Korean deal only the company's CEO, the deputy manager and the marketing manager were involved in the assessment and evaluation processes. As the deputy manager is himself the technical manager, it's supposed he has all the required information in terms of the firm's manufacturing capability for manufacturing contract or packaging deals. However, the RandD division were not involved in strategy decision-making for that deal*".

FIRM B

In contrast, FIRM B rarely plays a purely passive role during the sense-making process. It performs formal active sense-making. FIRM B's assistant general manager maintains that "*our collaboration deals are taken up through three steps. The first step is when we identify a specific opportunity and contact several regional or international firms for a collaboration proposal, the second when one international manufacturer looks for a distributor in the Middle East area, the third when the agent – a drug store – of one international company, searches for local manufacturers. We present our profile and needs through our website. We also participate in many e-marketing pharmaceutical websites*".

He adds "*searching and identifying any potential opportunity for growth, at first, started from FIRM B's objectives. In line with the main objectives of the continual developing of new drugs, such as brand generic or innovative drugs through licensing in or packaging agreements, or penetrating a new market, searching new opportunities start from the marketing department*". The assistant general manager stressed that selecting the collaboration form usually depended on the content of the deal (i.e. the technology underpinning it, the available opportunity, the partner's offer, etc). FIRM B's assistant manager advised that "*In many cases, a product produced under license has already met with success and has a proven track record. The fact that a licensed product was developed in another country can lend prestige to your home market sales efforts*". In scanning the international market for potential licensors, FIRM B prefers partners who are well known and with whom they have had previous successful ventures. The assistant manager contends that this helps the firm in reviewing the product opportunities, negotiating the license agreement and implementing the production of the new product within a significantly short time zone.

Moreover, FIRM B performed informal sense-making but only at the regional level. For instance, based on the top management network and contacts, the company was able to carry out a joint venture deal in Algeria. Assistant manager RandD and (Development and Special Projects) DandSP maintains that "*We thought, at first, to out-license the eye drops technology to one Algerian company. The Algerian market is a big market, however it is well regulated. The Algerian government implemented many regulations to encourage foreign investments and to protect the Algerian local generic manufacturers. Based on the general manager's contacts*[5]*, my department started contacting Saidal to establish a joint venture. The Algerian market is new*

[5] His participation in the JAPM association enabled him to have good contacts with some people in this company.

and not well understood. For us this project helped to commercialise our own products and to protect our technology."

In assessing any opportunity to pursue open innovation and collaboration, FIRM B set specific mechanisms and integrate several departments across the firm. FIRM B assigns a "New Drug Committee (NDC)" to be responsible for scrutinising innovation projects (i.e. thinking carefully about how innovation projects fit into the firm's overall strategy, and the firm's technology, skills, resources) and is led by the assistant manager. FIRM B's assistant general manager asserts the importance of the NDC in proceeding with any potential opportunity, and maintains – after describing the search processes for any potential opportunity for growth or collaboration "*then specific suggestion forms are applied to the New Drug Committee team. The NDC then defines the key areas of the business and identifies any opportunity that is viable economically. This team is also responsible for examining any external request for collaboration…. The decisions to invest or conduct any project are made jointly between the CEO and the assistant general managers (the director of RandD and Development and Special Projects and the director of marketing and sales departments). If the project is concerned with introducing a new generic drug, the technical division goes ahead to formulate it. If it is about an innovative drug or penetrating a new market, the DandSP department contacts the potential firm for some kind of collaboration*".

FIRM C

FIRM C also performs an active sense-making mode for collaboration. For example, FIRM C participated in the ICSE/CPhI international exhibition to establish new contacts, spread awareness of the company in Europe and worldwide, and explored new ventures in the pharmaceutical business. As an outcome, the company secured a US$50 million contract manufacturing with Germany. FIRM C developed its profile and participated in many e-marketing pharmaceutical websites, such as Pharma-licensing Company. It also uses the many pharmaceutical newspapers to establish itself as a known entity in the international arena. As recalled by the general manager "the *scanning process for any potential collaboration opportunities normally started from the business development department or business planning team…. choosing a licensing deal for producing innovative drugs depends more on the available opportunity and the other partner's offer. Before approaching the other partner, we ensure that we have the ability to win the deal and that our capabilities fit, or could be extended to, match the available opportunity*".

