

Full Length Research Paper

External Sources of Knowledge, Absorptive Capacity, and Performance of R&D Subsidiaries of Multinational Companies

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Abstract

In this paper, the mediating role of absorptive capacity between external sources of knowledge and performance of firms was investigated. It is suggested that the aspect of absorptive capacity (quality and speed of innovation) can highly impact the performance of the subsidiaries with the efficient help from external sources of knowledge. Results showed that external sources of knowledge on their own could not have a significant contribution to the performance of the subsidiaries. With the same number of external sources of knowledge, firms with a higher quality of innovation exhibited more superior performance in comparison to those with lower quality of innovation. However, higher speed of innovation was not shown to enhance the performance of the firms.

Key Words: Absorptive capacity, External source of Knowledge, Multinational companies Performance.

Introduction

Currently, companies especially Multinational Companies (MNCs) are expanding their businesses with the help of operations such as foreign Research and Development (R&D) subsidiaries. MNCs might gain a competitive advantage by creating knowledge in their headquarters and transfer it to the subsidiaries and vice-versa (Tan & Mahoney, 2006). Such kind of operations is considered to be vital for the performance of the subsidiaries and the overall firm as a whole (Colakoglu & Caligiuri, 2008). Knowledge transfer is considered to be one of the most important and effective processes conducted by the subsidiaries.

The construct knowledge transfer is often associated with absorptive capacity (AC). AC is often described as the ability to identify knowledge, determine its value, assimilate it in a comprehensive manner, and apply it to enhance the quality of outcomes (Gaur et al., 2007). As Easterby-Smith, Lyles, & Tsang (2008) put it, some aspects of knowledge transfer critically depend both on the source as well as on the recipient of that knowledge.

Several researchers have suggested that knowledge transfer operations work and act through the sequential framework of ability, motivation, and opportunity (Argote, McEvily, & Reagans, 2003). The ability to access knowledge is not restricted to within the MNCs. As Zucker

et al. (1998) stated, the connection to extramural knowledge sources may bring benefits to the accessibility and exploitation of external knowledge.

However, there are only a few studies that examine the intricate relationship between the knowledge transfer process of the subsidiaries and the performance of the firms (Gaur, Delios & Singh, 2007). We, therefore, undertook this research to attempt to bridge this gap, by examining the mediating role of absorptive capacity (AC) between external sources of knowledge and performance of the firm.

We aimed to highlight both the importance of accessing external knowledge and theorized on the potential benefits of external knowledge access. The research question of this study therefore is: How and to what extent does AC of the MNCs' R&D subsidiaries mediate and impact the relationship between external sources of knowledge and the innovative performance of subsidiaries?

We rely on literature related to AC, access to external knowledge, innovative outcome of MNCs, and knowledge transfer as a theoretical guide to answer the question mentioned above. This study adds to the theory related to performance of the firm, AC and expands on the existing literature to consider the impact of AC on the quality and speed of the firm's innovative outcome (firm's performance).

The rest of the article is presented as follows. Section 2 presents theories related to knowledge transfer, AC, and its mediating role, and ends with the formulation of testable hypotheses. Section 3 describes the empirical method used in this article. The results of the analysis are presented in section 4, and discussion in section 5. Finally, Section 6 outlines the conclusion and recommendations.

Theoretical Background and Hypotheses

The following section reviews the existing literature in a narrative manner. We focus on discussing the major theoretical aspects that had been explored in the previous research works and building upon these literature to develop testable hypotheses.

External Sources of Knowledge

The strategic management of organizations in recent days is based on the achievement and proper application of knowledge. Knowledge can be considered as one of the most important assets of an organization. It is the development and application of the knowledge which is considered to be the key resource of an organization. The application of knowledge plays an important role in determining the level of difference in the performance or output of different firms. Knowledge development often leads to a dilemma for firms in their decision whether to develop knowledge internally or through external sourcing. The value of obtaining knowledge from external sources has been highlighted in the knowledge acquisition related literature (Kim, 1998; Lane & Lubatkin, 1998; Liebeskind, Oliver, Zucker & Brewer, 1996). Internal knowledge acquisition and creation is realized within the boundaries of the firm when employees create and distribute new knowledge, resulting from activities such as in-house R&D. On the contrary, External knowledge development, take place when boundary spanners bring in new knowledge from an outside source. This knowledge is then transferred throughout the organization. External sourcing of knowledge broadens the internal knowledge base of the firm for the simple reason that it integration requires the different perspectives and ideas from employees of the firm.

