RESEARCH ON THE OPERATIONAL INTEGRATION PROCESSING OF TELECOM OPERATORS BASED ON GAME THEORY

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Abstract: Referring to the Game theory, the paper gives a conclusion of China's telecom industry restructuring, and analyze how to reserve advantage business in both sides and how to find the profit-maximizing strategy for each side when they are merged together. In addition, the paper also analyzes the competition between telecom operators and cooperation, and gives the corresponding recommendations based on the "Prisoner's Dilemma" case study.

1 INTRODUCTION

China Telecom industry has a late start, as well as it's development history experienced large numbers of reforms such as the separation of enterprise and operators restructuring to establish a reasonable market standard. After the telecom restructuring in 2004, there are six operators named China Telecom, China Mobile, China Unicom, China Netcom, China Satcom and China Tie Tong. However, the development of telecom industry is unsatisfactory. First, the mobile communications strongly impact the two fixed operators, business income and number of users decline each year. Second, the process of grabbing the mobile market between China Mobile and China Unicom is lack of effective competition mechanism, resulting in the unnecessary waste of mobile market resources, and bringing losses to the country and industry. Therefore, the telecom operators restructured again in 2008. China Telecom acquired CDMA network of China Unicom; China Unicom combined with China Netcom; China Telecom acquired China Satcom's basic telecom business; China Tie Tong combined with China Mobile. Competition status of China Telecom, China Mobile and China Unicom has formed finally, and we called this status "the three pillars" pattern.

The restructuring will promote the competition between operators, and is good to increase the efforts to promote information products during the time when the development of operators in the voice business is slow down or even stagnated (Lv Xuehai, 2008). Currently the three major 3G operators have begun to form their own marketing characteristics, by providing differentiated products and producing mix to form the competitive differentiation. It is very favourable for the weak operator to adjust self-location and improve the competitiveness.

2 RELATED WORK

There are a lot of documents analyzing the companies merger and service convergence at home and abroad. Yadong Luo utilized historical data to analyze the integrated economic system which has the formation of combining several economies, and analyzed the interdependence and Games Relations between the economies. He also pointed out some major factors impacting the performance of the economy strongly in the point of new institutional economics and enterprise competitiveness (Yadong Luo, 2008). Dai Rui analyzed the reasons and motives of the business vertical expansion in domestic telecom operators in the point of classical economics, new institutional economics and enterprise competitiveness, and attempted to study the impact of the vertical expansion to the industrial chain by game theory (Dai Rui, 2009). Through the use of the diffusion model of network innovation, Chunyan Li has also analyzed the development prospects of the domestic telecommunications

market, and given the profits of the enterprise customers and market share before and after China's telecom industry restructuring by the analysis of the historical data (Chunyan Li, 2009). In addition, domestic scholars are also studying the development strategy after the restructing and analyzing the price competition of the mobile industry by using the knowledge of game theory. By now, they have already proposed much more objective and effective method.

Through the existing research results, we can directly study the impact of the companies merger to the market, or study the market expansion by the use of game theory purely, or give some recommendations with regard to the merger and restruction of telecom operators. However, there is no studying for the model of the parent company's business integration. The paper, based on the carrier recombination as the background, using the game theory as the weapon and taking broadband services for example, will focus on the cooperative game in the process of the integration of the parent company's business and the competitive game between the telecom operators after the merger (Qibin Xiong, 2009). Meanwhile, based on the theoretical results, the paper has proposed a number of advices and offered suggestions for the telecom companies to develop harmonious and orderly (Changsh liu,2007).

3 MODEL ANALYSE

Suggest A and B are respected as the domestic Telecom operators, A' is the subsidiary company combined with A. N_A means the number of clients who use the broadband services of A company at the present stage. $N_{A'}$ is total broadband customers of company A'. Now, we can approximate suggest that $N_{A'} + N_A$=const.

