Acta Technica *62* (2017), No. 5A, 981–988

Analyzes of the constructing operator data platform

Xi Yang[2,4], Ting Jie Lv[2], Xia Chen[2], Yang Zhang[3]

Abstract. In the face of the policy put forward by the China government, the operators rely on the profit model of the basic telecom business to be affected. This paper analysis qualitatively based on establishing a dynamic game model. The strategy is presented to meet the needs of mobile operators and industry development. In order to make operators examine emerging data services with a developing point of view, to complement each other, to take the required, to achieve a reasonable allocation of resources. Avoiding the prisoner's dilemma led to a sharp drop in global returns owing to the excessive pursuit of their current benefits. Only through the correct guidance of the government can encourage operators to build data platform. In the future, only when the data platform is officially completed, can the market demand increase gradually, the profits will stimulate the operators to fund, manpower, technical corresponding inputs continually, to make data realizable, to achieve the purpose of operators to increase income transformation.

Key words. Operator, data platform, game theory, dynamic game.

1. Introduction

In the Internet age, the data is money[1]. China's telecommunications market is facing enormous pressure, the time when rapid development of basic telecommunications business has been dividend is about to disappear2. Premier Li KeQiang put forward clearly to promote the speed and reduce the costs of communication when he presided over the executive meeting of the State Council on May 3. "Reduce the communication costs at the same time to improve the transmission speed" is a policy, to force operators to reduce communication costs through policy means, to

[1]Acknowledgment - This paper is supported by Major Program of the National Social Science Foundation of China under Grant No.15ZDB154, National Basic Research Program of China (973 Program) under Grant No. 2012CB315805, and National Natural Science Foundation of China under Grant No. 71172135.

[2]Workshop 1 - School of Economics and Management, Beijing University of Posts and Telecommunications, Beijing, 100876,China

[3]Workshop 2 - Networks, China mobile communication corporation, Beijing, 100023,China

[4]Corresponding author: Xi Yang ;email:yangxibupt@163.com

benefit the people while restricting the development of the telecommunications industry. At the same time, the popularity of smart phones, the user's daily have been inseparable from their smart phones, smart phones are used even more frequently than the computers3. And the operator has lots of customer's information, such as, when or where was the customer, with what type of hand phone, to whom did he talk? Which is the customer's favorite phone brand? Customer's consumption behavior, habits and hobbies hidden in these big data information. After being refined, calculated, and wisely used, this big data is like a vast treasure trove of information, will create great business value for the operator. [4] At present, Chinese operators still remain in the basic telecom business profit model. They are not able to develop and make full use of massive amounts of data generated by users and networks. Therefore, China's telecom operators must understand the situation correctly, think attentively, strategically and timely, introduce new services and profit model in the field of new data analysis[5].

Mobile operators have a great opportunity in the aspect of development in large data analysis and other business field[6]. Based on the large data of Internet of Things technology receipt, the industry provides large data solutions to the tourism, transportation, finance, retail, credit and other industries, through the deep analysis and mining of the data, and industry needs are considered[7]. The advancement of large data analysis techniques has led to the deepening of the value of these "massive" data. Based on the game theory, this paper takes the two mobile operators as the participants to establish the static game model under the condition of complete information. Through the comparison of the income under different conditions, the corresponding equilibrium solution is determined. In the presence of different environments. In addition, this paper establishes a dynamic game model based on qualitative analysis. The strategy is presented to meet the needs of mobile operators and industry development. In order to make operators to build emerging data services to the future point of view, to complement each other, to take the required, to achieve a reasonable allocation of resources. In order to avoid the prisoner's dilemma led to a sharp drop in global returns because of the excessive pursuit of their current benefits. They need the correct guidance of the government, encourage operators to build data platform.

2. Background escription and condition hypothesis

Operators have a wealth of data assets, data features as follows:

(1)The huge amount of data, with the number of PB-level data.

(2)Location information, Internet access information, detailed information are directly related with other customer behavior and hobbies, they have high commercial values, the data is the basis of customer behavior analysis, it needs to be calculated before applications.

