Impact of Managing Information-Related Tension in Coopetitive Alliances*

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Abstract

Coopetition, i.e., collaboration among competitors, has become an inevitable strategic choice for modern businesses to survive fast-changing environment. The growing attention to coopetition, particularly in knowledge intensive sectors, can be explained by the modern economic reality: rapidly changing technologies, shrinking product life cycles, and stricter industrial standards. Firms choose coopetitive alliances in order to reduce costs and to stimulate total demand growth by combining complementary resources, both financial and informational. In this paper, we propose a model to understand the behavior of two competing firms in strategic coopetitive alliance. Grounded on game theory, we investigate two types of firms' decisions: coopetitive effort and output level. We aim to answer the following questions: Can coopetition be a strategy for firms in the presence of information related tension? What are the optimal levels of coopetitive effort or knowledge sharing to maximize profits? What

are the optimal output levels at equilibrium? Our findings may provide practitioners with strategic guidelines.

Keywords: Coopetition, Alliance, Information

Ⅰ. Introduction

Coopetition is a new concept in the inter-organizational relationships in which firms compete and cooperate simultaneously as it is mainly referred in the management literature (Bengtsson and Kock, 1999). Although coopetition as an economic term has been formulated by Brandenburger and Nalebuff in 1996, yet it is not a new phenomenon – examples of rivals entering the coalition to achieve common goals can be found in politics, sport and, of course, business. In 2004 Samsung Electronics Co.Ltd and Sony Corporation established joint venture producing LCD panels for both Sony and Samsung televisions that brought them to the leading positions in the market (Gnyawali and Park, 2011). In another similar example, Toyota Peugeot Citroën Automobile Czech manufactures small cars to for sale in Europe under three different brands. GM and Toyota assemble automobiles, Siemens and Philips develop semiconductors, and Thomson and JVC manufacture VCRs (Luo, 2007).

The growing attention to coopetition, particularly in knowledge intensive sectors, can be explained by the modern economic reality: rapidly changing technologies, shrinking product life cycles, stricter industrial standards. Organizations involved into coopetitive alliances reduce costs and stimulate total demand growth by combining complementary resources, financial and informational; positive influence of coopetition on firm's efficiency and innovativeness was approved by some of the previous research (Czakon, Mucha-Kus and Rogalski, 2014). Moreover, pioneer research advocates that coopetition is the most preferred strategic choice for firms (Brandenburger and Nalebuff, 1996; Lado, Boyd, and Hanlon, 1997; Bengtsson and Kock,1999). This kind of hurried conclusions stimulates firms to collaborate with their competitors without proper understanding of what coopetition is and doom the whole project to failure.

Coopetition has two facets: it can promote performance and innovation but also is full of risks of opportunism and misunderstanding harmful for fruitful partnership. The evidence of negative influence of coopetition on performance can also be found in the existing literature (Nieto and Santamaria, 2007; Ritala, Hallikas and Sissonen, 2008) revealing the risks inherent in applying cooperation and competition simultaneously.

This dilemma instigates us to explore the topic and find factors influencing on coopetition to define conditions at which it can be successful. This study examines relationship between coopetitors within the field of strategic alliances in which the focus is mostly on formal agreements as alliances are commonly based on a written contract stipulating, for example, the extent of the cooperation, dividing the outcome, and controlling ownership. Strategic alliance, even if it is between competitors, cannot be considered coopetitive unless there exist simultaneity of competition and cooperation and relational tensions triggered by this paradoxical situation. Using same managing methods is the main mistake that brought many companies to fiasco because conventional strategies are not applicable in this case. The aim of the thesis is to build a model that can (a) fully reflect the concurrence and interdependence of conflicting logics and (b) show how managerial antecedents influence on firm's profit.

