Value-Chain Value Distribution in Service Outsourcing in the Manufacturing Industry

Tao Jing

Economics Department, Ningbo University
Zhejiang Ningbo, China

***Abstract* — This paper discusses the problem in service value determination in traditional manufacturing, and studies value achievement methods by establishing new value-chain structure of manufacturing service value, and the relation between creation and distribution. It adopts game theory as research basis, to deduce the pricing mechanism of intermediate product in the supply chain. First, through two-phase dynamic game process, we study the pricing process of intermediate products in industry value-chain. The non-cooperative game process of product pricing is also discussed. Then we determine the price range under bilateral dynamic theory, and the influence on profit distribution of the game sequence. The price oscillation convergence to intermediate values is proved and equilibrium solution of the value distribution in the industry value chain is proposed. Finally empirical analysis is provided to verify the influence mechanism for value creation based on service modularization of value-chain.**

Keywords-value-chain; intermediate product; supplier; downstream enterprise; game theory.

I. INTRODUCTION

From 1980s, through grasping international transferring opportunity of multinational corporations in production system, our national manufacturing industry depended on comparative advantage to undertake lots of manufacturing outsourcing business. Thus, "made in China" has been fashionable in the world. In addition, China is famous for "world factory". Service outsourcing has become another research focus after manufacturing outsourcing [1]. However, current theories which are adapted to service outsourcing are very few. Global value chain theory is the theoretical tool to study manufacturing outsourcing. In view of difference between manufacturing outsourcing and service outsourcing, global value chain theory cannot be totally applied in the manufacturing service outsourcing field. Burger [2] believes that pure entity production-type manufacturing has not adapted to requirement in rising market development and puts forward service enhancing-type manufacturing definition. They point that manufacturing will be divided into two pure service and solution supplier under extreme conditions but service corporation will gradually adopt manufacturing enhance-type service strategy in new environment. Sun [3] puts forward service-type manufacturing viewpoint and believes that newly industrial form integration of manufacturing industry and service industry constructs a creatively advanced manufacturing mode: service-type manufacture. It fuses product and service to realize integration and cooperation of individually scattered manufacturing resources and core competitiveness capability. However, by coordination between productive service and service production between corporations, value addition of various stakeholders in manufacturing value chain will finally be reached. Through defining connotation and extension of service concept, Liu [4] considers that manufacturing servicing is an extension in industry value chain. However, most given researches only focus on concept surface, there also lacks deeper level and application level in research achievements. It has not formed complete analysis framework of operating and managing service organization modularization and it even does not analyze key problems in service module operation of service value creation and value addition in detail.

This paper attempts to rely on global value chain theory, introducing service outsourcing value chain concept, and analyzing international transferring law in service industry, so that our national service corporation could be involved in global service industry division and set up its competitive advantage in global service network to offer some beneficial thoughts. We study the unified strategy of industrial value chain from value distribution and value creation and introduce a generalized two-stage game process-based mixed game model. As a kind of application, this paper studies production value chain relationship between value creation and distribution from suppliers and manufacturers.

II. VALUE CHAIN CHANGE ANALYSIS DURING MANUFACTURING SERVICETIZATION

A. Environmental Carrier-based Cooperative Development Evaluation Model

Basic activities and support activities make up traditionally manufacturing value chain together. Production operation, logistics transportation, marketing management and after-sale service are usually regarded as basic activities in value chain while support activities take purchase input, technological development and human resources management as main content. Potter's viewpoint [5] believes that traditional value chain takes single manufacturing as value chain of various value activities in core analysis corporation, which is shown as figure 1.