(3)Distributed in a wide range of industries. Operators are targeted at a wide range of services, with data distributed in all popular industries. Based on the mass data of operators, data mining technology, customers with large data applications, customized solutions for tourism, transportation, retail, finance, education, medical,

community, environment and other industries large data services.

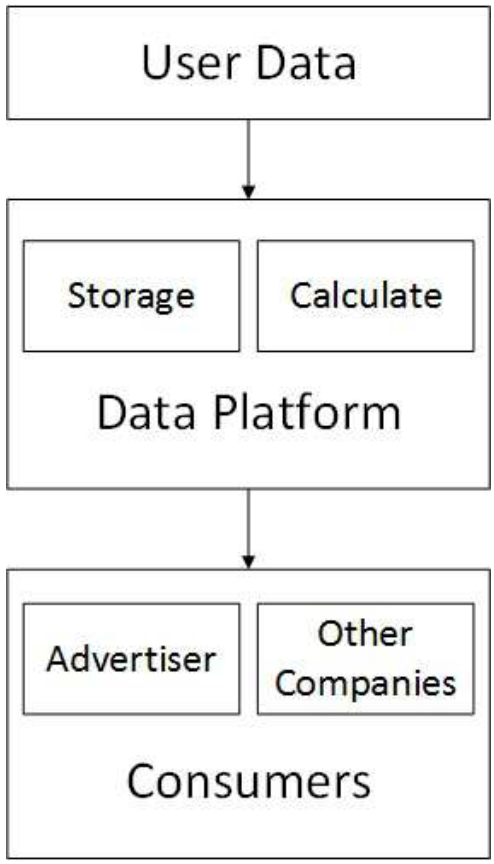

Fig. 1. The structure of Data platform

Carriers need to shift from incremental to inventory management. It was presented that big data platformand key technologies played an important role in inventory management. The proposed technologies could solve the existing problems in current carrier's supporting systems.[5] As the owner of the "mass of trusted data", the operator can mark each user feature tag, based on user personal information, call information, location information, Internet records and other data. With the large data analysis technology for customer classification, help operators to understand the user's potential consumer demand characteristics in-depth, by analyzing the user's call and Internet space-time features, online shopping preferences, etc. After the exact match between the user and the communication service package, the user is recommended service package which they are interested in, through the appropriate channels at the right time, to achieve accurate marketing, to enhance the user experience and stimulate the user to spend and expand revenue.

The China Mobile's big data platform based on the cloud. This platform integrates the big data storage, the development and deployment of big data ETL

(Extract, Transfer, Load) and DM (Data Mining) into a unified framework[9]. Now, telecom operators start establishing big data platform and mining user profile to support business sales. At present, under the dual drive by government policy and market interests, operators face decision-making questions that how to fund the construction of data platform layer. Both sides of the game for the current network operators, assuming that the difference between the funds and the strength of the operators of the two sides of the game, that is, only consider the objective benefits without considering the opportunity cost.

As the operators are closely linked with each other, the degree of information asymmetry is very small, can be ignored.

In summary, combined with China's actual situation analysis, this paper argues that the following scenarios should be considered in the game model:

There is a close relationship between the two sides of the game operators and social interaction, information asymmetry is low.

Operators to develop data platform, both sides of the game can get the same investment income, ignoring the difference in user volume, data size, data mining technology.

Operators who respond positively to government policies will not only gain investment income, but also gain hidden non-monetary gains such as "becoming an industry model". While members who refuse to respond to government policies face government and social penalties, and their penalties are not limited to loss of profits and encouragement of capital gains, as well as loss of "reduction of industry status and reduction of resources".