Coopetition can be distinguished from other interorganizational interactions by its paradoxical nature resulting from the simultaneity of cooperation and competition. We suggest that the paradoxical nature of coopetition is the key characteristic of the relationship as the phenomenon juxtaposes two contradictory although interrelated elements, which are equally important to gain benefits from the relationship (Bengtsson and Kock, 2014). Since this paradox can be difficult for understanding it is often misinterpreted as cases in which cooperation occurs during one period and competition occurs during another period which is very incorrect. It is more accurate to say that rivals cooperate in some areas while competing in others (Luo, 2007). Cooperation is dominating in upstream and downstream value chain activities such as long-term outsourcing or supply agreements, co-production, co-marketing, R&D, information systems, organizing experience, and managerial expertise.

In the alliance literature competitive aspects are regarded as potentially harmful

and need to be reduced to minimum (Child et al., 2005; Hennart, 2006) which contradicts to the concept of coopetition. The emerging coopetition perspective tries to integrate the two paradoxical logics into a common construct (e.g. Bengtsson et al., 2010 and Chen, 2008) to make them dependent on each other. As we propose it can be achieved if positive and negative impacts are functions of the same managerial antecedent but with opposite signs; in our case increase in revenue is in contrast to increase of costs. Applying this idea to profit function we can analyze the influence of coopetition of form's performance. We suggest that the level of coopetitive effort can be a variable we are seeking for, since information related tension is critical for strategic coopetitive alliance. The distribution of the articles over time shows that interest increased rapidly since the early 1990s. In the decade between 1993 and 2003, 28 articles were published, compared to 137 between 2004 and 2014 (Dorn, Schweiger and Albers, 2016). The review of the management literature on coopetition showed that there are two main bodies of related research: impact of coopetition on the performance and managing paradoxical coopetitive tensions.

Information related tension is crucial for several reasons. First of all, being unperishable knowledge can be used after the collaboration is finished eliminating advantages of a company in other markets. Besides, transferring of information is not necessarily a spillover or appropriation but a part of a working process mutually performed by both sides. Lastly, asymmetry of learning is inevitable since some firms learn faster than others (Bouncken and Kraus, 2014). The level of coopetitive effort in this study is the degree of information and knowledge sharing between coopetitors. Firms need to find the safe level of coopetitive effort to gain maximum benefits from coopetition and at the same time insure themselves from opportunistic behaviors and other risks. Optimal level of coopetitve effort is the main concern of this study.

We implement game theory, namely extended Cournot's duopoly, to build a model simulating behavior of two competing firms in strategic coopetitive alliance making two types of decisions: coopetitive effort and output level. The solution will answer the following questions: Considering information related tension can coopetition be a preferred strategy for all firms involved? What are the optimal levels of coopetitive

effort or knowledge sharing to maximize profits of all firms involved? What are the optimal output levels given levels of coopetitive effort for each of the firms? These findings will contribute to the previous research reviewed in the next chapter and recommendations for practitioners discussed in the last chapter of the paper.

Ⅱ. Literature Review

First of all, previous research did not provide a direct evidence regarding the relationship between coopetition and firm's performance. Positive influence was revealed by Marques, Robert and Le Roy (2009), Neyens, Faems and Sels (2010), Peng, Pike, Yang and Roos (2011), Bouncken and Fredrich (2012). Neyens et al. (2010) divided the set of 217 Flemish startups into 'discontinuous alliance strategies' and 'continuous alliance strategies' with competitors and found that there is a positive impact on the incremental innovation in the first group and radical innovation in the other. Findings of Peng et al. (2011) research confirmed that for a certain period competition and cooperation mutually promote each other leading to higher levels of performance. The research asserted that expected levels of performance can be achieved faster in a certain timeframe and the indicators slowing down in pre-network can be reinvigorated in the coopetition. Lechner, Soppe and Dowling (2016) proposed that unbalanced vertical coopetition is more beneficial for young and small firms, since relationships with larger competitors can lead to more of social capital than with same size or smaller ones.