Researchers such as Bierly and Chakrabarti (1996) emphasize the need for external knowledge but place a higher value on internal knowledge generation. Others (Cohen, 1990) suggest an integration of internal and external sources of knowledge for innovation to be successful. The question remains, do external source of knowledge bring about more advantages in the generation of innovation and competitive advantage?

Absorptive Capacity

The construct of absorptive capacity (AC) is considered to be one of the most important concepts that play a major influential role in the aspect of the knowledge management (Zahra & George, 2002). Several

researchers have critically and comprehensively examined this construct. AC is usually defined as the capacity to identify the new information or knowledge, analyze it, and apply it according to the requirements so that the knowledge transfer process becomes more viable, and the organizations become able to generate more significant outcomes with the help of the newly processed information (Noblet, Simon, & Parent, 2011). It has also been observed that lack of AC may decrease not only the effectiveness of the knowledge transfer but also the level of the performance of the subsidiaries as well as the whole firm. The factor of trust might also play an important role in the aspect of enhancing AC because a higher level of trust between the MNCs and the subsidiaries may boost the subsidiaries to concentrate more on the absorption and analysis of new information so that stronger strategies can be formulated.

AC of MNCs subsidiary mainly consists of four components: identification, processing, combining, and application (Zahra & George, 2002). The first one is the identification of the knowledge whereby the subsidiaries can realize the validity and the significance of the knowledge that has been extracted from the external environment. The second component is the processing of the knowledge so that the leaders appointed at the subsidiaries can develop a proper and comprehensive understanding of the external knowledge. The third component is the process of combining the newly gained and understood knowledge with the existing organizational knowledge that has already been analyzed. The fourth and final component is the application of the properly assessed knowledge so that greater and better commercial outcomes can be achieved.

Researchers have predominantly studied the aspect of AC as a conceptualized single construct. However, several recent studies have started to assess and evaluate the construct of AC as the only significant variable that has an immense impact on the process of knowledge transfer (Van Wijk et al., 2008). But most researchers believe AC should be treated and considered as a single construct that consists of various steps and components which are equally significant and interconnected within the entire process of the system which determines the level of the performance put forward by a firm or organization with the help from its subsidiaries (Lee, Liang, & Liu, 2010).

The success of the knowledge transfer is intricately related to the AC, and it is processed in two different ways. In the first process, the subsidiaries successfully accept and receive the knowledge or information which has been extracted from the external environment (Duchek, 2014). In the second process, the subsidiaries properly apply the received and analyzed knowledge by integrating the achieved information within the organizational framework of usual operations and daily functions of business (Aribi & Dupouet, 2016).

Theoretically, the AC of a subsidiary refers to its potential to receive and assimilate the newly gained external knowledge, but it does not necessarily refer to the actual extent of the knowledge transfer or the application

of that knowledge that might be conducted by a subsidiary (Cooper & Molla, 2014). However, if a subsidiary has a higher AC, it is expected to acquire and apply the knowledge more effectively compared to another subsidiary which has a lower AC if the amounts of knowledge received by the two subsidiaries are the same.

The Mediating Role of AC

The AC of a MNC subsidiary adds several benefits to the entire organizational operation. This capacity may help the subsidiaries to moderate the relationship between the competencies of the external sources of knowledge and the capabilities of the subsidiaries to receive the knowledge through inter-connected steps of the knowledge transfer process (Sánchez-Sellero, Martínez, & García-Vázquez, 2013). A lower level of absorptive capacity of the MNC may effectively weaken the strength of the relationship between the competencies of the external sources of knowledge and capabilities of the subsidiaries to properly receive the knowledge (Elbashir, Collier, & Sutton, 2011).

The strategy literature theorists have stated that both the sources and the recipients of the knowledge have to be characteristically strong and efficient so that the knowledge transfer becomes successful (Lenox & King, 2004). It has often been observed that even if the external sources of the knowledge are efficient and sufficiently competent, the subsidiaries may fail to properly receive and accept the knowledge simply because of the lack of efficiency (Liao et al., 2009). Therefore, it is important for the subsidiaries to develop a proper prior knowledge source so that the new knowledge can be properly acquired, processed, and applied per the requirements through the enhancement of AC. Furthermore, AC of the subsidiaries may also play a moderating role in the relationship between the knowledge received by the subsidiaries and quality of performance of the subsidiaries.

Hypotheses

In the quest for the development of competitive advantages, firms are not limited to activities taking place within their boundaries. The connection to outside sources of knowledge can provide benefits for the access and exploitation of knowledge as emphasized by Zucker et al. (1998).