3. Game theory analysis3.1 static game model of operator development data platform

Assuming that the communications industry ecology has two competing operators in the network operatorP_1 andP_2. They face whether to carry out the platform for the development of business strategy, priority development, general development, without development respectively. ParticipantsP_1 strategy set for thesp_1.

$$sp_1 = \{PD, GD, ND\} \tag{1}$$

PD means priority development, GD means general development, ND means not to develop. ParticipantP_2strategy set is sp_2.

$$SP_2 = \{PD, GD, ND\} \tag{2}$$

PD means priority development, GD means general development, ND means not to develop. Besides set the impact of the external environment for the N, N strategy set issn.

$$sn = \{HMD, PP, NPND\} \tag{3}$$

HMD means high market demand, PP means policy point, NPND means no

policy point to no market demand. Taking into account the construction of the platform layer of the time to pay the technology, personnel and other costs, in the case of high market demandP_1, P_2 at the same time the action strategy as shown in the table below.

Table 1. In the case of high market demand in the Bureau of the strategy

		P_2		
		priority development	general development	not to develop
P_1	priority development	(22)	(31)	(40)
	general development	(13)	(11)	(10)
	not to develop	(04)	(01)	(00)

In the case of high market demand, this time Nash equilibrium solution for both sides choose to give priority to the development of the strategy, both sides of the income are 2. In the actual competitive environment, driven by the interests, operators will actively build platform to occupy the market, with a lot of investment to get higher profits.

Table 2. In the case of policy points in the Bureau of the strategy

		P_2		
		priority development	general development	not to develop
P_1	priority development	(11)	(12)	(10)
	general development	(21)	(22)	(20)
	not to develop	(01)	(02)	(00)

Policy point refers to the government to do the appropriate punishment or incentives to the operator with the control or administrative means based on the level of the construction platform level. In the case of policy point of view, the Bureau of the Nash equilibrium solution for both sides choose the general development strategy, the income is 2. In the actual social environment, under the pressure of government policy, and no market demand driven, operators must choose to use the general cost of building the platform to avoid punishment, and if they choose to actively develop the strategy, operators will face too high Cost investment and less market returns dilemma.

Table 3.The strategy of the people in the Bureau in the case of no policy point of view, low market demand

		P_2		
		priority development	general development	not to develop
P_1	priority development	(-2-2)	(-2-1)	(-20)
	general development	(-1-2)	(-1-1)	(10)
	not to develop	(0-2)	(0-1)	(00)

In the absence of policy support and low market demand, the Bureau of the Nash game balance solution for both sides do not develop. In China's current environment, operators are currently in this Nash equilibrium, although the operators have countless available data, but they will not put human and material resources to the corresponding development of the data, as there is no market demand-driven.

3.1. Dynamic game theory

Assuming the premise of high market demand, the telecommunications industry to participate in the competition in the Bureau of a and b, they have the same financial basis and technical capacity, there is complete information dynamic game, and has the same strategy space input, The Assuming a high demand, increasing the input to the data platform can increase the market share occupied by the bureaucrats. Assuming the Bureau of the first person to act, then B, A in turn action. The simplified dynamic game of its input behavior is described as follows:

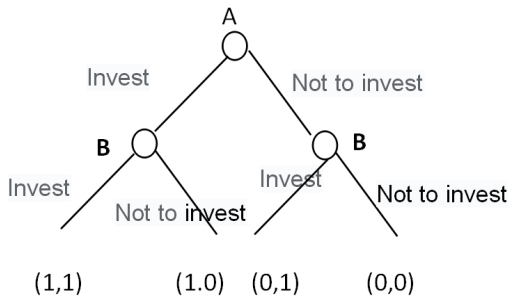

Fig. 2. Carriers complete information dynamic game description

The utility function of A is:

$$u_1(q_1, q_2) = q_1 P(Q) - cq_1 = q_1(a - q_1 - q_2) - cq_1 \tag{4}$$

The utility function of B is:

$$u_2(q_1, q_2) = q_2 P(Q) - cq_2 = q_2(a - q_1 - q_2) - cq_2 \tag{5}$$

A decided to invest first. B depends on the decision of A.

$$\frac{\partial u_2}{\partial q_2} = a - c - q_1 - 2q_2 = 0 \tag{6}$$

$$q_2^* = \frac{1}{2}(a - c - q_1) \tag{7}$$

The utility function of a is converted into the input function.

$$u_1(q_1, q_2^*) = q_1(a - q_1 - q_2^*) - cq_1 = \frac{1}{2}q_1(a - c - q_1) \tag{8}$$

