Service Cooperation in Alliance: A Shapley Value Perspective

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ABSTRACT

The globalization stimulates the revolution of market since 1980 in terms of politics, society, culture, technology, and economics. A firm may ally with others owing to strategic reasons and attempt to turn competitors to partners. This research proposes the following research questions: (1) can companies merely focus on service exchange and resource sharing? and (2) how to allocate the generated benefit in alliance? We propose a novel concept of service alliance that allows the company which is efficient and has great ability in a particular service. In this situation, the synergy of service alliance will be enlarged. Shapley value also helps companies identify the contribution fairly. In addition to fairly distribution the profit from Shapley value viewpoint, resource-based theory can be also used to consider the synergy of service alliance. In summary, we consider increasing the usability of recourses may result in a competitive environment.

Keywords

Service Alliance, Resource-Based Theory, Strategic Alliance, Shapley Value

INTRODUCTION

The globalization stimulates the revolution of market since 1980 in terms of politics, society, culture, technology, and economics. The international market replaces the local market and results in cooperation for enterprises. That is, airline companies also turn to alliance under the competition. Particularly, three alliances are formed in airline industry: Star Alliance, Skyteam, and Oneworld. The ratio of carried passengers for three alliances has been more than 55% in the market. Members in the alliance can share code, integrate information, and co-purchase resources. Members which are not in the alliances will face monopoly, supplant, and unequal treatment without niche market and support of resources. Consequently, it is necessary to join the alliance for airline companies nowadays.

Big companies start to use urban management owing to the change of environment. For example, outsourcing non-core activities and increasing cooperation with others to devote into self competency and obtain resources from outside (Baden-Fuller, Charles, Grant and Robert, 2004). Strategic alliance is the most popular format of cooperation. The examples of strategic alliance mostly exist in airline industry (Oum, Park and Zhang, 2000). Strategic alliance is a voluntarily protocol among companies such as exchange, share, and co-develop product technology and service (Gulati, 1998). A firm may ally with others owing to strategic reasons and attempt to turn competitors to partners. For example, the reasons for alliance in airline industry may gain airspace right and expand cities. In practice, there are still many outsourcing activities in existing airline alliance. However, the focus is still on expanding cities. This research then proposes the following research questions: (1) can companies merely focus on service exchange and resource sharing? and (2) how to allocate the generated benefit in alliance?

In order to address the proposed questions, we propose a novel concept called "service alliance". The notion of service alliance comes from strategic alliance, which investigates the possibility to retain core resources and competence of a company and outsource some services via alliance in service industry. This concept is also similar to virtual organization to strategically focus on outsourcing services. In other words, we also utilize the concept of service blueprint to separate the services as the basis to investigate the exchange of recourse (e.g., services) to maximize the synergy. This research uses Shapley Value as the method to estimate the payoff of each member in the alliance. Meanwhile, resource-based theory is also used to examine the efficiency of service exchange. We expect to use the concept of service alliance to maximize the potential benefit in service industry.

LITERATURE REVIEW

1.　Strategic Alliance

Strategic alliance is a voluntarily protocol including exchange, sharing, and co-develop techniques and service (Chen, Lay and Lee, 2009; Gulati, 1998). Dyer, Harbir, Jeffrey, Kale, Prashant and Singh defined strategic alliance is a channel to obtain complimentary resources and technologies among firms and a formal/informal agreement of sharing goal among companies (Dyer et al., 2001). Alliance not only increases professional ability but also facilitate knowledge creations and transformation as well as the variety of product and service (Cowan , Jonard and Zimmermann, 2007). The reason to form the alliance is to enter the international market and obtain sustainable competitive advantage. In addition, improving the effectiveness of strategies, gaining new technologies, and attaining economies of scale (Harbir, Kale, Perlmutter, Prashant and Singh, 2000). Hoffmann considered strategic alliance can improve external changing of environment and adaptability (Hoffmann, 2007). Some Researchers discovered strategic alliance can improve the efficiency for managing environment changing (Chen, Lay and Lee, 2009; Lee, 2007; Nielsen, 2010; Yaprak, 2011). Certain researches considered size of company, competition, variety of product, and finance as the important factors to form alliance (Barley, Freeman and Hybels, 1992; Brantley and Powell, 1992; Kogut, Shan and Walker, 1994; Shan, 1990).Researches show alliance was not always successful. The successful rate of alliance is low all the time. The reason is many companies cannot completely understand the potential benefit to cooperate with partners (Gulati, Sytch and Mehrotra, 2008; Harrigan, 1985; Kale, Dyer and Singh, 2002; Kalmbach and Roussel, 1999; Kogut, 1989). Finally, the selection of partner is also the issue in strategic alliance. The partnership emerges when organization realizes the reliable relationship (Aiken and Hage, 1968; Levine and White, 1961). Richardson suggested companies should try to find a reliable partner (Richardson, 1972). Moreover, three major theories are discussed in strategic alliance, resource-based perspective, transaction cost theory, and social network theory (Gulati, 1998). This research defines strategic alliance as putting companies together to share product development, manufacturing, marketing, and sharing resources of channels.