On the other hand, Nieto and Santamaria (2007), Ritala, Hallikas and Sissonen (2008) proved coopetition to be harmful for firm's performance. In the contrast to Neyens et al. (2010), Nieto and Santamaria (2007) suggest that cooperating with rivals has negative effect on the degree of innovation novelty. According to them, not only collaborating with competitors was inefficient for producing innovation but, moreover, its' impact was harmful for more novel innovations, which may be crucial for maintaining a competitive advantage over the competition. The reason was seen in the fear of increased risk of opportunistic behavior and lack of trust. Ritala et al.

(2008) also proposed that firms should avoid multiple strategic alliances with their key competitors since that contributes negatively to their performance. The subject of the study is the effect of strategic alliances between key competitors on the performance of a single firm by approaching the issue from two directions: the relative number of coopetitive relationships among the group of firm's strategic alliances and the relative number of coopetitive relationships among the group of firm's key competitors. Authors claim that coopetition can be beneficial to a firm's performance, but only when the firm collaborates with only some, and not all, of its key competitors.

The most recent flow of coopetition literature addresses managing tensions inside coopetition which is now considered to be a more complex strategy than it has been suggested by the previous research. Chin, Chan and Lam (2008) determined and examined success factors critical to coopetition strategy management and explored them on the example of the Hong Kong manufacturing. The results showed that the most important factors are management, leadership development of trust, and long-term commitment. Bengtsson and Kock (2015) provided the conceptual framework for analyzing dyadic coopetitive tensions between two conflicting firms and defined two types of dyadic relationships: reciprocal coopetition and multi-polar coopetition. Raza-Ullah, Bengtsson and Kock (2014) explored the paradoxical nature of coopetition through the concept of internal and external boundaries and distinguish paradox from tension. Wilhelm (2011) explored managing coopetition within the supply chain at supplier-supplier and network levels. Fernandez, Le Roy and Gnyawali (2014) highlighted three levels of tensions in coopetition that can be efficiently managed by principles of separation and integration.

There are few papers concentrating particularly on information related tension that concerns this study also. Fernandez and Chiambaretto (2016) discuss implementing formal and informal control mechanisms to share and protect different kinds of information divided by appropriability and criticality.

In this research we tried to tie together two flows of the previous literature mentioned above and analyze the impact of managing tensions inside coopetition on firms' performance. We believe it can start a new direction in the coopetition research with

a big potential and challenges for future studies. There are other papers that had similar motivation, such as Bauncken and Fredrich (2012) who tried to find the correlation between managerial antecedents, performance and innovation effects, and two relational factors, trust and dependency, of coopetition. This study showed that the most beneficial context is both high in trust and dependency. Such results led us to the idea that if trust or the lack of trust is correlated with firm's performance than it should be included as a variable to the profit function and by doing so we can prove its' impact on the performance.

In conclusion it should be said that we agree with Bengtsson and Kock (2014) who wrote that despite the increased number of publications, the coopetition field remains in the process of development, and needs additional research to extend our current knowledge.

III. Model

The model is based on the classic Cournot duopoly in which two competing companies: firm1 and firm2 simultaneously make independent decisions on the amount of output to produce. Firms establish coopetitive alliance in which they have to share knowledge and learn from each other. The model is extended by introducing new decision variables (coopetitive effort) s_1 and s_2 in such a manner that they have dual impact on firms profit functions: positive and negative.

Profit functions of firm 1 and firm 2 are

$$\pi_1 = ((1+s_1+s_2)a-q_1-q_2)q_1-cq_1-\alpha s_1^2$$
$$\pi_2 = ((1+s_1+s_2)a-q_1-q_2)q_2-cq_2-\beta s_2^2$$

where

q_1, q_2 - output quantity of firm1 and firm 2 respectively

c - marginal cost, identical for both firms.

s_1, s_2 - coopetitive effort (sharing knowledge) of firm1 and firm 2 respectively;

$0 < s_1,\ s_2 < 1$.

$s_1,\ s_2 = 0$ – no any cooperation, $s_1,\ s_2 = 1$ – providing full access to any information on partner's request.