Take the derivative with respect to q and set the derivative equal to 0.

$$q_1^* = \frac{1}{2}(a - c) \tag{9}$$

Put (1) into(3):

$$q_2^* = \frac{1}{4}(a - c) \tag{10}$$

Table 4. The strategy of dynamic game theory

		B				
		(Invest,Invest)	(InvestNot to invest)	(Not to investInvest)	(Not to invest,Not to invest)	
A	Invest	(11)	(11)	(10)	(10)	
	Not to invest	(01)	(00)	(01)	(00)	

Obviously, there are two pure equilibrium strategies: input,input, input, put input, not put into, so B used the strategy for A, B input. A is not put into, B also put. In short under the same technical conditions, the operator must be in order to get more market share and choose to increase investment.

4. Results analysis

Through the static game and dynamic game results under different conditions, we can see that in the case of high market demand, operators are willing to actively develop the data platform. When they are in the same technical level, the level of funding conditions, the two sides in order to seize the market competition will gradually increase the investment in data platform construction.

In the case of policy direction, the operator will build a data platform, but without too much investment.

In the environment that low market demand, without the policy point of view,

the operator will not invest money and manpower to build the data platform, which coincides with the current operating conditions of the operator, the current Chinese operators have a lot of data resources, but no power to develop, resulting in a great waste of data resources. At the same time, operators do not have the power to develop new business platform for data, and still rely on basic communications services to profit. In the current social environment, the establishment of data platform and can not immediately get a higher market demand. So if only rely on market demand driven, it is difficult for operators to take this innovative step. Operators to carry out the construction of the data platform is a project that needs to be guided by the government's encouragement. Only after the formal completion of the data platform, the market demand will gradually increase, the profits will continue to stimulate the operators to fund, manpower, technical corresponding investment, so that the data realized, to achieve the purpose of operators to increase income transformation.

References

[1] G. H. Zhou, P. Y. Jiang, Y. F. Zhang: *Approach to an E-service operation platform for web-based networked-manufacturing.* Computer Integrated Manufacturing Systems *8* (2002), No. 4, 294–298.

[2] Q. Xue: *A Conceptual Architecture for Adaptive Human-Computer Interface of a PT Operation Platform Based on Context-Awareness.* Discrete Dynamics in Nature and Society *20* (2014), No. 6, 435–444.

[3] R. Fukui: *Automated Construction System of Robot Locomotion and Operation Platform for Hazardous Environments— Basic System Design and Feasibility Study of Module Transferring and Connecting Motions.* Journal of Field Robotics *60* (2015), No. 60, 479–485.

[4] Y. Ling: *Multidimensional Optical Sensing Platform for Detection of Heparin and Reversible Molecular Logic Gate Operation Based on the Phloxine B/Polyethyleneimine System.* Analytical Chemistry *87* (2015), No. 3, 1575.

[5] C. Hauert, G. Szabo: *Game theory and physics.* American Journal of Physic *73* (2015), No. 5, 405–414.

[6] C. F. Camerer: *Behavioral game theory, Experiments in strategic interaction.* Cuadernos De Econom *23* (2004) 229–236.

[7] L. Feng, L. L. Meng: *A Study on the Stability of Ecological Industry Chain Based on the Evolutionary Game Theory.* Science Technology & Industry *149* (2011), No. 2, 274–293.

[8] P. K. Chintagunta, V. R. Rao: *Pricing Strategies in a Dynamic Duopoly: A Differential Game Model.* Management Science *42* (1996), No. 11, 1501–1514.

[9] T. S. Genc, G. Zaccour: *Capacity investments in a stochastic dynamic game: equilibrium characterization.* Operations Research Letters *41* (2013), No. 5, 482–485.

[10] F. C. Lu, S. H. Chen, W. He: *Study on Interest Coordination Mechanism of Green Supply Chain Based on Dynamic Game.* International Journal of u- and e- Service, Science and Technology *8*, (2015), No. 1, 532–535.

Received November 16, 2017