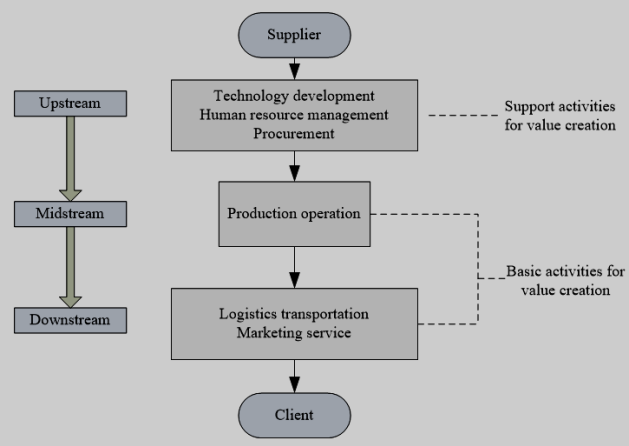

Figure 1. Basic Constitution of Traditional Manufacturing Value Chain

The value chain of manufacturing industry is usually made up by three steps including upstream, middle reaches and downstream. Upstream step contains technological development, human resources and purchasing management. Productive operation is middle reach and downstream step is made up by logistics transportation, marketing management and after sale service [6,7]. One manufacturing is performed various activities set including product development, production manufacture, marketing management, transportation and maintaining product in upstream, middle reach and downstream. This is usually called traditional value chain and it involves basic activity and support activity. Due to rising market competition, production manufacture less and less influences corporation competitiveness advantage but productive service activities at upstream, middle reach and downstream are more frequent. Productive service activity also becomes important increment node in manufacturing industry.

B. Servicetization Value Chain Structure in Manufacturing Industry

With transformation and upgrading in manufacturing industry, constant shift in servicetization of corporation promotes related activities of servicetization in manufacturing industry to become the core of corporation competition advantage. Figure 2 shows that structure model of servicetization value chain in manufacturing industry and service activity in upstream, middle reach and downstream [8]. Manufacturing service value chain is a system structure which is realized by value in essence. By means of core ability, manufacturing is identified as customers' offered core product and related service activity. Through outsourcing non-core ability, service can be outsourced to adaptive production service corporation in companies so as to provide service for customers in life cycle of product.

Compared to traditional manufacturing value chain, value chain change of servicetization in manufacturing industry is reflected in the whole life cycle at upstream, middle reach and downstream:

Upstream stage: it contains main business activities such as requirement analysis, new product development and product design. Current knowledge technology intensively productive servicetization occupies market share. In addition, it also develops aiming services in risk investment and financial service.

Midstream stage: with production, modification, product assembling, etc, it involves purchase, base storage, raw material and quality control of other activities. Midstream activity is usually called the process from raw material process to art product. More and more manufacturing companies lower invest cost and improve core competitiveness through outsourcing production activities.

Downstream stage: it contains product sale, maintenance, etc and involves product marketing, advertisement, after-sale service, maintenance, product recycle, etc. Many manufacturings warrant product sale, after sale service and product repair to individual sale client and fully take advantage resources optimization assembly to improve competitiveness.

In addition, information management, finance, human resources are fully concentrating whole life cycle of product during upstream, middle reach and downstream. Compared to traditional value chain, manufacturing industry servicetization effectively relates all relevant corporations on a unified platform based on value net which is formed in servicetization of manufacturings. It fully satisfies customer's requirement so as to improve efficiency in manufacturings and further increase corporation values [9].

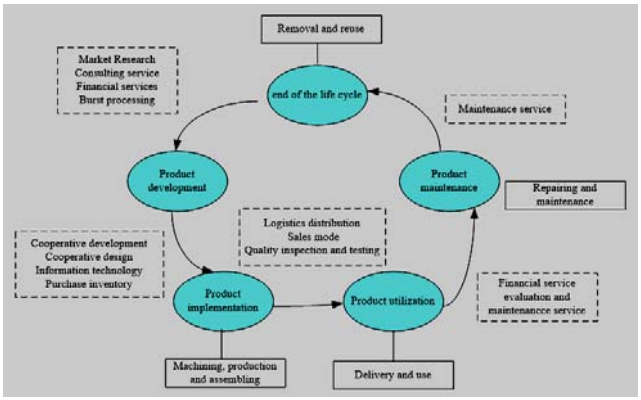

Figure 2. Services value chain and service activities of Manufacturing

III. VALUE RALATION STUDY OF MANUFACTURING SERVICE VALUE-CHAIN BASED ON GAME THEORY

A. Principle Assumption of Models

In consideration of service supplier providing service to downstream enterprise, we assume service product price as P, supply quantity as Q, and cost as C_1. The the value acquired frm service by suppliers is:

$$v_1 = PQ - C_1(Q) \quad (1)$$

Total value brought to downstream of service product is $V = V(Q)$, and incremental service value of downstream enterprises is:

$$v_2 = V(Q) - P(Q) \quad (2)$$

Incremental service value of co-operation is:

$$v = v_1 + v_2 = V(Q) - C_1(Q) \quad (3)$$

Assuming the const function provided by service supplier and service value function of downstream enterprises is mutual consensus, we have the following proposition:

