Incentive of Mediator on *k-Implementatio*n of Strategy Game

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***Abstract*–In firm's business activities, it is important to decide target which product market. Actually, firms are misspending great cost and time on marketing. Nevertheless, firms overlap product of the same quality in the market. In the strategic form game of the game theory, there is proposed a solution of the game in which the mediator participates as another party. This paper focuses on k-Implementation, from the viewpoint of the three problems in Nash equilibrium, analysis and consider about the solution of the game. In addition, the authors complement the problem of k-Implementation, and indicate that it is useful in deciding the business strategy.**

I. INTRODUCTION

In business activities, firms stratify their main market with needs, it is important to decide on a pinpoint about the their target product (e.g. Lanchester [1], Drucker [2], Porter [3][4], Burgelman and Siegel [5]. Firms admit to frittering away cost of time on marketing. They are challenging to avoid price competition with competitors, are adjusting their product. But, the attractive product is limited by market. As a result, the market flooded the similar product, price competition will occurs in the market, and often firms are reduced income by it. As how to solve the problem which the firms would create similarly products with competitors, have been proposed the utilization of mediator on games by previous studies. (Nagai and Tanabe [6] [7], Nagai et al. [8],Nagai and Ito [9]).

Generally, the strategy game of the game theory is constructed by three major elements. One is the players which play in the strategy game, another is the strategy of each player and the third is the payoff by which each player can get in the game. The authors found a solution for strategy games in which mediator participates as another party. When the mediator participates in the game, if player go along with a strategy which proposed by the mediator, he/she will be able to get a relatively high payoff (Rosenfeld and Tennenholtz [10], Monderer and Tennenholtz [11][12], Tennenholtz [13]).

This paper uses the concept of mediator, and can avoid competition with competitors. Mediator is sorting firms product in the market. The authors consider about way to get payoff as high as possible.

This paper is organized as follows. Next chapter explains Nash equilibrium, and indicates the three problems of Nash equilibrium to be pointed on this paper. The third chapter indicates the k-Implementation as a proposal to solve the problems of the Nash equilibrium, and describes in detail about how to make a solution of the game. The fourth chapter points a lack of explanation on problem of Nash equilibrium in k-Implementation. The authors indicate a new discussion. Final chapter explains a conclusion as the outcome at the end, and indicates future work.

II. NASH EQUILIBRIUM

Accrding to Okada [14], game theory is research in which ”Under a specific condition, among multiple agents that affect each other are considered about the strategic interaction”.

The concepts of game theory have common viewpoint that a rational agent will have to consider about the rationality of other agents. However, game theory exists a problem in which undesirable strategy become dominant strategy in some situations by the rational behavior of the players, and thereby the players are reducing the payoff as a result (Watanabe [15]). In the past, many researchers have been working on the solution of the game. Nash equilibrium is the solution concept of the game, and can be formulated as follows (Aumann [16]).

Let N be the set of all players of the game, X_i be the set of strategies available to player i, X_{-i} be the set of strategies available to other than the player i, and let u_i be player i's utility function.

Here, a set of strategy x^* is Nash equilibrium if

$$\forall i \in N \ \ \forall x_i \in X_i \ \ u_i(x^*) \geq u_i(x_i, x^*_{-i}) \qquad (1)$$

Nash equilibrium (J.Nash [17]) as a solution in the game has been pointed out several problem. This paper focuses on three problems of Nash equilibrium in particular. First, payoff of all players is only guaranteed by strategy of Nash equilibrium. Nash equilibrium is not considered that player deviates by coalition with opponent. Third, if there are several Nash equilibrium solutions, he/she does not know which is solution of the game. Regard to above problems, in the *k-Implementation*, the mediator participates as another party, and solves a problem of the Nash equilibrium (Rosenfeld and Tennenholtz [11], Monderer and Tennenholtz [12][13], Tennenholtz [14]).