The key tenet of the construct of AC is that firms cannot freely and effortlessly absorb knowledge from outside their boundaries. Firms, therefore, differ in the absorption and exploitation of knowledge from outside. Extra work is needed to identify, assimilate, and exploit external knowledge. Researchers have identified several activities that can improve a firm's AC. Cohen and Levinthal (1989) focused on investments in R&D; Rosenberg (1990) examined the role of basic research activities. For the purpose of this research, we adopt the work of Zucker et al. (2002) and focus on collaborations with external players, that is to say, external source of

knowledge. For this research, we used R&D outsources; licensed technology; and external acquisition of knowledge as external sources of knowledge. Laursen and Salter, 2006 states that it is possible for firms to benefit from a proactive alertness on external researches and innovations and to enjoy superior access to useful knowledge. Collaboration with external sources of knowledge makes it possible for the firm to identify important research and open the gates to possible complementary knowledge. Several types of research have shown that collaboration with external players positively impact the number of a firm's patents. It is, therefore, possible to expect improvement in innovative performance with higher AC.

Hence, the hypotheses to be tested in this study are:

Hypothesis 1; Higher connection to external sources of knowledge, results in better quality and higher speed of innovation for the subsidiary

Hypothesis 2; The higher the level of quality and speed of innovation, the better the performance of the subsidiary

Hypothesis 3; With a greater level of quality of innovation, the relationship between external sources of knowledge and performance (ROI and ROE) of the subsidiary is more pronounced.

Hypothesis 4; a Higher level of speed of innovation would strengthen the relationship between external sources of knowledge and performance (ROI and ROE) of the subsidiary.

Methodology

Sample and Data

We gathered and used data collected from several sources. We collected patent data of 33 Taiwanese subsidiaries belonging to 18 multinational companies with headquarters in the United States. Patent data collection is made using United States Patent and Trademark Office (USPTO) database. We also use data from BEEPS (The Business Environment and Enterprise Performance Survey) conducted by World Bank.

Statistical analysis was done using SPSS. We performed one-step regression analysis to test the existence and the level of correlation among the variables of this study. After that, statistical analysis test was performed to examine the relationship between the different variables at different stages and different modes of the relationship. The results are interpreted in a comprehensive manner using a systematic approach that separately discusses the findings and the connection between them. Finally, we derived a conclusion from the interpretation of the results obtained from the statistical analysis.

Variables

Independent variables

- External source of knowledge

Knowledge provides a firm with valuable and unique capabilities essential for building competitive advantages. It is, therefore, important to have a better understanding of how the manipulation of sources of knowledge impacts the performance of a subsidiary. The need to acquire external sources of knowledge lead to local, national, and even international knowledge sources. For this research, we developed a multi-dimensional index for external sources of knowledge composed of the following components: Outsources of R&D, Licensed Technology, Acquisition of external knowledge.

Dependent variables

- Absorptive Capacity (AC)

We developed a bi-dimensional index for AC composed of Quality and speed of innovation.

Quality of innovation

In this study, we referred to quality of innovation as the number of forward citations that a firm’s patents receive. In fact, researchers have used the number of forward

Control Variables

- Firm’s research intensity. We follow Cohen and Levinthal (1989) and use a ratio of R&D expenditure and the number of employees of the firm
- Firm size: we use the annual number of employees.
- Average number of citations to prior patents
- Average number of patent claims belonging to firms
- Average number of backward citations to firm’s patents

We created indicators (High and Low) for the assessment of the different hypotheses. The indicators represent the level of the different variables. We defined low and high in

citations that a focal patent received as an indication of the invention’s usefulness in the future (Hall et al.,2005). We, therefore, used the average number of forward citations received by firm’s patent as an indication of the quality of their innovation.

Speed of innovation

Speed of innovation refers to the age of the knowledge that the firm builds upon. The “references cited” section in the patent application is used to indicate the related knowledge used. We used the grant dates of the patent (used as prior art) and the date of publication of non-patent prior art as an indication of the age of the knowledge being used. The difference between the cited patent and the novel invention is used as the velocity with which the prior knowledge has been utilized in the invention. The longer the difference, the slower the speed of innovation.

- Performance of the Subsidiary

The variable “Performance of the Subsidiary” is made up of two different components: Return on Investment (ROI) and Return on Equity (ROE) of the firms.