Proposition 1: If both supplier and downstream enterprises cannot determine the price of product, which choose quantity to maximize their value. Both sides play game to get a maximum balance of common value.

Proof: Service suppliers choose Q to maximze its provit as v_1. The optimal one-order condition is:

$$P^{\#} = MC_1(Q) \quad (4)$$

$MC_1(Q)$ is marginal cost of suppliers. The downstream enterprises determine the maximum value v_2. The optimal one-order is acquired by equation 5:

$$P^{\#} = MV(Q) \quad (5)$$

$MV(Q)$ is total marginal cost. Game equilibrium solution $Q^{\#}$ can be obtained by simultaneous equations:

$$MV(Q^{\#}) - MC_1(Q^{\#}) = 0 \quad (6)$$

Equation 6 is just the condition of equation 3. Therefore, $Q^{\#}$ makes the maximum increment of total serivice value created by both sides.Due to proposition 1, if both sides have not decision right, they will choose the maximized service quantity of self value. Then game equilibrium can get the maximum value and accordance of self and total value.

B. Service Product Price Determination of Different Games

In supplier oriented value chain, we first determine the wholesale price w. Then downstream enterprises determine retail price p and quantity Q accordint to w. When $Q = a - bp$, the profit of supplier and downstream enterprise is:

$$\prod_s (w-c)Q = (w-c)(a-bp) \quad (7)$$

$$\prod_r (p-w)Q = (p-w)(a-bp) \quad (8)$$

Proposition 2: In supplier oriented value chain, the optimal decision of supplier and downstream enterprise is:

$$w^* = \frac{a+bc}{2b},\ p^* = \frac{3a+bc}{4b},\ Q^* = \frac{a-bc}{4}$$

Proof: Inverse push method is adopted. Fist the decision of downstream enterprise is considered. Since

$$\frac{d\prod_r}{dp} = a - abp + bw,\ \frac{d^2\prod_r}{dp^2} = -2b < 0 \quad (9)$$

We determine $\prod_r$ is concave function for p. Then the optimal p^* satisfies $\frac{d\prod_r}{dp} = 0$. After the solution we get

$$p^* = \frac{a+bw}{2b} \quad (10)$$

Above equation is substituted into $Q = a - bp$ to get the optimal order quantity as

$$Q^* = \frac{a-bw}{2} \quad (11)$$

So it can be seen that, when wholesale price is known, we can make optimal decision without knowing the cost c of suppliers. When considering the decision of suppliers, under optimal decison of downstream enterprise, the profit function of supplier is:

$$\prod_s = (w-c)Q = \frac{(w-c)(a-bw)}{2} \quad (12)$$

Since

$$\frac{d\prod_s}{dw} = \frac{a-2bw+bc}{2},\ \frac{d^2\prod_s}{d^2w} = -b < 0 \quad (13)$$

We solute $\frac{d\prod_s}{dw} = 0$ to get the optimal slution of supplier as:

$$w^* = \frac{a+bc}{2b} \quad (14)$$

At last, we substitute equation 14 to 10 and 11 to get conclusion of proposition 2.