III. K-IMPLEMENTATION

According to Watanabe [15], Aumann [16] a group deviation or a coalition deviation is possible in the prisoner’s dilemma. In k-Implementation, mediator uses the cost k, and commits the additional payoff. The mediator commits the additional payoff to players by using the cost k in k-Implementation. Additional payoff creates dominating strategy on payoff matrix.

A. Case: Graphic LSI for digital pachinko

We can be found similar phenomena in the society. Actually, Nagai et al. [8] have clarified that these joint deviations are incurred by coalition of players. Therefore, this paper uses the actual case, and describes the k-Implementation.

1. Player1: Axell

Axell is a fabless[1] semiconductor venture in which was established by Yuzuru Sasaki in 1996, and Graphics Processing Unit(GPU) for digital pachinko is the main product. This GPU is using the image processing technology in which is invented by the University of Tsukuba (In general, we called this open innovation[2]).

So far, animation for digital pachinko was created by cutoff animation. However, by using this GPU can creates computer graphics（CG）animation. This GPU has a 60% share of the market, and has became the de facto standard in the market (handout of first-quarter results briefing in 2012[19])

2. Player2: Real Vision

Real Vision is a fabless semiconductor venture in which was established by Naoshi Sugiyama in 1996, and this firm's core competence[3] is the 3D image processing technology which has received a technology transfer from the U.S. venture. Several firms adopt this 3D GPU. For example, Capcom is using this 3D GPU in development tool for arcade video game machine, and also NEC is adopting this GPU for the 3D CAD workstation (Aizaki [21]). But, the development tool for arcade video game machine and/or the 3D workstation are small market, and cannot be expected to grow so big market. This firm decided to enter into pachinko market[4] as a new application of a 3D image processing technology, and to develop GPU for digital pachinko.

3. Two needs of digital pachinko

At that time, digital pachinko had two needs. Every pachinko companies have the needs which want to achieve the 3D computer graphics on flagship model. Players were not satisfied in the simple animation of expanding, shrinking and rotation until now, and were demanding a more powerful and a realistic 3D animation. On the other hand, in the low end model had another needs. Every pachinko firms work positively to reduce cost of the digital pachinko. The pachinko halls have been decreasing the users, because of this, they were demanding discount of new digital pachinko. Needs of multi function GPU in which includes LED driver circuit and an audio output circuit have because pachinko companies want to reduce the cost of electronics circuit. Table 1 is a summary of the above.

TABLE 1 TWO NEEDS OF DIGITAL PACHINKO

Model	*Market needs*	*Target*
Flagship	Achieving of 3D animation	3D GPU
Regular	Desire to integrate the audio output and the LED driver in the graphic LSI.	Multi GPU

These GPU has the following both merits and demerits by each model. The 3D animation GPU (3D GPU) for flagship model is low demand, but the high sales price conduce higher profit margins. On the other hand, The market volume of multi GPU for low-end model is very big, but the pachinko companies demand a severe low price, therefore but the low sales price conduce lower profit margins.

4. Situation of players

Real Vision and Axell are possible development of both GPU. Real Vision can be developed as 3D GPU by using the core competence (3D image processing technology). Alternatively, if Real Vision can get technical assistance from NEC, he/she will be able to develop multi GPU. Axell, on the other hand, can develops 3D GPU by which co-develop 3D image processing technology with the University of Tsukuba. Alternatively, Axell as audio output IC[22] and LED driver IC[23],he/she will be able to develop multi GPU. But, Real Vision and Axell have limits to the development resources, therefore They can develop GPU either 3D GPU or multi GPU. Both firms did not want to compete price in market by developing a comparable GPU, but they could not get information from each other. Above relationship can present as a payoff table in table 2. If only one of any can sell the multi GPU, margin of the product will be very small, but sales volume will be very big, and he/she gets payoff of 6. Conversely, if only one of any can sell the 3D GPU, margin of the product will be very high, but sales volume will be small, and he/she gets payoff of 4. If both companies sell the same GPU in the market, he/she will share market, and payoff will be in half for each other. Actually, both players' payoff will be decreased much more by price competition in the market, but it does not consider here.

