The Effect of Structural Holes on the Corporate Performance and Strategic Alliances Network in Pharmaceutical Industry

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Abstract. Pharmaceutical companies have carried on active strategic alliance to encourage new medicine development and innovative development in the situation in which R&D productivity is continuously decreasing. Nevertheless, the research on strategic cooperation influencing on R&D productivity of pharmaceutical company such as alliance and M&A, is limited, especially in respect of a network analysis. Therefore, this research is going to look at how the performance of corporation is affected by strategic alliance from the network analysis.

Many researches use the density of network as the method of measuring the effect of network but this research progresses the analysis by focusing on structural holes. Especially, in case of the corporations in structural holes, they can get the not overlapped information and resources, so they have potential power for creating value.

First, this research analyses strategic alliance network through network analysis and look at the role of corporations for acquiring information. Second, after analyzing the characteristics of strategic alliance between pharmaceutical corporations by deriving an indicator of network structural holes, this research is going to examining how the structural holes influence the performances of corporations.

Keywords: Pharmaceutical Industry, Network, Structural Holes, Performance Analysis.

1. Introduction

Pharmaceutical companies have carried on active strategic alliance with universities, bio corporations and venture corporations to encourage new medicine development and innovative development in the situation in which R&D productivity is continuously decreasing since the 1990s. Such strategic alliances are cheaper and more effective for achieving technologies and abilities than achieving from external transaction with other companies. Especially, it makes possible to sharing competitive advantage asset complementarily, therefore strategic alliances tend to be rapidly increased in many fields. Nevertheless, the research on strategic cooperation which have an influence on R&D productivity of pharmaceutical company such as alliance and M&A, is limited, especially in respect of a network analysis. Therefore, this research is going to look at how the performance of corporation is affected by strategic alliance from the network analysis. Pharmaceutical corporations can find partner for alliance easily and take advantage of information from this research. Furthermore, it could be an important supporting material for establishing polich to increase the productivity of pharmaceutical industry.

2. Theoretical Background

2.1. Strategic Network

Strategic network means various forms of link and include strategic alliance, joint venture, long term supplier-buyer partnership [1]. Especially, strategic alliance means the strategy to gain a competitive edge by establishing a collaboration relationship. Since strategic alliance provides external resources [2], transmit knowledge and improve learning ability of organization, strategic alliance is also considered to be studied in respect of network [3],[4]. Network theory argue that the performance of corporation can be increased by improving transaction efficiency and collaboration with partner not by accumulating resources which are impossible to imitate as mentioned by resource based view of the firm [2],[5],[6]. The scholars studying resource based view of the firm claim that corporation is the aggregation of resources and that properties in

each resource have an influence on the competitive advantage of the company and improve the performance of corporation [5],[7]. However, as company environment become complex and uncertain, individual company is hard to internalize every resource and cope with expense for resource development. Therefore network analysis is being used as a tool for diversification of risks [8]. Researches on voluntary and cooperative agreement form of corporation trying resource exchange, sharing and joint development, are now proceeding. This concept well explain contribution between corporations possessing capital, technology and specific asset [9]. Furthermore, strategic management analyse network as the most important concept by explaining characteristics such as trust within social relations, that is social capital in respect of sociology.

2.2. Network Theory

We are going to look at by classifying indicators which represent influence or measure how performers are related as a similar form.

2.2.1. Network Density and Centrality

First of all, we are looking at the indicator which represents influence. Network density measures the number of performers which are connected to every performer in the network and it represents how many relations are connected. The closer to 1, more directly connected with other performers. Centrality is another indicator but this research is going to compare network density to structural holes.

2.2.2. Network Structural Holes

There are equivalence and structural holes as a concept of measuring how performers are related as a similar form. Equivalence means that performers are in same position and structural holes means the position which exists between not directly connected performers or groups, and connected with each performer. Burt(1992)[3] argue that when a certain performer selects the optimal position approaching the only information inside the network in a loose network, that is, when showing high efficiency of structural holes, the performer can get the effect of network by blocking approach of other partners in measuring the influence of network. Therefore, the corporation securing structural holes is easy to be more competitive since it could be an arbitrator for exchanging various information and resources using network [10]. Preceding research, which explains the loose network concept of structural holes as weak connection strength, claim that weakly connected relation between the main agents increases opportunities for approaching to various information and knowledge, and finally improve the performance of movie in the network of movie industry. Network structural holes are used in this research since it is focused not on the influence of network but on what kind of relation is formed by performers. Furthermore, by classifying network between the domestic hotels and corporations into three types, other preceding research [4] explains that possessing structural holes with high efficiency influence the performance of management positively in each type of network. Based on these preceding researches, this research is going to check whether high efficiency of structural holes also influence pharmaceutical industry positively. On the contrary, according to the recent research [11] explaining structural holes, the effect of network should be measured by classifying research object and sample rather than depending on the form of the network effect. Besides, when analysing the performance of corporations, it is argued that using contingency approach is right [12]. Based on primarily background, the following hypotheses are set up.

Hypothesis. If structural holes index of pharmaceutical preparations(SIC code 2834) strategic alliance is high in pharmaceutical industry, then the management performance would be better than other competitors.

- Particular hypothesis 1. If structural holes index of pharmaceutical preparations on Medical chemicals and botanical products (code 2833) are high, then the management performance would be better than other competitors.
- Particular hypothesis2. If structural holes index of pharmaceutical preparations on In vitro and in vivo diagnostic substances (code 2835) are high, then the management performance would be better than other competitors.
- Particular hypothesis3. If structural holes index of pharmaceutical preparations on Biological products, except diagnostic substances (code 2836) are high, then the management performance would be better than other competitors.