FIRM C also conducted a direct sense-making mode when it undertook an acquisitions deal but at the international scope. FIRM C acquired an RandD company specialised in transdermal patch technology and took over the intellectual property, processes and know-how including all the finished and intransient products of Stowic Co Ltd, a British small-medium RandD company that had a patch technology. The idea for the project came through FIRM C's CEO. The firm's CEO had several contacts with different international pharmaceutical firms. He outlined some broad, challenging goals for the new project: "*to be the first to introduce this technology in MENA in a commercially feasible way*". The CEO then defined the most important technical sequences and critical decision points. Through his communication network, he employed some experts in transdermal patch technology. The general manager recalled that " *at that time this was the only option available for us for achieving growth…..To penetrate the local and regional market and to expand our business, we looked at different technologies through drug delivery systems. Patch transdermal technologies was*

considered. As we did not have the capability to develop this technology in-house, and due to the time pressure, we looked for some kind of partnership arrangement with a firm that is a specialist in this technology. With this in mind, we hired specialist people who were experienced in patch technology and related fields". The general manager advised that the people who were involved in that agreement were the owners, the general manager, the company's lawyer, and the RandD manager. The choice of partner took into account factors such as how much knowledge the partner had to enable the easy transfer of the technology, and the business opportunities. FIRM C found that the acquisition of Stowic Transdermal Technology was the most advantageous way for the firm to grow. The business development manager claims that "*at the time we carried out the deal, the idea was how can we penetrate the local, regional and international market and achieve market penetration …. Now we are one of the nine companies in the world that have this technology*".

In performing an RandD acquisition project, FIRM C established a Development and Special Project (DandSP) division in the business development department to be responsible for carrying out the project. With regard to how FIRM C carries out any new collaboration project, the general manager advised that "*In addition to the RandD department, the marketing department usually works closely with the business department – DandSP division – staff to ensure the feasibility of any collaboration project."*

FIRM D

FIRM D also performs an active sense-making mode for collaboration but with more vigour than FIRM B and FIRM C. In organising strategic search, FIRM D established a specialised licensing department for scanning and contacting international firms for any available and feasible licensing opportunities. FIRM D's licensing division claims that "*Our task is to search for and contact any potential partner for any potential innovative drug with proven success in another market. Then several business plans are prepared. The decision to conduct any plan is taken by FIRM D's CEO, and business development manager*". In introducing new drugs through pursing open innovation, FIRM D's licensing division manager asserts that "*our role begins when the business development manager decides to go the license-in or 'drug master file' purchasing option. Through investigating the generic or innovative drugs database, pharmaceutical companies' profiles, or pharmaceutical campaign magazines, we identify potential partners. Sometimes upper management recommends some partners based on their previous experience.*" She adds "*By producing products under license, you take advantage of other companies doing your product development work for you. You can acquire the rights to a fully developed new product under license for as little as 10% of its actual development costs*".

FIRM D also conducted a direct sense-making mode when they acquired the Instituto Biochimico Pavese Pharma (IBP), the Italian pharmaceutical company which specialised in manufacturing liquid and Lyophilized injectables, e.g. vancomycin. Through the CEO's connections, the Italian company, IBP, was identified. FIRM D established a pure project-based department (called business Development for Special Projects (DandSP)) to deal solely with acquisition projects. The business DandSP manager contends that "*FIRM D established a 'problem solving team' to address any particular problem. The membership of this team comprised of people who know how to deal with the problem*". He adds "*In the Italian acquisition deal, several teams were set up to evaluate IBP facilities, the possibility of upgrading and exploiting the existing*

facilities, and the feasibility of the project. These teams include representatives from RandD, technical, business development, engineering, and marketing departments". The DandSP department played the main role in completing the acquisition process of the Italian firm. This department had all the responsibility of conducting the acquisition project tasks. These include identifying clearly defined guidelines and deadlines for the project, identifying the expected results and the expected contribution of each partner in terms of resources and procedures necessary for the acquisition deal (plant, technological skills, time, money, etc), defining the control mechanisms for quality or performance control.

7. CONCLUSION

Table (1) summarizes the mechanisms that four firms used to perform strategic innovation search toward open innovation. The research findings show that the strategic search practices for collaboration influence the firm's level of participation in international collaboration, and help to explain the variances across the four case studies in terms of innovation performance.

Passive scanning for collaboration is associated only with packaging deals, while active scanning is associated with licensing-in deals and profitable manufacturing contracts. A key factor impacting firms' participation in international collaboration is management pro-activeness in the process. Although formal active scanning generates more specific information and increases the chance of identifying a partner that meets the firm's criteria, this type of formal sense-making was not seen as very effective. In contrast, a direct search strategy is associated with more highly integrated deals, such as joint ventures, RandD acquisition, and company acquisition. In direct searching, the selection of the potential partner, the technology, and the collaboration form rely more on the firm's top management's networks than on more explicit criteria or frameworks.