In downstream enterprise oriented value-chain, downstream enterprises announce its marginal profit for domination. The sequence of downstream enterprise and supplier is: first downstream enterprise determine the marginal profit U_r. Then supplier determine wholesale price w according to U_r. At last retalier determine retail price p and quantity Q. When $Q = a - bp$, $p = w + U_r$, the profit of both is:

$$\prod_s = (w-c)Q = (w-c)(a-b(w+U_r)) \quad (15)$$

$$\prod_r = U_r Q = U_r(a-b(w+U_r)) \quad (16)$$

Proposition 3: In downstream enterprise oriented value-chain, the optimal decision of supplier and downstream enterprise is:

$$w^* = \frac{a+3bc}{4b},\ U_r^* = \frac{a-bc}{2b},\ p^* = \frac{3a+bc}{4b},\ Q^* = \frac{a-bc}{4}$$

Proof: Inverse push method is adopted. Fist the decision of supplier who has known the marginal profit of downstream enterprise is considered. Since

$$\frac{d\prod_s}{dw} = a - 2bw - bU_r + bc,\ \frac{d^2\prod_s}{dw^2} = -2b \quad (17)$$

We know $\prod_s$ is concave function of w. So its optimal solution satisfies $\frac{d\prod_s}{dw}=0$. We get the solution as

$$w^*=\frac{(a-bU_r-bc)}{2} \tag{18}$$

Under the optimal decision of supplier, the profit function of downstream enterprise is

$$\prod_r=\frac{U_r(a-bU_r-bc)}{2}$$

Since $\frac{d\prod_r}{dU_r}=\frac{a-bU_r-bc}{2}$ and $\frac{d^2\prod_r}{d^2U_r}=-b$, we know $\prod_r$ is concave function of U_r. Then the optimal solution satisfies $\frac{d\prod_r}{dU_r}=0$. So

$$U_r^*=\frac{a-bc}{2b} \tag{19}$$

Finally we substitute $U_r^*=\frac{a-bc}{2b}$ to equation 18 to get

$$w^*=\frac{a+3bc}{4b} \tag{20}$$

Substitute equation 19 and 20 to $Q=a-bp$, $p=w+U_r$, to get $p^*=\frac{3a+bc}{4b}$, $Q^*=\frac{a-bc}{4}$ and proposition 3 is proved.

By analysis we know, in downstream enterprise oriented value-chain, downstream enterprise makes decison first and the optimal marginal profit is $\frac{a-bc}{2b}$. The most important parameter is supplier cost c. The downstream enterprise cab determine the optimal marginal profit only when c is known.

So we obtain the price of intermediate product from different game sequence and compare it to the whole optimal price. The price decided by supplier is always higher than the whole optimal product price, and price decided by downstream enterprise is always lower than the whole optimal product price:

$$P_1^{\#\#}<P_1<P_1^{\#}$$

Thus, we get the price range of intermediate product P_1. When bilateral cost function and market demand function are public information that is known by both sides, the upstream and down stream enterprises will make negotiation in the price range. From the sequence of game, the one who plays game will get more profit than the one lie in lagging position of game. It also verifies the advantage of first move in behavior.

From the decision of price, we find the one who has decision on intermediate product price, will get more profit, since it forces the opposite to accept the product price and choose optimal quantity. Simultaneously, it illustrates that the intermediate product price has key function on profit distribution for upstream and downstream enterprises. Actually, in the relation of value-chain, price decision right is strong right, which determines the price of intermediate product during the process of mutual bargaining.

C. Game Theory-based Value Relation Study in Manufacturing Service Value Chain

We consider that supplier and downstream enterprise make up a simple upstream and downstream supply relationship to form providing chain. Providing company offers downstream corporation products. Supposing production of supply chain in upstream and downstream corporation, two corporations in supply chain are independent corporations and there exists strategic partner relationship between corporations. The optimized production of profit determines supply chain production. There exists two conditions:

(1) Upstream supplier has price hegemony and production reflection function in downstream corporation determines supply-chain match production.

(2) Downstream corporation has price hegemony and production reflection function of upstream supplier determines supply chain match production.

It is proved that there exists price range [$p^{\#\#}$, $p^{\#}$], which respectively denote two extreme case of upstream supplier and downstream enterprise owing price monopoly rights. The price of intermediate must be in this range, as depicted in figure 3.