$(1 + s_1 + s_2)a$, is a synergetic effect from combining complementary resources of the firms resulting in market growth.

$\alpha s_1^2,\ \beta s_2^2$ are firms' coopetition costs or costs of sharing information with competitors, reflecting the competitive logic of coopetition and risk of opportunistic behavior of partners.

Coefficients $\alpha,\ \beta$ determine the heterogeneity of the firms.

Each of the firms aims to maximize profit given the decision of the other firm on the coopetitive effort and the level of output.

Proposition 1.

Given levels of coopetitive effort of firm1 and firm2: $0 < s_1,\ s_2 < 1$, *there exists unique Nash equilibrium at which strategy* $x^* = (s_1^*,\ s_2^*,\ q_1^*,\ q_2^*)$ *is a strictly dominant strategy for both players.*

$$s_1^* = \frac{a(3c - a)\beta}{a^2(\alpha + \beta) - 9\alpha\beta}$$

$$s_2^* = \frac{a(3c - a)\alpha}{a^2(\alpha + \beta) - 9\alpha\beta}$$

$$q_1^* = q_2^* = \frac{a^2(3c - a)(\alpha + \beta)}{3(a^2(\alpha + \beta) - 9\alpha\beta)} - \frac{a - c}{3}$$

$$\pi_1^* = \left(\frac{a^2(3c - a)(\alpha + \beta)}{3(a^2(\alpha + \beta) - 9\alpha\beta)} + \frac{a - c}{3} \right)^2 - \alpha \left(\frac{a(3c - a)\beta}{a^2(\alpha + \beta) - 9\alpha\beta} \right)^2$$

$$\pi_2^* = \left(\frac{a^2(3c - a)(\alpha + \beta)}{3(a^2(\alpha + \beta) - 9\alpha\beta)} + \frac{a - c}{3} \right)^2 - \beta \left(\frac{a(3c - a)\alpha}{a^2(\alpha + \beta) - 9\alpha\beta} \right)^2$$

Let $(s,\ \pi)$ be a game of 2 players firm 1 and firm 2, where $S = S_1 \times S_2 = (s_1,\ q_1) \times (s_2,\ q_2)$ is the set of strategy profiles and $\pi(x) = (\pi_1(x_1),\ \pi_2(x_2))$ is its payoff (profit)

function evaluated at $x_1 \in S_1$ and $x_2 \in S_2$. Each firm decides on the level of the knowledge sharing s_i and the amount of the product to be produced q_i to maximize profit π_i. A rational player who believes that his opponent is playing $x_1^* = (s_1^*, q_1^*)$ will always choose $x_2^* = (s_2^*, q_2^*)$ as the best response and vice versa, as π_1 and π_2 were solved simultaneously for maximization (Appendix). Since strategy profile $x^* = (s_1^*, s_2^*, q_1^*, q_2^*)$ is a strict dominant strategy equilibrium, $x_1^* = (s_1^*, q_1^*)$ and $x_2^* = (s_2^*, q_2^*)$ are strictly dominant strategies for firm1 and firm 2 respectively and no unilateral changes of the strategy made by one of the players can be profitable for that player. In other words, if one of the firms changes either coopetitive effort level or output level or both different from (s_i^*, q_i^*) the equilibrium will not exist anymore and the other member of the alliance will lose the motivation to cooperation. ∎

The existence of Nash equilibrium proves that firms can coordinate with each other and choose such a strategy that coopetition will be mutually beneficial. In other words, we proved the legitimacy of strategic coopetitive alliances in which both firms should play optimal strategy and any unilateral changes will breach the balance.

It is surprising, that at Nash equilibrium shares of both firms are equal, although their levels of coopetitive efforts can differ. Even it may seem unfair at the first glance, if profits received in coopetition are higher than could be otherwise, firms should enter the alliance.

It is also important to notice that equal share of the market does not guarantee equal profits. These results shows again the interplay of cooperation and competition: firms create market and split it in halves as partners but each is responsible for its' own profit.