Table 1. Summary of key results

	Sense-making mode	**Scanning focus**	**Criteria used in selection / evaluation**	**Search, evaluation, and selection process**	**Who are involved**	**Type of project the company performed (Collaboration outcomes)**	**Dominant type of innovation performance**
FIRM A	Passive	Local + regional	- No explicit criteria - Profitability of the offered project - Complementary of the manufacturing - capability	No systematic or formal process for searching for potential partners, except present their profile in pharmaceutical e-marketing websites and journals	**Search:** • Marketing planning division plays main role **Analysing, designing, and assessing:** • Marketing planning division **Final decision to perform the project:** • CEO, assistant manager marketing, and assistant manager technical	Performing some packaging and manufacturing contracts	- Developing generic drug under its chemical name or own branded name - Incremental process/product innovation

FIRM B	Passive, formal and informal active	Local + regional	- Feasibility of the project – profitability and the economic value added - Complementary technological knowledge - Positive previous experience - Reputation - Location - Product assortment - Fit in corporate culture	- Systematic formal process for searching for potential partners through business development department - CEO plays main role in searching process - NDC are involved in assessment processes	**Search:** • Direct search through top management contact • Business development department and NDC **Analysing, designing, and assessing potential collaboration:** • NDC • D and SP-business development for collaboration project **Final decision to perform the project:** • CEO and Assistant manager (Rand D, D and SP, and marketing departments)	- Packaging and manufacturing contracts - Licensing-in deals - Joint venture with an Algerian firm to access new market Licensing-in some innovative drugs - Penetrating regional markets through some joint ventures - Licensing out of its own branded drug	- Incremental process/ product innovation

FIRM C	Passive, formal and informal active	Local, regional, international	- The knowledge underpins the project and the possibility of the knowledge transfer	- Systematic process for searching for potential partners through business development department - CEO plays main role in searching process - D and SP division are involved in assessment processes	**Search:** • Direct search through top management contact • Business development department **Analysing, designing, and assessing potential collaboration:** • D and SP division within business development department **Final decision to perform the project:** • CEO and the general manager	- Manufacturing contracts - Licensing-in deals - Rand D acquisition and Employing new drug delivery techniques through R and D acquisition deal	- Incremental process/ product innovation - Radical process/ product innovation

FIRM D	Passive, formal and informal active	Local, regional, international scopes	- Complementary technological or market knowledge - Reputation - Previous experience - Product assortment - Other partner size, location, market access - Feasible of the project – economic, learning, technical, etc.	- Systematic process for searching for potential partners through business development department - CEO plays main role in searching process - Different people at different levels are involved in these processes	**Search:** • Direct search-through top management contact • Business development department • D and SP department • Licensing division in marketing department • Marketing planning division • Rand D department **Analysing, designing, and assessing potential collaboration:** • Business development department • D and SP department **Final decision to perform the project:** Senior management team	- Manufacturing contracts - Licensing-in deals - Many acquisition deals for new technology and accessing market in Europe and the US Employing new drug delivery techniques through some merger and acquisition deals - Penetrating non-traditional market (e.g. Europe and US)	- Incremental process/ product innovation - Radical process/ product innovation

In addition, how firms organize for strategic search contributes to the choice of partners, projects and governance structures. In particular, cross-functional integration, and multi-level involvement (Isaksen and

Tidd, 2006) were important. It was found a relationship between the level (i.e. strategic or operational level), the people who are involved and how they are integrated, and the firms' innovation performance.

For example, in FIRM A only the CEO, marketing manager and technical manager are involved in strategy decision-making to carry out any potential innovative projects, only the marketing planning department is involved in evaluating and assessing any potential innovative project. FIRM A only performs some manufacturing and packaging deals at the international level, and focuses on the regional level. In contrast, FIRM B established an NDC to assess any potential innovative project. In FIRM B, the NDC serves only as an advisory panel to the upper management and other departments (e.g. the RandD department or DandSP department), and is not involved in the negotiation process or implementation of the project. The firm produces many innovative drugs through such license deals, and performs many incremental innovations for its drugs (i.e. developing branded generic drugs with different dosages).