3. Research Method

3.1. Setting Sample

This research deal with about 180 companies as subjects based on pharmaceutical industry strategic alliances between 1989 and 1999. Furthermore financial data was collected for analysing the performance of corporations.

3.2 Statistical Analysis Method

Structural holes with Medical chemicals and botanical products, In vitro and in vivo diagnostic substances and Biological products, except diagnostic substances were set up to dependent variables.

The structural holes indicator of corporations inside the network was achieved by calculating the size of efficiency after setting each corporation as the central point of the network and eliminating overlapped values. The formula is as follows and resolution method from the preceding study [8],[13],[14], which explains network analysis, was adapted to this formula and the method giving indicator

$$\text{suitable size of structural holes} = n - \left(\frac{2t}{n}\right)$$

(n: the number of performers in the network, t : the number of lines connected between performers in the network, $\frac{2t}{n}$: overlapped value)

Sales/turnover (net) was used for a dependent variable to analyse the performances of corporations. Since, in pharmaceutical industry, new medicine development or stimulating innovative activity influence the performance, the cost of R&D can not be ignored. Furthermore, human resources take an important role of increasing efficiency of research, so the cost of R&D and the number of employers were used for control variables.

4. Result

Networks were established by using Ucinet 6.0 program, table1 and table 2 shows descriptive statistics and correlation with variables.

Table3 represents the results of multiple regression analysis in order to verify the hypotheses. The more R&D expense arespend and the more employees are hired, the performances of corporations get the better end of competitors. In this case, it does not mean all employees but researchers who study for the performance. The structural holes effect between Medical chemicals and botanical products and pharmaceutical preparations is not significant. The reason why result is not significant is few data of strategic alliances between Medical chemicals and botanical products (code 2833) and pharmaceutical preparations (code 2834). In case of in vitro and in vivo diagnostic substances (code 2835) and pharmaceutical preparations (code 2834), negative relation is significant. The network result between Biological products, except diagnostic substances (code 2836) and pharmaceutical preparations (code 2834) represented positive correlation. From second and third result, it seems to be important to take structural holes position for enough and various information while structural holes position in which opportunistic behavior appears should be avoided.

variable	Obs	Mean	Std.dev	Min	Max
Structu_2833	83	2.555506	3.088896	0	15.75
Structu_2835	83	2.809916	3.827081	0	18.75
Structu_2836	83	3.276036	4.887803	0	24.821
Employees	83	11.67897	21.59316	.0056667	95.28867
Research_d~t	83	288.4208	534.113	.0938	2656.737
Sales_turn~r	83	2410.413	4724.384	.2463333	23827.56

Table 1: descriptive statistics

	Sales_turn~r	Sales_turn~r	Sales_turn~r	Sales_turn~r	Sales_turn~r	Sales_turn~r
Sales_turn~r	1.000					
Structu_2833	0.6187*	1.000				
Structu_2835	0.6117*	0.9880*	1.000			
Structu_2836	0.6382*	0.9670*	0.9729*	1.000		
Employees	0.9801*	0.5950*	0.5913*	0.6009*	1.000	
Research_d~t	0.9544*	0.6319*	0.6327*	0.6969*	0.9251*	1.000

Table 2: correlation between variables

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      Source |       SS          df       MS              Number of obs  =       83
-------------+----------------------------------           F( 5,    77)  =   711.32
       Model | 2.7472e+09          5    549440797          Prob > F       =   0.0000
    Residual | 59476635           77    772423.831         R-squared      =   0.9788
-------------+----------------------------------           Adj R-squared  =   0.9774
       Total | 2.8067e+09         82    34227812.4         Root MSE       =   878.88

  sales_turn~r |      Coef.    Std. Err.       t     P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------------
  structu~2833 |    258.493    208.5571       1.24    0.219    -156.7972    673.7832
  structu~2835 |  -392.7911    186.3615      -2.11    0.038    -763.8843   -21.69786
  structu~2836 |   240.1347    100.9716       2.38    0.020     39.07458    441.1947
   research_d~t |   1.454165     .250093       5.81    0.000     .9561661    1.952164
     employees |   168.9975    10.48887      16.11    0.000     148.1115    189.8835
         _cons |  -318.6022    141.2717      -2.26    0.027    -599.9102   -37.29429
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Table 3: regression

5. Conclusion

This research examined the role of corporations in possessing information from analyzing strategic alliance. As structural holes index of pharmaceutical preparations (code 2834) on Medical chemicals and botanical products (code 2833),Biological products, except diagnostic substances (code 2836) is increasing, corporations in pharmaceutical preparations represents the better management performance by acquiring competitive advance of information. On the contrary, structural holes index of pharmaceutical preparations on In vitro and in vivo diagnostic substances (code 2835) did not influence the management performance. In this research, there are some limitations. First, this research used old data when strategic alliance was actively progressed. Second, human resource (the number of employer) and qualitative resource (R&D expense) were used as the control variable but there might be other control variables influencing the result. Furthermore, if data up to now is analyzed using time series, it is considered to get more accurate result and it is a further research plan. Pharmaceutical corporations can find partner for alliance easily and take advantage of information from this research. Besides, it could be an important supporting material for establishing policy to increase the productivity of pharmaceutical industry.

6. References

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