TABLE 2 PAYOFF TABLE OF REAL VISION AND AXELL

		Real Vision	
	Choice	Multi GPU	3D GPU
Axell	Multi GPU	3 , 3	6 , 4
	3D GPU	4 , 6	2 , 2

5. Mediator: Sammy

Sammy is a leading company in the pachinko industry, and has a great influence in the market. This firm grasps the needs of the player on quickly, and has constantly put out new products to market. Other pachinko firms always have great attention to Sammy, and these firms believe the best

[1] Fabless is the firm in which does not have a fabrication facility.

[2] Open innovation is to use the external development capabilities and intellectual property rights, and produces innovative business models and others (Chesbrough [18]).

[3] Core competence is ability (technology) in which cannot be imitated by another firm among the firm's activities (Hamel and Plahalad [20]).

[4] Major semiconductor firms consider the business relationship with existing user companies, and are not actively to the he betting industry. Therefore, these firms have not entered into pachinko market. This is major reason why Real Vision has decided to enter into the pachinko market.

course of action would be to use the new technology and new electronic components which Sammy adopt to digital pachinko. If Sammy adopts the new GPU to digital pachinko, it will be likely to become the de facto standard in the pachinko industry.

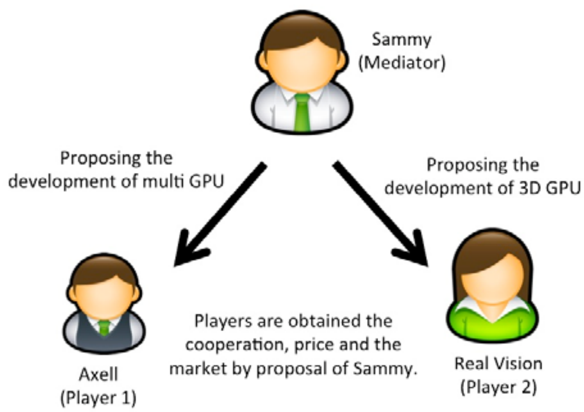

Fig 1 Relationship between the mediator and the players

As shown by Figure 1, Sammy proposed the development of 3D GPU to Real Vision, and proposed development of multi GPU to Axell. In this proposal, Sammy committed to carry out the following three commitments and/or support when opponent firm has developed the similar GPU.

- We provide accurate information about technical information of digital pachinko.
- We adopt your GPU to digital pachinko certainly.
- We purchase GPU by your desirable the sales price.

These three commitments are presenting as a payoff of 10 in the payoff table3. In a case, both companies have gone along with suggestions from Sammy, Real Vision developed the 3D GPU([24]) and Axell developed the multi GPU([25]).

TABLE 3 ADJUSTMENT OF THE PAYOFF TABLE BY SAMMY

		Real Vision	
	Choice	Multi GPU	3D GPU
Axell	Multi GPU	3 +10 / 3	6 / 4
	3D GPU	4 / 6	2 / 2 +10

B. Brief of k-Implementation

As shown in Chapter Ⅱ, the Nash equilibrium has the following three problems.

- Payoff of all players is only guaranteed by strategy of Nash equilibrium.
- There are several Nash equilibrium solutions.
- Nash equilibrium is not considered that player deviates by coalition with opponent.

Here, the authors consider about reason to have been able to solve the problem of Nash equilibrium in a case of section III-A. Sammy proposes the development of different GPU to each player, and commits that player will be entitled to get three additional payoff if he/she has gone along with the proposal.

As shown in table2 and table3, proposal of Sammy change the payoff table, thereby was making the dominant strategy (solution of game). Dominant strategy of Real Vision is to makes a choice of 3D GPU, and dominant strategy of Axell is to makes a choice of multi GPU. Payoff of 10 represents the additional payoff in which is committed by the proposal. Sammy's proposal can solve two problems on Nash equilibrium, one is "Payoff of all players is guaranteed by only strategy of Nash equilibrium", and other is " There are several Nash equilibrium solutions". This solution of the game can be represented by the follows.