2.   Resource-Based Theory and Core Competence

Resource-based theory was mentioned by Penrose, which considers companies need to use recourses efficiently based on the specialty for sustainable growth and profit (Penrose, 1959). Wernerfelt extended the perspective of Penrose to propose resource-based view that focuses on internal resources instead of products (Wernerfelt, 1984). Researchers considered resource is the source of competitive advantage. Owing to the heterogeneity and resource endowments, resources are immobility and result in different competitive advantages (Barney, 1991).

Grant proposed the concept of resource-based view and considered resource is introspective and can lead the company to a strategic direction (Grant, 1991). Barney proposed a model for resource-based theory and indicated companies have competitive advantage due to some features of resources such as valuable, rare, imperfectly imitable, and without equivalent substitutes (Barney, 1991). Four features should be considered at the same time to create irreplaceable and sustainable competitive advantage. However, certain researchers considered resource is not the only weapon to create competitive advantage and emphasized that resources should be appropriately allocated (Barney and Mackey, 2005; Sirmon, David, Hitt and Ireland, 2007).

Makadok considered the specialty of company is the basis to obtain profit (Makadok, 2001). Day indicated ability is related to organizational routine and is embedded in organizational processes (Day, 1994). The ability to use resources for companies is also different (Morgan, Neil, Vorhies and Mason, 2009). Since each firm has own tacit knowledge, it is difficult to identified and managed (Teece, David, Pisano and Shuen, 1997), and competitors are difficult to imitate. Prahalad and Hamel extended the viewpoint of resource-based theory to the view of core competence (Prahalad and Hamel, 1990). They considered companies need to integrate internal resources to maintain and create competitive advantage. Hamel indicated core competence is not the physical asset but the integration of multiple techniques of organizations (Hamel, 1994). Core competence can create a core value and differentiate with competitors to enter the new market. In addition, core competence can also increase added value to customers and obtain profits with competitive advantage.

RESEARCH METHOD

This research uses the concept of Shapley value to simply estimate the distribution of benefit of service alliance. Shapley value was proposed in 1953 and used to dispatch the benefit based on the degree of contribution a fair way. Shapley value emphasizes on the degree of contribution of the participants, which means participants should obtain fair benefit according to the contribution. The model of Shapley value we used is as follows:

$$\emptyset i = \sum_{\substack{T \subset N \\ i \in T}} \frac{(m-1)!\,(n-m)!}{n!} [v(T) - v(T - \{i\})]$$

We assume there exists a TU game (N, v) and the possible set of participants is N={1,……,n}. $\emptyset$ is the null set to satisfy $v(\emptyset)=0$. $v(T)$ is the payoff function for the alliance T and $T \subseteq N$. The new alliance is (N, v) and participant $i \in T$. m is

the number of members in the alliance *T*. *n* is the total participants in the alliance. T –{i} is the alliance except participant *i*.

Hence, the payoff is v(T) – v(T – {i}), which is also the payoff of the participant's contribution. $\frac{(m-1)!(n-m)!}{n!}$ is the probability of *i* to join the alliance T- {i}.

1. Assumption

We assume there is an alliance, including company A, B, and C. They cooperate each other by sharing resources to provide superior services. The scale of company is A>B>C. A has 50% resource of a service, while B and C have 40% and 10% respectively. According to basic assumption of Shapley value, the generated total benefit should large than generated benefit of any member. This research uses profit ABC to represent the expected total revenue of the alliance. We also assume the allocation of profit is based on the contribution to the alliance. That is, company A can earn 50% of profit, company B can earn 40%, and company C can earn 10%. In the model, profit A is $\frac{5}{10}$profit ABC, profit B is $\frac{4}{10}$profit ABC, and profit C is $\frac{1}{10}$profit ABC. profit A > profit B > profit C. In the alliance, there are only two companies are willing to cooperate. Consequently, the assumptions for any pair of companies are as follows.