We control the following variables:

relation to the median of the value obtained for the different variables related to the companies in our sample. By doing this, we were able to obtain a relative measure for the firms in our sample. We then interacted the variables high and low with each other, allowing us to observe the variation in marginal values of each variable.

Results and Discussion

Table 1 below presents the results of the one-step regression analysis.

Table 1: Means, Standard Deviations, and Correlations between the Variables.

	Variables	Mean	Standard Deviation	1	2	3	4
1	External Sources of Knowledge	4.47	1.51				
2	Quality of innovation	5.44	0.69	0.23**			
3	Speed of innovation	5.12	0.68	0.41**	0.39**		
4	Return on Investment (ROI)	0.69	0.61	0.19**	0.21**	0.33**	
5	Return on Equity (ROE)	0.61	0.40	0.15*	0.22**	0.31**	0.21**

(*) suggests that the significance level of the correlation was found to be at the base of $p < 0.05$. The double asterisk marks (**) suggest that the level of significance was found to be at the base of $p < 0.01$.

It can be observed from Table 1 that with r value of 0.23 and a p value of less than 0.01, quality of innovation was found to be significantly related to external sources of knowledge. The speed of innovation was also found to be significantly related to external sources of knowledge as the correlation results showed the r value, in this case, was 0.41, and the p-value was less than 0.01. These findings help to establish the first hypothesis as true and allow us to state that a greater level of connection to external sources of knowledge would result in better quality and higher speed of innovation for the subsidiaries.

Furthermore, the results also unfold several other aspects. It was observed that ROI is significantly related to external sources of knowledge ($r = 0.19$, $p < 0.01$), quality of innovation ($r = 0.21$, $p < 0.01$), and speed of innovation ($r = 0.33$, $p < 0.01$). ROE was also found to be significantly related to external sources of knowledge ($r = 0.15$, $p < 0.05$) as well as quality of innovation ($r = 0.22$, $p < 0.01$), and speed of innovation ($r = 0.31$, $p < 0.01$). Although the level of the significance differed in these two cases, the main point was that the relationships were

found to be highly significant ($p < 0.01$). These findings suggest that both the aspects of performance (ROI and ROE) have a significant positive relationship with both indicators of AC (Quality and speed of innovation) of the subsidiaries. Therefore, these findings help to establish the second hypothesis which states that a greater level of quality and speed of innovation (AC) would result in better performance of the subsidiaries.

However, one interesting and important outcome to take note from this analysis was that although the relationship between ROI, ROE with external sources was significant, these relationships were relatively weak ($r = 0.19$ and 0.15 respectively) in comparison to the correlation between ROI and Quality or speed of innovation ($r = 0.21$ and 0.33 respectively) or between ROE and quality or speed of innovation ($r = 0.22$ and 0.31 respectively). These results indicate that the relationship between external sources of knowledge and performance exists but is not as strong as the relationship between external sources of knowledge and AC of a subsidiary.

Table 2: Impact of External Sources of Knowledge on ROI and ROE at different levels of quality of innovation

	Level of Quality of innovation	ROI	ROE
External Sources of knowledge	High	0.38	0.49*
	Low	0.21*	0.17

(*) suggests that the significance level of the correlation was found to be at the base of $p < 0.05$. The double asterisk marks (**) suggest that the level of significance was found to be at the base of $p < 0.01$.

Table 2 presents the results of the analysis conducted to examine the impact of external sources of knowledge on ROI and ROE (performance) at varying levels of quality of innovation. External sources of knowledge were considered as the independent variable, and ROI and ROE the dependent variables. The analysis showed that with a higher level of quality of innovation, the coefficients for the relationship between external sources of

knowledge, and both ROI and ROE are larger in magnitude compared to the case at a lower quality of innovation, as expected. However, some of the results were found to be statistically insignificant. These results prove the third hypothesis holds which states that with a greater level of quality of innovation, the relationship between external sources of knowledge and performance (ROI and ROE) of the subsidiary is more pronounced.

Table 3: Impact of External Sources of Knowledge on ROI and ROE at different levels of speed of innovation

	Level of Speed of innovation	ROI	ROE
External Sources of Knowledge	High	0.15	0.42
	Low	0.20	0.14*

(*) suggests that the significance level of the correlation was found to be at the base of $p < 0.05$. The double asterisk marks (**) suggest that the level of significance was found to be at the base of $p < 0.01$.