Let $G = (N,X)$ be a game, where N is the set of players, and X is the set of strategies available to players N. For every vector of payoff function V is added in the game $G(V)$, let $\bar{X}(V)$ be the set of non-dominated strategies of i in the game $G(V)$, and let $\bar{X}(V) = \bar{X}_1(V) \times \bar{X}_2(V) \times, ..., \bar{X}_n(V)$. Vector of payoff function V is limited to strategy profile $\bar{X}$. In accordance with the above, X in a case can be represented as follows.

$$X_1 = (Multi\ GPU, 3D\ GPU)$$
$$X_2 = (Multi\ GPU, 3D\ GPU)$$

$$X_1 \times X_2 = \begin{pmatrix} Multi\ GPU, Multi\ GPU \\ Multi\ GP, 3D\ GPU \\ 3D\ GPU, Multi\ GP \\ 3D\ GPU, 3D\ GPU \end{pmatrix} \qquad (2)$$

If $V_i(x) \geq 0$ for every player i and for every $x \in X$, vector of payoff function V be true non-negative ($V \geq 0$). Let consider a set of desired strategy profiles $O \subseteq X$ for mediator in the game $G(U)$ of table 2. Let U be the payoff function in game G. As shown in the following formula (3), the payoff function meets condition of O to add to the payoff of the non-dominant strategy $\bar{X}$.

$$\emptyset \subset \bar{X}(U+V) \subseteq O \qquad (3)$$

Table 4 represents the relationship between payoff function U and payoff function V when the mediator commits payoff function V($V \geq 0$) to player.

TABLE 4 VECTOR OF PAYOFF FUNCTION V AND PAYOFF U

X	V_1	V_2	U_1	U_1
Multi GPU, Multi GPU	10	0	3	3
Multi GPU, 3D GPU	0	0	6	4
3D GPU, Multi GPU	0	0	4	6
3D GPU, 3D GPU	0	10	2	2

As shown in Table 3, the mediator commits V_1 when X is *(MultiGPU, Multi GPU)*, and commits V_2 when X is *(3D GPU, 3D GPU)*. By doing so, mediator is making a desirable strategy by which player obtains payoff of $U+V$. Therefore, if $\forall x \in \bar{X}(U+V)$, when player i implements strategy x in O, his /her payoff function of V is

$$\sum_{i=1}^{n} V_i(x) \le k \tag{4}$$

If player implement a strategy in O, he/she won't get payoff function of V_1 or V_2. However, if player implement a strategy other than O, the cost of k will arise for mediator. There are the following two assumptions to mediators in the *k-Implementation*.

Having the observability of the results.
The mediator is able to observe the behavior of the players.

Having the responsibility capacity.
The mediator has a responsibility to payoff in which committed to players.

Establishing credibility from players.
The mediator has trusted by players.

The mediator can only propose a behavior in which the player can obtain a lot of payoff as much as possible, therefore he/she cannot to change the rule of game and cannot enforce behavior.

However, by the assumption of the above, players will go along with the desirable strategy in which was created by the mediator. O is the preferred strategy for the mediator. Mediator commits V to the player by using cost k, and change x in O to dominant strategy.

Let $G = (N,X)$ be a game. For every vector of payoff function V, let $\bar{X}(V)$ be the set of non-dominated strategies of i in the game $G(V)$. Vector of payoff function V is restricted to $\bar{X}$. Here, necessary payoff function V for which chooses strategy in O by player, is the lowest limit value of the cost k. That is, k is the lowest cost to create $U+V$ for which player can chooses desirable strategy. $V_i(x)$ is necessary cost $k(O)$ for which the player choose a desirable strategy, and can be formulated by the follows.

$$\max_{x \in \bar{X}(U+V)} \sum_{i=1}^{n} V_i(x) = k(O) \tag{5}$$

IV. MEDIATOR'S INCENTIVE

A. Problem solving in Nash equilibrium

In k-Implementation, mediator makes a dominant strategy, and his/her suggestion is solving two problems of Nash equilibrium, one is " Payoff of all players is only guaranteed by strategy of Nash equilibrium", and other is " There are several Nash equilibrium solutions".