- $\frac{5}{10}$profit ABC ≤ profit AB ≤ $\frac{9}{10}$profit ABC

- $\frac{5}{10}$profit ABC ≤ profit AC ≤ $\frac{6}{10}$profit ABC

- $\frac{4}{10}$profit ABC ≤ profit BC ≤ $\frac{5}{10}$profit ABC

2. Shapley Value

First, we estimate the Shapley value of company A. The contribution of company A and other two companies should be calculated according to the model. The possible combinations of cooperation are A cooperates with B, A cooperates with C, and A, B, and C cooperate each other. Hence, the Shapley value is as follows.

$$w(A) = \sum_{\substack{T \subset N \\ A \in T}} \frac{(m-1)!(n-m)!}{n!}[\, v(T) - v(T - \{A\})\,]$$

v(T) is the payoff function for alliance *T* among participants. *N* is the set of participants, N = {A, B, C}. *n* is the number of participants, *n*=3. *m* is the number of participant to join alliance *T*, m=2. T - { A } is the alliance except A. The payoff of A is v(T) - v[T - { A }], which is based on the estimated contribution of A. $\frac{(m-1)!(n-m)!}{n!}$ represents the probability of A to join the alliance T – { A }.

- **A cooperates with B or A cooperates with C**

In the cooperation between A and B, the contribution of A is [v(A, B) – v(B)] which is equal to profit AB – profit B. We can then derive it to $\frac{1}{10}$profit ABC ≤ [v(A, B) – v(B)] ≤ $\frac{5}{10}$profit AB. In the cooperation between A and C, the contribution of A is [v(A, C) – v(C)] which is equal to profit AC – profit C. We then derive it to $\frac{4}{10}$profit ABC ≤ [v(A, C) – v(C)] ≤ $\frac{5}{10}$profit ABC. The probability of A to join the cooperation is $\frac{(2-1)!(3-2)!}{3!} = \frac{1}{6}$.

- **A，B，C cooperate each other**

In the cooperation among A, B, and C, the contribution of A is [v(A, B, C) – v(B, C)] which is equal to profit ABC – profit BC. We then derive it to $\frac{5}{10}$profit ABC ≤ [v(A, B, C) – v(B, C)] ≤ $\frac{6}{10}$profit ABC. The probability of A to join the cooperation is $\frac{(3-3)!(3-1)!}{3!} = \frac{2}{6}$.

Hence, the Shapley value of A is $\frac{1}{6} \times \{\,[v(A, B) - v(B)\,] + [v(A, C) - v(C)]\,\} + \frac{2}{6} \times [v(A, B, C) - v(B, C)]$, which is $\frac{15}{60}$profit ABC ≤ w(A) ≤ $\frac{22}{60}$profit ABC. We consider the maximum value of w(A) = $\frac{22}{60}$ profit ABC, which is still lower than original profit of A ($\frac{5}{10}$profit ABC). We can estimate the Shapley value for B and C respectively. The Shapley value of B is $\frac{11}{60}$profit ABC ≤ w(B) ≤ $\frac{18}{60}$profit ABC. The Shapley value of C is = $\frac{2}{60}$profit ABC ≤ w(C) ≤ $\frac{15}{60}$profit ABC. According to Shapley value,

the maximum value for w(B) is $\frac{18}{60}$profit ABC, which is lower than the original profit of B ($\frac{4}{10}$profit ABC). The maximum value for C is $\frac{12}{60}$profit ABC, which is the only company larger than original profit of C ($\frac{1}{10}$profit ABC). This research summarizes the results in Table 1.

■ Company	Estimated Shapley Value	Comparison
■ A	$\frac{15}{60}$profit ABC $\leq$ w(A) $\leq \frac{21}{60}$profit ABC, w(A) = $\frac{21}{60}$profit ABC	w(A) = $\frac{21}{60}$profit ABC < $\frac{20}{60}$profit ABC
■ B	$\frac{11}{60}$profit ABC $\leq$ w(B) $\leq \frac{18}{60}$profit ABC, w(B) = $\frac{18}{60}$profit ABC	w(B) = $\frac{18}{60}$profit ABC < $\frac{24}{60}$profit ABC
■ C	$\frac{2}{60}$profit ABC $\leq$ w(C) $\leq \frac{12}{60}$profit ABC, w(C) = $\frac{12}{60}$profit ABC	w(C) = $\frac{12}{60}$profit ABC > $\frac{6}{60}$profit ABC