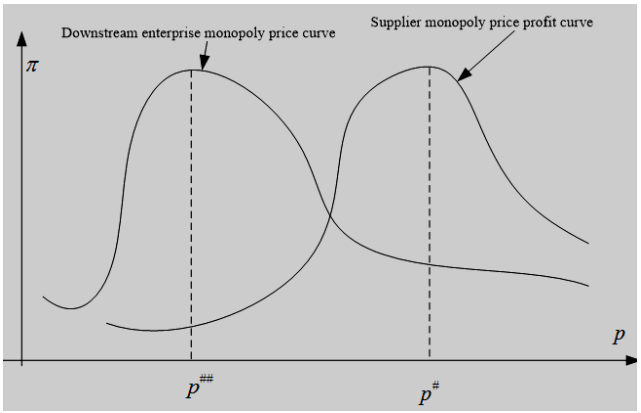

Figure 3. Price range of intermediate product of bilateral monopoly price

If both sides have not price monopoly, it is a mutual dynamic bargaining process. Then the value-chain lies between dynamic oscillation of two monopoly pricing of [$p^{\#\#}$, $p^{\#}$].

In dynamic pricing system, both sides have no price decision, but they all have the right to decide their own optimal output according to the price of the intermediate product, that is, the price of the reaction function [10]. But

to supply both sides, in the price range given by intermediate products as a price, both sides can't also make production according to their own optimal yield production. If it is likely to cause the supply chain upstream and downstream production that does not match, we assume that the upstream and downstream enterprises of the output are matched. So we divide the supply into the formula of price and output, and divide the dynamic price of the intermediate product into two processes, according to the price production and output matching: price adjustment process and an intermediate product price adjustment process.

Assuming the price-product response function for product production and quantity match is $\begin{cases} q = f_1(p) \\ q = f_2(p) \end{cases}$, then the oscillation system can be describe as:

$$\begin{cases} p_{t=0} = p_0 \\ q_i = f_1(p_i) \quad i = 0,1,2,... \\ p_{i+1} = f_2^{-1}(q_i) \end{cases} \tag{21}$$

In one oscillation period, the changing relation of price can be described as:

$$p_{i+1} = f_2^{-1}(f_1(p_i)) = F(p_i) \tag{22}$$

The equilibrium point of system satisfies:

$$p_e = f_2^{-1}(f_1(p_e)) = F(p_e) \tag{23}$$

The price oscillation process of value-chain may cause intermediate product price convergence or divergence of unstable price.

Proposition 3: For any initial price input $p^* \in [p^{\#\#}, p^{\#}]$, the price oscillation function of service product system satisfies

$$|F(P) - F(P_e)| \le \alpha |P - P_e|, \ \alpha < 1 \tag{24}$$

Then the price oscillation system is convergent.

Proof: Obviously, $p_e \in [p^{\#\#}, p^{\#}]$. From equation 24, let $P^{(1)} = F(P)$, we have

$$|P^{(1)} - P_e| \le \alpha |P - P_e| \tag{25}$$

Therefore, $P^{(1)} \in [p^{\#\#}, p^{\#}]$. Similarly, from equation 25, $P^{(i)} \in [p^{\#\#}, p^{\#}]$.

$$|P^{(i)} - P_e| \le \alpha |P^{(i-1)} - P_e| \le ... \le \alpha^i |P - P_e| \tag{26}$$

$$\lim_{i \to \infty} |P^{(i)} - P_e| = 0 \tag{27}$$

So proposition 3 is proved. We define price response rate in price response function, which denotes the changing absolute value of optimal service quantity response of all sides, caused by unit price change under certain price.

Proposition4 : In dynamic range of service product price $[p^{\#\#}, p^{\#}]$, if the price response rate of downstream enterprises are larger than price response rate of service suppliers, satisfying $|\frac{dMV^{-1}(P)}{dP}| \ge |\frac{dMC_1^{-1}(P)}{dP}|$, $\alpha > 1$, this dynamic price oscillation system is convergent.