However, *k-Implementation* do not solve about the problem with " Nash equilibrium is not considered about group deviation by coalition of players ". In the *k-Implementation*, payoff function V in which is committed by the mediator have the incentive for which the player implement joint deviation. If the payoff function V is too large, the player may think about that he/she can get large payoff when he/she does not go along with the proposal of the mediator better than when he/she go along with it. The k-Implementation is exploring to the lowest limit payoff function, but it does not mean to be considering the joint deviation. It is trying to find the cost k as lower as possible. Therefore this section will discuss payoff function V from the viewpoint of the joint deviation of the player.

B. Deviation of players

As shown in Table 5, if player P_1 (Axell) gets a large payoff from the mediator M (Sammy), he/she will be think better to develop the multi GPU with player P_2 (Real Vision) than go along with proposal of mediator. When the player P_1 and player P_2 have developed a multi GPU together, the mediator will purchase the multi GPU on desirable selling price of player P_1. Player P_1 can distribute payoff of 1 or more to player P_2 among the payoff function of V_1.

Similarly, if player P_2 gets a large payoff function from the mediator M, his/her payoff function will be better to develop the 3D GPU with player P_1 than go along with proposal of mediator. When the player P_1 and player P_2 have developed a 3D GPU together, the mediator will purchase the 3D GPU on desirable selling price of player P_2. Player P_2 can distribute payoff of 4 or more to player P_2 among the payoff function of V_2.

TABLE 5 PAYOFF FUNCTION OF V

		P_2 (Real Vision)	
	Choice	Multi GPU	3D GPU
P_1 (Axell)	Multi GPU	$3+V_1$ / 3	6 / 4
	3D GPU	4 / 6	2 / $2+V_2$

In the case, the following three commitments in which are committed to the player by mediator represents as payoff function of 10 in table3.

- We provide accurate information about technical information of digital pachinko.
- We adopt your GPU to digital pachinko certainly.
- We purchase GPU by your desirable the sales price.

As stated above, in the case study, if the mediator commits the payoff function V very favorable for the player i, the player i will think the coalition with opponent.

First, the player will choose one of GPU of the multi GPU or the 3D GPU, and will co-develop it with opponent. If players obtain sufficient profits by GPU in which was co-developed first, they will move into action to co-develop the other GPU. By doing this, players can use effective of resources, a large profit can be got from GPUs.

Mediator will commit payoff function $V_i(x)$ which is necessary to player i implementing the strategy x in O, this payoff function would be good on minimum payoff which is able to create a dominant strategy. If player i go along with the dominant strategy, cost k won't arise to mediator M, but if player i does not go along with the dominant strategy, mediator M pays payoff function V_i for player i. Mediator M should set the payoff function which can get most large payoff function when player i go along with the dominant strategy. Table 6 represents relationship between the payoff function V and the benefit-sharing to opponent.

TABLE 6 INCENTIVE OF PLAYERS

V_1	D_1	*Incentive of* P_1
0	0	Don't have an incentive to go along with the mediator
1	0	Have an incentive to go along with the mediator
2-10	1 or more	Have an incentive to implement group deviation or joint deviation
V_2	D_2	*Incentive of* P_2
0-3	0	Don't have an incentive to go along with the mediator
4-7	0	Have an incentive to go along with the mediator
8-10	4 or more	Have an incentive to implement group deviation or joint deviation

In *k-Implementation* is the minimum payoff for making to change desirable strategy into dominant strategy. If player gets this payoff, he/she will not have the incentive to implement the deviation with coalition of players. Going along with desirable strategy is rational choice for player.