Table 1. Estimated Results of Shapley Value

DISCUSSION

1. The Stability of Alliance

Shapley value focuses in fair distribution. However, members in the alliance may not accept the concept of fairness. In addition, the relationship of cooperation may not be stable and long. The reason may be policy issue except marginal contribution. In our results, we observe company A and B have more profits based on estimated Shapley value. For example, if company A is excellent in cargo service in airline industry, it has more bargaining power in the alliance. The profits will be distributed unfairly in this situation. Hence, new members will not join the alliance if few companies hold key resources. The alliance will be unstable and not exist too long. On the other hand, the formation of alliance is to learn each other and exchange resources to create value in practice. The selection of partners replies on strategic thinking in terms of resources, reputation, and so on. In sum, Shapley value can help companies focus more on fair distribution of benefit.

2. Usability of Resources

According to the viewpoint of resource-based theory, the competitive advantage replies on the resources of companies. The alliance of service is totally different from existing alliance. This research applies the concept of Shapley value to discuss if the alliance of service is feasible. The results show big company may not bring more profits in the alliance. In other words, we should focus on the company that can provide efficient resource usability not the one has the most resources. In our results, C is better than A to provide cargo service. Moreover, companies should consider the complimentary of resources when providing services. Core competences of firms are extremely important in this situation. The new concept is benchmark will not necessary bring the most profit in the alliance. Efficiency is the most important issue in the alliance of services.

3. The Change of Company

Service is different from product. The features of services allow companies to focus more on soft ability (in terms of service) than resources. The service has been dominated the GDP of most countries. However, the alliance in service industry still focuses on strategic viewpoint. In airline industry, the goal of alliance is to provide superior level of service and reduce cost. For individuals, the benefit of economies of scale is the most important issue nowadays. Existing airline alliance mostly shares code in cooperation. Even for the service cooperation, most airline companies will not share core competencies with others in the alliance. The unstable service quality is the factor to decrease customer value. This research considers service alliance can provide a roadmap for airline companies to cooperate. Recourse is not the only issue for alliance and the synergy of alliance is the new trend for airline industry.

CONCLUSION

This research utilizes the concept of Shapley value to simply estimate the contribution of members in the alliance based on assumptions. The actual contribution from Shapley value perspective is not only resources but also the negotiation,

communication, and integration in the alliance. We propose a novel concept of service alliance that allows the company which is efficient and has great ability in a particular service. In this situation, the synergy of service alliance will be enlarged. Shapley value also helps companies identify the contribution fairly based on the mathematical model. In addition to fairly distribution the profit from Shapley value viewpoint, resource-based theory can be also used to consider the synergy of service alliance. Increasing the usability of recourses may result in a competitive environment. For customers, each service is provided by a best company (best may not be benchmark or the biggest size of the company). For members in the alliance, companies can improve core competencies and increase resource usability. For the market, the best match of resource can bring the most efficient situation. In summary, this research aims to provide a roadmap for service alliance in cooperation and prove the feasibility of it.

REFERENCES

1. Aiken, M. and Hage, J. (1968) Organizational interdependence and intra-organizational structure, *American Sociological Review*, 33, 912-930.

2. Barley, S. R., Freeman, J. and Hybels, R. C. (1992) Strategic alliances in commercial biotechnology, in N. Nohria and R. Eccles (Ed.), Networks and Organizations: Structure, Form and Action. Harvard Business School Press, Boston, MA, 311–347.

3. Barney, J.B. (1991) Firm Resources and Sustained Competitive Advantage, *Journal of Management*, 17, 1, 99-120.

4. Barney, J. B. and Mackey, T. B. (2005) Testing Resource-Based Theory, in David J. Ketchen, Donald D. Bergh (Ed.), Research Methodology in Strategy and Management, 2, 1-13.

5. Chan, S., Kensinger, J., Keown, A., and Martin, J. (1997) Do Strategic Alliances Create Value, *Journal of Financial Economics*, 46, 1, 99-221.

6. Chen, H., Lee, P. and Lay, T. (2009) Drivers of dynamic learning and dynamic competitive capabilities in international strategic alliances, *Journal of Business Research*, 62, 12, 89–95.

7. Cowan, R., Jonard, N. and Zimmermann, J. B. (2007) Bilateral collaboration and the emergence of innovation networks, *Manage Sci*, 53, 7, 51–67.

8. Day and George, S. (1994) The Capabilities of Market-driven Organizations, *Journal of Marketing*, 58 ,4 , 37-52.

9. Dyer, Jeffrey H., Kale., Prashant and Singh, Harbir. (2001) How to make strategic alliances work, *MIT Sloan Management Review*, 42, 37-43.