Table 3 presents the results of the analysis conducted to examine the impact of external sources of knowledge on ROI and ROE (performance) at varying levels of speed of innovation. Judging from the magnitudes of the coefficients, the results indicated that the relationship between ROE and external sources of knowledge is more evident with the higher speed of innovation compared to the lower speed of innovation. On the other hand, this was not the case for ROI where its relationship with external sources of knowledge seemed slightly stronger with a lower speed of innovation. However, these coefficients were not found to be statistically significant in both cases with high speed of innovation and between ROI and external sources of knowledge with low speed of innovation. These results did not prove hypothesis four which had stated that higher level of speed of innovation would strengthen the relationship between external sources of knowledge and performance (ROI and ROE) of the subsidiary, to be true.

This research has been undertaken to test the role of AC in the relationship between external sources of knowledge and performance of a subsidiary. Open innovation theory states that access to external sources of knowledge should lead to more efficient innovative capacity. Moreover, innovation theory predicts that better innovation leads to better performance for firms. The results obtained from analyses in this study showed that contact or interaction with external sources of knowledge does, in fact, provide a positive impact regarding both the quality and speed of innovation of a subsidiary.

While mostly supportive of the expected benefits of external sources of knowledge and innovative performance of the subsidiaries, the results bring light to some interesting differences by considering the quality and speed of innovation. External sources of knowledge contribute to the benefits of the dimensions of absorptive capacity (quality and speed of innovation). However, higher level of speed of innovation did not strengthen the relationship between external sources of knowledge and performance (ROI and ROE) of the subsidiary.

The results, therefore, showed that subsidiaries with more external contacts (sources of knowledge) might enjoy more superior performance. However, this is not always the case. It was shown that the external sources of knowledge would yield a greater impact in enhancing performance when the subsidiary has a better internal absorptive capacity. This outcome can be explained in two different ways. First, if the subsidiaries have higher levels of absorptive capacity, then better performance of the R&D subsidiaries can be efficiently achieved by the utilization of the aspect of received knowledge. Secondly, if the subsidiaries have higher levels of absorptive capacity, external sources of knowledge can immensely help the subsidiaries to receive more knowledge as a part of the knowledge transfer process. This might be result of the tendency of the external sources to more intricately

engage and involve in the entire process of the knowledge transfer if the sources find out that AC of the subsidiaries is at higher level.

Also, if AC of the subsidiaries is higher, external sources of knowledge can more efficiently enhance the performance of the R&D subsidiaries of the MNCs in an indirect manner. External sources of knowledge on their own cannot have significant contribution to the performance of the subsidiaries as shown in this study. The aspect of AC can highly impact the extent of knowledge reception by the subsidiaries and the performance of the subsidiaries within the process of the knowledge transfer framework with the efficient help from the ability of the external sources of knowledge. However, the entire process should be thoroughly conducted, and equal importance should be given to the ability (both soft skills and technical skills) of the subsidiaries as well as their absorptive capacity to achieve better results.

Conclusion and Recommendations

This study has focused on the mediating and influencing role of AC of the R&D subsidiaries of MNCs in the relationship between external sources of knowledge and the overall performance of the subsidiaries. Knowledge transfer process and performance of firms. It was found that external sources on their own do have a significant positive relationship, though weak, with the performance of the firms. Higher external sources of knowledge were also shown to improve AC. Higher AC was shown to improve performance in the case of quality of innovation as opposed to speed of innovation. The process of knowledge transfer through AC can be more productive if some specific conditions are properly met.

Future research works and studies can produce more viable and significant results if the researchers exclude some of the limitations that exist in this study. First, the use of patent data for the analysis of innovative performance of subsidiaries is questionable for the reason that all innovation of companies is not patented. Using patent data as the sole representation of innovative performance may limit the scope of this study. Secondly, this study is based on one industry. It will then be interesting to conduct further empirical research to test the hypotheses in a variety of different industries.

Also, the researchers should make sure that they do not only focus on the transmission of knowledge from the external sources of knowledge to the R&D subsidiaries of the MNCs but also immensely concentrate on the process through which knowledge is transmitted from the subsidiaries to the headquarters. Moreover, this study has researched on the subsidiaries located in the region of an emerging economy, but the parent companies or the actual MNCs belong to a region of developed economy. Therefore, it would be relevant and interesting to find out if the subsidiaries, which operate in the developed economy

but the parent organization belongs to an emerging economy, produce the same kind of results in such scenarios. More theoretical establishment and practical approaches are needed so that the MNCs can develop a proper understanding of the actual scenario, and the R&D subsidiaries can make use of the beneficial factors to their advantage to achieve greater outcomes.

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