As shown in Table 6, when considering the coalition of opponent, additional payoff V_1 which mediator can commit to the player P_1 is only 1. However, 1 is a weak dominant strategy. When P_1 can get more than 2 of payoff from mediator M, P_1 distributes more than 1 payoff to P_2. At this moment, P_1 and P_2 will dissolve the incentive to go along with the mediator. On the other hand, P_2 does not have incentive to do joint deviation when payoff function is 4 to 7. At this point, 4 is a weakly dominant strategy, more than 5 is the dominant strategy. If mediator commits payoff to player in the range of 4 to 7, he/she does not have incentive to implement joint deviation.

By determining the appropriate payoff function, we can resolve the problem of deviation with coalition of players which does not consider in the Nash equilibrium. If the player gets a small payoff function from the mediator, he/she cannot change dominant strategy even if he/she wants to think distributing the benefit-sharing with the opponent player. Above contents is represented by the payoff table in Table 7.

TABLE 7 GROUP DEVIATION OR JOINT DEVIATION

		P_2	
	Choice	Multi GPU	3D GPU
P_1	Multi GPU	$(3+V_1)-D_1$, $3+D_1$	6, 4
	3D GPU	4, 6	$2+D_2$, $(2+V_2)-D_2$

D. Rationality of the mediator

The authors have considered that dominant strategy is created by rational activity of mediator. Therefore, this paper will consider about incentive of mediator. Mediator M (Sammy) creates the dominant strategy by which commits the payoff function V in the case. The authors think that if the player who goes along with the dominant strategy, mediator M will get the incentive from them. Mediator M desired to achieve the following.

Flagship model
Achieving of 3D animation.

Regular model
Desire to integrate the audio output and the LED driver in the graphic LSI.

This paper considers as possible many payoffs in which the mediator M can gets from the player i, without changing the dominant strategy. Player has the following behaviors based on the strategy.

P_1 and P_2 go along with the mediator.
P_1 obtains payoff of 6 and P_2 obtains payoff of 4. At this time, the mediator M can obtains maximum payoff C_1 of 2 from P_1, and obtains payoff C_2 of 1 from P_2 as fee of suggestion.

P_1 go along with the mediator, P_2 does not go along with it.
Mediator M pays payoff function V_1 to P_1.

P_1 and P_2 do not go along with the mediator.
P_1 obtains payoff of 4 and P_2 obtains payoff of 6. Mediator does not need to pay payoff function V to P_1 and P_2.

P_1 does not go along with the meditor, P_2 go along with it.
Mediator M pays payoff function V_2 to P_2.

As the above shows, mediator can get incentive C only when the P_1 and P_2 will go along with the mediator. However, incentive C should be in the range in which does not change the dominant strategy. Thus, P_1 is $C_1 \leq 2$ and P_2 is $C_2 \leq 1$. Table 8 is considering about the payoff function V which is committed by mediator, and estimates the incentive C which mediator can get it.

TABLE 8 PAYOFF FUNCTION V AND PAYOFF FUNCTION C

	P_2		
	Choice	X_2	Y_2
P_1	X_1	$U_1^{(x_1,x_2)}+V_1$ $U_2^{(x_1,x_2)}$	$U_1^{(x_1,y_2)}-C_1$ $U_2^{(x_1,y_2)}-C_2$
	Y_1	$U_1^{(y_1,x_2)}$ $U_2^{(y_1,x_2)}$	$U_1^{(y_1,y_2)}$ $U_2^{(y_1,y_2)}+V_2$

The rationality of the mediator can be formulated as follows based on the above.

Let $G = (N,S)$ be a game. For every vector of payoff function V, let $\bar{X}(V)$ be the set of non-dominated strategies of player i in the game $G(V)$. X_m is a desirable strategy in which is made by mediator M, and u_i is a payoff which can be obtained in each strategy by player i.

Mediator commits additional payoff V for the players, and proposes that take a commission C when all players have chosen the desirable strategy x_m. The mediator M will be able to take a commission C from players if desirable strategy O is dominant strategy.