10. Grant, R. M., Baden-Fuller and Charles (2004) A knowledge accessing theory of strategic alliances, *Journal of Management Studies*, 41, 1, 61-84.

11. Gulati, R. (1998) Alliances and networks, *Journal of Strategic Management*, 19, 293-317.

12. Gulati, R., Sytch, M. and Mehrotra, P. (2008) Breaking up is never easy: planning for exit in a strategic alliance, *California Management Review*, 50, 4, 147-163.

13. Hamel, G. (1994) The Concept of Core Competence, in Hamel and Heene (Ed.), Competence-Based Competition, Wiley, Chichester.

14. Hamel, G. and Prahalad, C. K.(1990) The core competence of the corporation, *Harvard Business Review*, 68, 3, 79-91.

15. Hoffmann, W. (2007) Strategies for managing a portfolio of alliances, *Journal of Strategic Management* , 28, 82, 7–56.

16. Kale, P., Dyer, J. H. and Singh, H. (2002) Alliance capability, stock market response, and long-term alliance success: the role of the alliance function, *Strategic Management Journal*, 23, 8, 747-767.

17. Kale, Prashant., Singh, Harbir, Perlmutter and Howard. (2000) Learning and protection of proprietary assets in strategic alliances: building relational capital, *Strategic Management Journal*, 21, 217-237.

18. Kalmbach, C. J. and Roussel, C. (1999) Dispelling the myths of alliances, Outlook, October (Special Edition), 5-32.

19. Kogut, B. (1989) The stability of joint venture: reciprocity and competitive rivalry, *Journal of Industrial Economics*, 38, 183-198.

20. Lee, C. (2007) Strategic alliances influence on small and medium firm performance, *Journal of Business Research*, 60, 7, 31–41.

21. Levine, S. and White, P. E. (1961) Exchange as a concepttual framework for the study of interorganizational relationships, *Administrative Science Quarterly*, 5, 583-601.

22. Lynch, R. P. (1989) The Practical Guide to Joint Ventures and Corporate Alliances, John Willey & Sons, New York.7-8, Harvard Business School Press, Boston.

23. Makadok, R. (2001) Toward a synthesis of the resource-based and dynamic-capability views of rent creation, *Strategic Management Journal*, 22, 5, 387–401.

24. Douglas, W. V., Mason, C. H. and Morgan, N. A. (2009) Market Orientation, Marketing capabilities, and Firm Performance, *Strategic Management Journal*, 30 , 8, 909-920.

25. Nielsen B. B. (2010) Strategic fit, contractual, and procedural governance in alliances, *Journal of Business Research*, 63, 7, 68, 2–9.

26. Oum, T. H., Park, J. H. and Zhang, A. (2000) Globalization and Strategic Alliances: The Case of the Airline Industry, Pergamon Press, Oxford.

27. Penrose, E. (1959) The Theory of the Growth of the Firm, Oxford: Basil Blackwell and New York: John Wiley & Sons.

28. Powell, W. W. and Brantley, P. (1992) Competitive cooperation in biotechnology: Learning through net-works, in N. Nohria and R. Eccles (Ed.), Networks and Organizations: Structure, Form and Action, MA, 366 – 394, Harvard Business School Press, Boston.

29. Richardson, G. B. (1972) The organization of industry, *Economic Journal*, 82, 883-896.

30. Shan, W. (1990) An empirical analysis of organizational strategies by entrepreneurial high-technology firms, *Strategic Management Journal*, 11, 2, 129-139.

31. Shan, W., Walker, G. and Kogut, B. (1994) Interfirm cooperation and startup innovation in the biotechnology industry, *Strategic Management Journal*, 15,5 , 387-394.

32. Sirmon, David G., Hitt, M. A. and Ireland, R. D. (2007) Managing Firm Resources in Dynamic Environments to Create Value : Looking Inside The Black Box, *Academy of Management Review*, 32, 1, 273-292.

33. Teece, D. J., Pisano, G. and Shuen, A. (1997) Dynamic Capabilities and Strategic Management, *Strategic Management Journal*, 18 ,7 , 509-533.

34. Wernerfelt, B. (1984) A Resource-Base View of Firm, *Strategic Management Journal*, 5, 2, 171-180.

35. Yaprak, A. (2011) Dynamic learning and strategic alliances: a commentary essay, *Journal of Business Research*, 64, 11, 28–30.