Proof: Initialize price $P \in [P^{\#\#}, P^{\#}]$, let $Q_1 = dMC_1^{-1}(P)$ and the banlance product quantity is Q_e.

$$F(P) - F(P_e) = MV(Q_1) - MV(Q_e) \tag{28}$$

Taking into account the price adjustment of service quantity matching process, and the monotonicity of response function, we get

$$F(P_1) - F(P_e) = |\int_{Q=Q_e}^{Q_1} \frac{dMV(Q)}{dQ} dQ| = \int_{Q=Q_e}^{Q_1} \frac{dMV(Q)}{dQ} dQ \tag{29}$$

While

$$|P - P_e| = |\int_{Q=Q_e}^{Q_1} \frac{dMC_1(Q)}{dQ} dQ| = \int_{Q=Q_e}^{Q_1} |\frac{dMC_1(Q)}{dQ}| dQ \tag{30}$$

So

$$\frac{dMV(Q)}{dQ} \le \alpha^{-1} \frac{dMC_1(Q)}{dQ} \tag{31}$$

Then

$$|F(P) - F(P_e)| \le \alpha^{-1} |P - P_e| \tag{32}$$

Due to proposition 2, it is convergent.

IV. IMPLEMENTATION ANALYSIS

A. *Proof of Intermediate Product Oscillation*

Adopting the assumption in previous sector, the cost function of upstream and downstream enterprises in value-chain is:

$$\begin{cases} TC_1(q) = (q - \frac{1}{2})^3 + \frac{q}{2} \\ TC_2(q) = \frac{1}{3}(q - \frac{1}{2})^3 + \frac{q}{2} \end{cases} \tag{33}$$

The demand function of final product is

$$p = f(q) = 6 - \frac{q}{2} \tag{34}$$

Then the profit function of supplier and downstream enterprises is:

$$\begin{cases} \pi_1 = pq - TC_1(q) \\ \pi_2 = f(q)q - pq \end{cases} \tag{35}$$

The price response function of supplier and downstream enterprises is:

$$\begin{cases} q = \sqrt{\frac{p - 0.5}{3}} + 0.5 \\ q = \sqrt{5.25 - p} \end{cases} \tag{36}$$

So the price oscillation function is:

$$F(p)=\frac{31}{6}-\frac{p}{3}-\sqrt{\frac{p-0.5}{3}} \qquad (37)$$

The price elasticity of response function of suppliers and downstream enterprises is $|\frac{1}{6}\sqrt{\frac{p-0.5}{3}}|$, $|\frac{1}{2}\sqrt{5.25-p}|$. When $1.8<p<5.25$, the price elasticity of downstream enterprise function is strictly larger than that of supplier. It can be approximatively believed that this rule is common, and it satisfies

$$|\frac{1}{2}\sqrt{5.25-p}|>1.04\times|\frac{1}{6}\sqrt{\frac{p-0.5}{3}}| \qquad (38)$$

$\alpha=1.04>1$. Suppliers are producers by price and downstream enterprises are production matching side. The intermediate product price is convergent. We select any intial price, after 10 periods of price adjustment, to acquire balance price of value-chain as p=3.16774905

B. Case Study

Company A is a large state-owned power generation equipment manufacturers, which has a large number of machine equipment. With the rapid growth of a sharp increase in demand for power generation equipment and market order, the normal operation of a variety of machine tool equipment become factory production goal and meet the user demand, to reduce the market risk with important assurance.

When equipment problems emerged previously, it needed equipment manufacturers to get in touch with the field maintenance in time. Due to temporary service demand for equipment manufacturers of the higher cost of service, personnel arrangement and spare parts are more difficult. Such service can not get manufacturers rapid response when the process is more complicated. The quality of service can not get effective assurance. At the same time, in the service price bargaining in passive receiver position in long equipment service and security cooperation, it exchanges gradually with equipment manufacturers that forms maintenance of equipment complete warranty service scheme. The full service plan includes technical service and spare parts service, such as service preparation work, searching breakdown reason, the decision of repairing or replacing etc.

TABLE I. CONTRACT AMOUNT, WARRANTY AMOUNT, ACTUAL FEE OF ENTERPRISE A OVER THE YEARS

	2012	2013	2014	2015
Contract Amount	35	58.4	51.4	63.2
Actual Fee	38	56	52.34	--
Cost difference	4	-2.3	0.83	--
Number of lathe	7	11	11	15
Average price	4.88	4.88	4.71	4.52

The contract has made accurate request to the service processing time, which can satisfy A to the equipment maintenance service request in time

Table 1 and 2 shows the amount of insurance equipment and the price information of the service contract, when adopting warranty service contracts since 2012.