If P_1

$$u_1^{(x_1,x_2)} + V_1 > u_1^{(y_1,x_2)} \text{ and } u_1^{(x_1,y_2)} > u_1^{(y_1,x_2)}$$

And if P_2

$$u_2^{(y_1,y_2)} + V_2 > u_2^{(y_1,x_2)} \text{ and } u_2^{(x_1,y_2)} > u_2^{(y_1,x_2)}$$

Mediator can take a commission from players into the range of the following.

$$\begin{aligned} c_1 &< u_1^{(x_1,y_1)} - u_1^{(y_1,y_2)} \\ c_2 &< u_2^{(x_1,y_1)} - u_2^{(y_1,y_2)} \\ c_m &= c_1 + c_2 \end{aligned} \tag{5}$$

E. Incentive of the mediator

Therefore, in this paper we take the assumption that the players are willing to pay incentive U_c for a mediator, and then consider the incentives of the mediator. The player understands a dominant strategy which is implemented using the additional payoff V by mediator. If the player does not go along with the proposal of the mediator, he/she may choose the same strategy by multiple the Nash equilibriums.

Thus, as a result, the player will get only a small payoff. However, if players go along with the proposal of the mediator, his/her payoff will be guaranteed by mediator. Figure 2 is shows the region which players can pay incentive based on the case study.

In all quadrants of the payoff table, if within the range of the $u^1_{min} > 0$, P_1 will be able to pay incentive for mediator. If the players think it is acceptable to pay one of payoff to the mediator, the payoff matrix will be shown in Table 9.

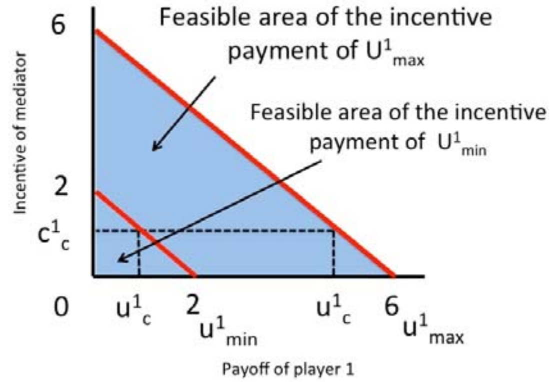

Fig 2 Payoff of players and incentive of mediator

TABLE 9 THE PLAYERS PAY INCENTIVE TO MEDIATOR

	P_2		
		x_2	y_2
P_1	x_1	$2+v_1$, 2	5, 3
	y_1	3, 5	1, $1+v_2$

If the players go along with the proposal of the mediator, the dominant strategy will be implemented by mediator. By mediator committing additional payoff, strategy x is a dominant strategy for P_1, and strategy y is a dominant strategy for P_2. As shown in the table 2, in strategy game in which mediator participates as another party, payoff table consists of the incentive for mediator and additional payoff to be committed by mediator.

TABLE 10 WHEN CONSIDERED THE ADDITIONAL PAYOFF AND INCENTIVE

	x_2	y_2
x_1	$u_1+v_1-c_1$, u_2-c_2	u_1-c_1, u_2-c_2
y_1	u_1-c_1, u_2-c_2	u_1, $u_2+v_2-c_2$

V. CONCLUSION

This paper focuses on three problem of Nash equilibrium as a solution of the game, engaged about the how to solve these problems. Specifically, we investigated way to solve using the mediator in *k-Implementation*. In the k-Implementation, mediator is solving the following problems.

- Payoff of all players is only guaranteed by strategy of Nash equilibrium.
- There are several Nash equilibrium solutions.

However, the following problem is lacking the discussion.

- Nash equilibrium is not considered that player deviates by coalition with opponent.

In *k-Implementation*, payoff function V in which is committed by the mediator, is with the condition that the preferred strategy is dominant. Deviation by coalition of players does not arise as a result by minimizing this cost k. The authors considered payoff which is the minimum and the maximum, in the viewpoint of necessary payoff V for which player implement the deviation by coalition of players. Mediator is behaved himself according to his rationality. The authors clarify that mediator will make a desirable strategy, because he/she only wants to get incentive. We consider that mediator gets incentive C from the player and indicate possible incentive C which mediator gets from them.

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