At the next level, FIRM C outperformed FIRM B in that it conducted deals that are characterized by a high level of integration such as an RandD acquisition project. FIRM C established a DandSP division to be involved in the innovative project from start to finish. FIRM C not only performs incremental process and product innovation, it also carries out radical innovation projects. This may suggest that a high level of integration deal may require a response by the company to carry out the project, and establish a project-based division to integrate the knowledge, rather than a cross-functional team as an integration mechanism. The most innovative case, FIRM D assigns a cross-functional, business-planning team, in the business development department to be able to perform and solicit many ideas from all the company's departments (e.g. RandD, manufacturing, marketing, DandSP department, quality control, procurement, etc), for any potential growth. Then, according to the potential proposal, tasks are assigned and allocated across highly specialized people, such as the licensing division within marketing, RandD or DandSP departments. The DandSP department is responsible for any collaboration deal that is characterized by a high level of knowledge integration. It is also responsible for any co-ordination between FIRM D–Jordan and FIRM D subsidiaries. Moreover, the firm practices involving and integration process, not only at the operational level as clarified above, but also at the strategic level. For instance, it assigns a senior management team that includes managers within FIRM D-Jordan and other FIRM D subsidiaries. This team helps FIRM D to expand its activities in the international market and to integrate FIRM D-Jordan policies with its subsidiaries policies.

8. Limitations and Recommendations for Future Research

This paper examined the practice of open innovation in the Jordanian pharmaceutical industry. It was found that strategic search practices and organizational integration processes contribute to higher levels of international collaboration and to different degrees of innovation outcomes. This helps to explain the observed variance in innovation performance of firms embedded in the same weak national and sectoral system of innovation, and offers a development path for firms in emerging economies.

The research has several limitations. Firstly, the specific country and sector context. The findings are indicative rather than conclusive and cannot be generalized to other sectors, other firms, other nations, and other cultures. Therefore, further research is needed in other sectors within Jordan to see if similar findings

apply, and in other countries in both pharmaceuticals and other industries. Secondly, the research is cross-sectional research and cannot establish fully the direction of causation between participation in international collaboration and firms' innovation performance. This causality relationship could go either ways or even probably results from a complex process of 'circular causation' with one set of factors influencing the other and *vice versa*. Historical or longitudinal research is therefore needed in order to examine causality in greater depth, accepting the possibility of mutual causality and cycles, virtuous or otherwise. However, the sequence and timing of the numerous collaborative projects and subsequent innovation outcomes does imply a plausible self-reinforcing development strategy and path.

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البحث الاستراتيجي للابتكار في الشركات الصناعية ذات النظم الوطنية الضعيفة للابتكار: دراسة حالة لمصانع الأدوية الأردنية

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ملخص

يهدف البحث الى دراسة الاسباب والطرق التي تجعل بعض الشركات المنتشرة في نظم وطنية ضعيفة للابتكار تتفوق بعضها عن بعض في اداء الابتكار؛ حيث يتناول البحث دراسة أداء الابتكار لبعض مصانع الأدوية الأردنية،كما يتناول على وجه التحديد دراسة الممارسات الاستراتيجية المرتبطة بالمشاركة في التعاون الدولي، كالبحث الاستراتيجي، ودراسة مدى مساهمة هذه الممارسات في تحقيق أنواع ودرجات أداء ابتكار مختلف ومتفاوت. البحث هو دراسة استطلاعية، ويعتمد على مسح الابتكار لسبع عشرة شركة أدوية محلية في الأردن، ودراسة حالة لأربع شركات رائدة في الابتكار يتم فيها تحديد كيفية إجراء البحث الاستراتيجي للتعاون الدولي، وكيف أن ذلك يؤثر في أداء الابتكار. توصلت الدراسة إلى ان اختلاف درجات المشاركة في التعاون الدولي يعزى إلى ممارسة الاستشعار والبحث الاستراتيجي عن شريك دولي، وأن فعالية الادارة العليا في عملية الاستشعار والبحث الاستراتيجي عن شريك دولي في شركة ما يؤثر في طبيعة ودرجة التعاون والتحالف الذي يؤثر أيضا في اداء الابتكار لهذه الشركة،حيث بينت الدراسة أن ممارسة الاستشعار والبحث الاستراتيجي عن شريك دولي بطريقة مباشرة وغير رسمية، الذي يتيح للشركات بعقد تحالفات وصفقات استراتيجية مهمة ترتبط بأداء ابتكار عالٍ، يعد أكثر أهمية من ممارسة الاستشعار والبحث الاستراتيجي بطريقة رسمية. كما بينت الدراسة ان وجود ممارسات تنظيمية تدعم مشاركة كبار الموظفين واندماجهم في القرارات الاستراتيجية يسهم في تحسين التعاون الدولي و اداء الابتكار .

الكلمات الدالة: الابتكار المفتوح، التعاون الدولي، إدارة الابتكار، النظم الوطنية للابتكار.

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تاريخ استلام البحث 2013/1/1، وتاريخ قبوله 2013/10/30.