TABLE II. WARRANTY SERVICE PRICE CHANGE OF EACH MACHINE OF ENTERPRISE A OVER THE YEARS

NO.	Name	2012	2013	2014	2015
1	CH5230EX310	3.5	3.3	3.5	3.1
2	XK7710		4.5	4.4	4.6
3	C5250(GAI)		3.9	3.9	4.2
4	DH2200/12NC	5.8	6.1		0
5	MF195	4.5	4.9	85.5	4.7
6	Dh2201				4.2
7	CK6100/400	3.7	3.9	4	4.2
8	PCM5000AT	6.1	6.4	5.9	5.2
9	MAMQ250-LG	5.6	6.1	5.8	5.9
10	SC50/80	4.7	4.9	5.4	5.2
11	SR3TG5		6.7	5.7	5.8
12	TK420001		3.6	3.5	3.6
13	C2550(GAI)		4.1	3.9	4.1
14	XKH6000				4.6
15	XKH8000				4.5

Since 2012, from the content and cost of repairing service we have following analysis:

Numerical control equipment for A get relative warranty after the failure. Company B provides not only first-class service and technical support, but also improves the quality of service parts. The reaction time is very short, which enables the equipment to quickly restore the function, to be put into production

From the analysis of the number of CNC equipment, insurance, mainly in the reduction of equipment failure downtime, the effect is obvious, and the maintenance costs are relatively reasonable.

In order to ensure the maintenance of factory equipment, A requires machine tool manufacturers of the control module using SIEMENS automatic control module, in the new equipment bidding process. In recent years, with the rapid development of factories, equipment investment, and the new purchase or transformation of large key equipment is gradually increasing..... In recent years, the factory NC brain drain is serious. It also can't invest large amounts of funds to purchase spare parts of certain company, covering mainly in reducing equipment failure downtime that has obvious effect. From analysis of CNC equipment insurance situation a few years, the maintenance cost is also more reasonable.

2012 on the basis of the game between the two sides the warranty service started. The manufacturer C repaired 7 machine tools, and service suppliers met the service response time requirements according to the contract. The contract amount is 350000 yuan, and the average price is 49600. According to actual cost of accounting for 388000, it greatly exceeds the contract amount of 11.8%, while the market changes in a rapid increase in the manufacturers for repairing. In the 2013 warranty service contract negotiations, the manufacturer's value creation function and service supplier's

cost function has made the big adjustment, both synthesis lead to service price basic stability.

From 2013 to 2014, the amount of services determined by the manufacturers did not change. By the end of 2013, the actual cost of the service suppliers than the contract amount is lower than 2.4 million yuan. According to the conclusion, the observation to the service supplier of the actual cost is lower than the contract cost, while the service of maintaining relatively is unchanged, which will lead to declining in the price of service. So in 2014, the contract price of services reduced from 4.87 to 4.69 million yuan.

From 2014 to 2015 supplier contract and the difference between actual observed costs is very small. The suppliers basically remain the same service response time. At the beginning of 2015, the manufacturer's value creation function was changed, and service made by manufacturers from 11 to 14 observed manufactures actual service demand was higher than that of the upper stage. The manufacturer service value creation function is to be adjusted, to maintain the service response time that is relatively constant. The amount of service manufacturer of increasing will lead to a decline in the price of service,. So in 2015, the contract price service fell from 4.69 to 4.52 million yuan.

V. CONCLUSION

During current industry transformation, it is more and more ineffective to purely depend on entity manufacturing industry to acquire profit. As a new production development format, manufacturing industry servicetization changes value creation of industry and competitiveness and it deeply affects social economy structure. Based on further analysis of value chain in value chain perspective on manufacturing industry servicetization, this paper mainly discusses numerical theory relation in manufacturing service value. Based on manufacturing service corporation and downstream corporation to create service value together, price definition can be used to realize value distribution. Different price right assembly can determine service price scope and convergence condition during price game of two parties are provided. Service creation and its numerical physics relation of value distribution is also obtained. Our schemes introduce new idea and viewpoint to study modern manufacturing industry servicetization system and it is significant to improve the competitiveness of regional economic.

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