3.1 The Game between A' and A

As A convergenced with A', both of them are completing their broadband services step by step. A company have added the scale of purchase from APRON and GPON, and set a large scale of net dispose. However, A keeps investing and try its hard to expand the group of client to benefit more. As the merger of these two company, A' becomes A's individual subsidiary company, mainly supplies regular comunication services, in face of limited customer base, parent company and subsidiary company share cross-promoting regions in the

business space. However, both sides must adhere to the premise of a parent company to achieve a common profit; it can reflect the significance of the merger. Therefore, in the combination of parent and subsidiary company in the broadband services business, there is not only mutually exclusive but also mutually complementary in business service. Using game theory to find an optimal strategy in a business combination will achieve profitability of both overall.

Parent and subsidiary company's payoff matrix is shown in the table 1 below: (figures in parentheses under the four-frame, A's income before, B's income after)

Table 1: This caption has one line so it is centered.

		Parent Company A	
		APON, GPON	ADSL
subsidiary company A'	APON, GPON	(a_1, a_1')	(a_2, a_2')
	ADSL	(a_3, a_3')	(a_4, a_4')

Obviously, the game of the parent and subsidiary company in business choice is in the area of the cooperative game, the two sides in the premise of the group premise, choose the appropriate strategy, and finally the overall interest increase, at least to ensure that individual interests are not reduced (Binzh Cheng, 2007). Cooperative Game study how to distribute co-operation profit when cooperate achieved, that is, issues of income distribution. Cooperative game takes a collaborative approach. Therefore, in accordance with the mother-child relationship and the respective advantages of broadband services based on, the two sides should choose (a_3, a_3') strategy, and this chosen will achieve the Nash equilibrium.

Get the result of a_3 and a_3' by the following linear programming:

$$\max z = a3 + a3'$$

$$a_3 = \sum_i w_i x_i$$

$$a_3' = \sum_j w_j' x_j$$

$$a_3 \geq 0$$

$$a_3' \geq T_p$$

In addition, X=(x_1, x_2, L, x_n), $n \in N^+$ means that several factors affected the benefits of broadband services,

including service penetration, customer satisfaction, product cost, infrastructure investment, quality of network service and so on. These parameters can be determined by the actual situation of operators. Parent company A, the weight coefficient corresponding to $W=(w_1,w_2,L,w_n), n \in N^+$ is used to control the ratio among the impact factors. Similarly $W'=(w_1',w_2',L',w_n'), n \in N^+$ is weight coefficients corresponding to subsidiary company A'. T_p is the average income in the aspect of broadband business before the merger of parent company and subsidiaries company.

3.2 The Game between A and B

A and B are two domestic telecom operators, each owns not only its comparably mature service systems and customer groups, but also advantageous services. The telecom industry restructuring in one hand accelerates company's full service development mode, in another hand further makes direct competition between companies more severely. As a result, in some services (here mainly discuss APON&GPON) A and B directly compete with each other. So an objective analysis of the competition relationship in aspect of gaming is described as follows.

Based on current infrastructure and service quality, the key factor which determines user group number is the price. A low price strategy surely will attract more customers, and in a certain price level, true "small profits, quick returns" will be achieved, so as to maximize company profit. However, one side's lowering price will inevitably cause another side to lower its own price, and then price competition begins. In face of this dilemma, to find the underlying cause using gaming theory and seek the way to get out is a most necessity.

In modern economics, a classical example named "Prisoner's Dilemma", e.g. in a situation when both sides cannot share information, each will choose a strategy only to maximize its own profit, but the sum of both added is lowest. In the opinion of game theory, oligopoly companies often find themselves in such dilemma, like prisoners, each competitor has an impulse to betray others or lower its own price. Though cooperation is attractive, but each competitor has good reason to worry if it adopts a mild strategy, others may make use of it and occupies a large market share. Therefore, in Telecom Industry, competition between A and B often leads to a fierce and low-profit situation.

Facing this predicament, both competitors can adopt a cooperation strategy like "Lowest Price Limit" or "Production limited price" (Qibin Xiong,2009). The so called cooperation strategy, e.g. companies in the same industry adopting consistent behavior aimed at limiting competition, is collusion in nature. "Price -fixing cartel" is a most common one, Home Appliance Industry has such precedent (Weifeng Ren, 2005).