Proposition 2.

If firms cooperate at $0 < s_1$, $s_2 < 1$ and compete at s_1, $s_2 = 0$, then optimal output levels of the firms q_1^*, q_2^* in coopetitive alliance is always higher than in pure competitive relationship.

The concept of coopetition claims that combining resources competitors can expand the market to be further divided among them so that not depending on the proportion in which market is shared the production level should increase for both firms. Let the firms have following strategic choice: to cooperate $(0 < s_1,\ s_2 < 1)$ or compete $(s_1,\ s_2 = 0)$. If we consider best response functions as payoff functions as output levels as outcomes $q_1 = \frac{1}{3}(a(1 + s_1 + s_2) - c)$ and $q_2 = \frac{1}{3}(a(1 + s_1 + s_2) - c)$, then we have another game $(s,\ q)$, where $S = S_1 \times S_2 = s_1 \times s_2$ is the set of strategy profiles and $q(x) = (q_1(x_1),\ q_2(x_2))$ its payoff function. The strategy profile $x = (s_1,\ ,s_2) = (0,\ 0)$ is strictly dominated : $q_1(0)$ and $q_2(0)$ can never be the best response to any strategy of the opponent. At any level $0 < s_1,\ s_2 < 1$ coopetition gives bigger production for both firms than not cooperating at all confirming the suggestion that coopetition can be a "win-win" strategy. ∎

Proposition 1 proved that optimal strategy for the firms is to choose equal level of outputs; Proposition 2 shows that this level is beyond what each firm can achieve independently. Firms aim on a "bigger pie" through coopetition, yet simultaneously or afterwards pursue increasing their share of the pie at the expense of the other firm. Bouncken Fredrich (2016).

However, one can make a wrong conclusion that the higher coopetitive effort level the better because it increases the output level. It should be reminded that coopetition is mutually beneficial at Nash equilibrium only and also the bigger amount of production does not guarantee profits growth.

Proposition 3.

If $(s_1^*,\ s_2^*)$ is a dominant strategy where s_1^* and s_2^* are Nash equilibrium optimal levels of coopetitive effort of firm 1 and firm 2 respectively, then:

- *firm 1 is less cooperative then firm 2, if $\alpha > \beta$*
- *firm 1 is more cooperative then firm2, if $\alpha < \beta$*
- *firm 1 and firm 2 are equally cooperative, if $\alpha = \beta$.*

Coopetitive effort levels of firms depend on α and β which are the coefficients of coopetition cost functions αs_1^2 and βs_2^2.

If $\alpha > \beta$, then coopetitive effort levels are related as $s_1 < s_2$, that means firm 1 is less cooperative then firm 2.

If $\alpha < \beta$ then coopetitive effort levels are related as $s_1 > s_2$, that means firm 1 is more cooperative then firm2;

If $\alpha = \beta$ then coopetitive effort levels are equal $s_1 = s_2$, that means firm 1 and firm 2 are equally motivated to cooperate.

The impacts of α and β can be explained through sensitivity of firms' profits to the change in coopetitive effort levels. αs_1^2 and βs_2^2 are quadratic functions with the average rate of change (slope) $2\alpha s_1$ and $2\beta s_1$ respectively. If $\alpha > \beta$, then the similar increase in s_1 and s_2 will cause a greater change in coopetition cost (αs_1^2) and so greater risks for firm 1 than for firm 2. On the contrary, if $\alpha < \beta$ the similar increase in s_1 and s_2 will cause a greater change in coopetition cost (βs_2^2) and so greater risks for firm 2 than for firm 1. Finally, if coopetitive effort levels are equal both firms bear the same risks when share more information with the partner. ∎

Logically, firms will tend to keep a low level of coopetitive effort if they are sensitive to changes in sharing information. That can characterize knowledge intensive sectors such as IT or services, especially for smaller size companies. However, it does not mean they should totally avoid participating in coopetitive alliances because in this way the benefits of coopetition will also be eliminated.

Influencing coopetitive effort levels coefficients α, β also have impact on optimal profits: lower coopettive effort level results in lower cost of coopetition and eventually higher potential profit in comparison to the partner's. It should be remembered that these results are true if firms implement optimal strategy, in which both of them produce the same amount of goods.

Ⅳ. Conclusion

This study contributes to both direction of academic literature on coopetition: its' impact on firm's performance and managing coopetitive tensions. First of all, the presented model formulates the information related tension in coopetition as a real managerial antecedent influencing on the profit not simply conceptually describes it as the prior research. Most of the papers on this topic are limited by understanding the role of information related tension in coopetitive alliance not trying to actually measure its' impacts. In our model it is clearly seen how coopetition has conflicting impacts on firm's profit. Moreover, we managed to include positive and negative impacts of coopetition so that they became mutually depending and not isolated from each other which totally coordinates with the concept of simultaneity of competition and cooperation. Implementation of coopetitive effort to the model as a positive and negative parameters gives understanding on how a firm should manage risks of coopetition related to knowledge sharing contributing at the same time to the success of the project.

This study proved that game theoretical methodology is applicable to the coopetition research. Strategy dominance and Nash equilibrium are effective tools in analyzing advantages of coopetition over pure strategies using which it was possible to justify that coopetition can be a win-win strategy and at what conditions. The majority of non-theoretical coopetition literature consists of empirical research or case studies so this study also contributes to the methodology of analyzing coopetition.

Our finding that firms have different reaction on the coopetitive effort increase so coopetition can be risky for certain types of businesses contributes to better understanding of coopetition and its laws. Knowing that individual characteristics of firms can moderate or amplify impacts of managing coopetition we can give practical recommendations to practitioners.

This study helps managers to better understand that the coopetition can be considered as a preferable strategy having both advantages and drawbacks. The difficulty of managing coopetition is the separation of benefits and risks of knowledge sharing in

time – synergetic effects can be observed in the period of collaboration while the consequences of partner's opportunistic behavior are realized outside the alliance so managers do not consider it at the moment of making decisions on providing access to firm's information. The simultaneity of competition and cooperation is one of the key aspect of presented model.

Another recommendation for managers is to be aware that coopetition can be more risky for companies pursuing knowledge as their competitive advantage, like IT startups. For businesses based on the informational resource sharing it with competitors is a big risk but also their major or even only contribution to the common project.

There are several limitations in this study. First of all, information is not characterized and used universally. Previous research divide information into four categories based on two dimensions: criticality (Baumard, 2010) and appropriability (Das and Teng, 1998; Oxley, 1997) supposing only critical and appropriable information to be strictly protected (Fernandez and Chiambaretto, 2016). Differentiating the levels of security for different categories of knowledge can improve managing intra-organizational tensions in coopetitive alliances and build more trust between partners. The impact of coopetition on marginal cost is not included into the model while cost reduction is one of the main motivations of firms to partner with competitors. The closer interaction and openness of coopetitiors can, for instance, decrease transaction costs.

Secondly, there are no findings explaining how a firm can receive a bigger share of a newly created value. Finding unique Nash equilibrium gives the idea how value is divided between members of a coopetitive alliance, yet cannot provide the mechanisms how to receive a bigger share.

Lastly, although it was claimed before that similarity of firms is correlated to the fair distribution of the value, cooperating with a too similar competitor is a threat for the alliance performance. First of all, identical firms are less complementary too each other so that less synergetic effects can be expected. Second of all, the risk of opportunism is higher because it is easier to apply knowledge of a similar firm.

Regarding future research, apart from alterations connected to limitations mentioned above, that would be interesting to extend the model for network with more than two

firms to find how the number of partners can influence on firms' profits and industry as a whole. A number of prior research is focused on coopetitive networks. Imperfect or incomplete information games will be more realistic in explaining opportunistic behaviors. Since this study is focused on the impacts of coopetition on profit new research can examine other variables like innovation performance or productivity.

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