In the gaming theory aspect, the two Telecom operators can benefit much from cooperation. Otherwise, betrayal will cause retaliation and no one has the courage to get out of this relationship. Therefore, under the circumstance when infinite and repeat gaming is possible, cooperation can be achieved. The meaning for A and B is, the possibility of cooperation between them does exist. First, in a predictable period of time, the competition between A and B will last for a long time, and this competition is almost like infinite and repeat gaming. Consequently, concerning both sides' long profit, cooperation is a better choice in this game. Second, government can interfere or set limit to Telecom operators' vicious price competitions.

4 RELATED SUGGEST TO SERVICE CONVERGENCE AND SPECIFICATIONS OF OPERATORS COMPETITION

4.1 Recommendations to Integration of Parent Company and Subsidiaries

As China Mobile merged with China Tie Tong fixed network for instance, the following comes several recommendations in the respect of broadband services convergence:

Consider about the big difference between Mobile broadband and fixed broadband in the respect of user habits, traffic model, routing strategy, the affordability of quality of service, and the factors in telecommunications policy regulatory, the recent suggestions come as following:

Maintain the two existing business network, CTTNET for fixed broadband services, and CMNET for mobile internet services.

▪ Nodes of China Mobile in the area of Hong kong share with China Tie Tong;

▪ Expand the core node level bandwidth of China Tie Tong and China Mobile's backbone Internet;

▪ Build provincial level Internet links to achieve sharing the contents of the two net in province , as well as the resource of provincial export bandwidth;

■ IDC of the two operators both access to the two net in AS-model simultaneously ，and achieve comprehensive resource sharing of IDC;

■ Utilize the QoS strategy deployment of existing CTTNET network resources to meet the rapidly growing VPN business for large customers;

■ After the deployment of MPLS VPN in CMNET, CTTNET can support for MPLS VPN users with backup channel in order to improve the security of client networks

The advantages of sub-network for carrying fixed and mobile services in the following:

■ Fixed and mobile traffic routing sub-network organization and implementation of control strategies, ease of maintenance management and business organizations;

■ In the case of MPLS VPN PE undeployed in CMNET currently, the CTTNET of China Tie Tong can provide VPN services quickly to meet the needs of enterprise customers;

■ Because of being dominated by real-time traffic services and P2P services, and bandwidth is in hare demand, the fixed broadband services, which has obvious characteristics of busy periods and high requirements to user IP address, sub-network carrying fixed and mobile broadband services, can avoid the telecom regulatory policy risk better, and avert complaints from other operators.

4.2 Recommendations for Long-term Integration

■ Make differential positioning of two nets, one for high-level customers as a high-quality network, which can provide comprehensive data for high-level business services, and provide national MPLS VPN service with assurance of QoS quality; while the other net provide Internet business to normal users;

■ With the deepening of network convergence, broadband user authentication system and DNS system are being built and unified step by step.

4.3 The Relevant Proposals for Operators Competition

Reference to "prisoner's dilemma", we can find unlimited game make the cooperative behaviour possible. After unlimited game, the two sides must be able to find common points of interest. Under certain conditions, the two sides can choose cooperation way to solve the problem. Therefore,

cooperation between competitors is possible, and both can get benefit. At the present time, domestic telecomm are still in face of the situation that usually called "the three pillars". The pricing strategy among the three operators is going on endlessly, instead two dominated the mobile market over past. At present, any actions attempt to change the market price of re-shuffling unilaterally are unrealistic in the condition of maturing market. Fighting for the market share is a zero-sum game. There must be a loser while somebody wins. But the pursuit of profit is a positive sum game which can achieve a win-win through cooperation. For China telecom operators, the competitive strategy should be changed, get out of the endless price war and create a significant competitive advantage in some section of the value chain.

It's the best way to build different modes of operation, focus on direction of brand, compete with the brand and make a head start in the brand competition for China's mobile operators. For example, "Tianyi" 3G Series which launched by China Telecom at present occupied the emerging market which put students as potential customers, won a place in the field of wireless communications for China Telecom after getting a mobile network license for the first time.

Rational competition and cooperation is needed to deepen reform of system for the situation of China Telecom. Extensive cooperation between operators can fully exert the performance of communication networks and improve the efficiency of communication networks resources. It also can expand market share together and improve economies of scale to get out of the trouble of "prisoner's dilemma" and to achieve good vision of win-win.

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