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【Research Note】

# First Step Analysis of Game Theory on Firms' Strategic Goals and Value Creation

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## Abstract

This study provides a first step analysis of how strategic goals influence value creation and firm performance using a strategic model based on game theory. Results have shown that players' choices of normative strategic goals are Pareto optimal. The key reasons are as follows: (1) the same choice of strategy acts as a rule to be observed, and (2) there is an equal allocation of value (i.e., payoffs) to players. The results imply that (1) consensus building through discussion by participants (e.g., employees) and (2) the seniority system, both still typical among successful Japanese firms, might contribute to building the highest level of value through maintaining a normative goal frame.

**Key words:** game theory, strategic goal, value creation

## INTRODUCTION

As reported in previous studies, firms aim to create value (Nonaka and Toyama, 2007). Goal-framing theory (Foss and Lindenberg, 2013) states that normative goals that express the desire to act appropriately in the service of a collective entity such as an organization are associated with the highest level of value creation because this goal frame alone can motivate organizational members to engage in truly collaborative activities, which Lindenberg and Foss (2011) called joint product motivation where organizational members can recognize a joint endeavor and see themselves as a part of this endeavor. Van de Ven and Lifschitz (2013) stated that everyday administrative behaviors appear to follow the logic of collective institutional standards of reasonableness. However, I contend that collective institutional standards can be identified as rules to be observed by a firm. Because Okada (2014) suggested that the study of game theory would be useful to build collaborative relationships and that game situations have a rule to be observed by players within a common structure, I have been motivated to explore the possibility that the theory could explain firm value creation through a collaborative activity under "a rule to be observed."

## SITUATIONS CONSIDERED

Situations considered here comprise the interactions among human resources as a team working for the value creation at a firm<sup>1</sup> and the goal frames<sup>2</sup> depicted by Foss and Lindenberg (2013) under a rule to be observed, which I contended to identify the collective institutional standards proposed by Van de Ven and Lifschitz (2013).

### Common Structures of Game Situations and Applicability to this Situation

Okada (2011) stated that game situations are the object of analysis in game theory and that there are common structures of the theory; the structures are as follows:

- (1) The existence of plural (i.e. , more than one) entities of decision making and action called players
- (2) A choice of action by players for realizing respective goals
- (3) The realization of players' goals is dependent on other players' choices of action
- (4) The existence of the obligation of players to observe a rule

I argue that a game situation is considered here for the reasons as follows:

- (1) There is human resources who can be identified as players because " human resources " here is an entity of decision making and action.
- (2) Human resources (i.e. , players) makes a choice of action for realizing respective goals (i.e. , hedonic, gain, and normative goals).
- (3) The realization of players' (human resources') goals is dependent on other players' choices of action because of the team function of value creation.
- (4) There is an obligation for players to observe a rule.

## THEORY AND ITS APPLICATIONS

### Which Game?

Okada (2011) defined games of strategic (i.e. , normal) form as a basic model to express the interdependence of other players' strategies. Because the game situations considered here interdepend on the choices of plural players, I argue that this situation represents a strategic form of game theory.

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1 Because a firm is an entity that produces goods and services (Odagiri , 2010) , not only private enterprises but also nonprofit organizations, such as international organizations, universities, independent administrative agencies, and incorporated foundations, can be considered firms as I argued in Hoshino (2014).

2 In addition to normative goals, there are two other goals as follows: (1) hedonic goals that express the desire to improve (or preserve) the way one feels and are related to fulfillment and (2) gain goals that express the desire to improve (or preserve) one's resources.

Okada (2014) defined a zero-sum game as where players' goals are completely in conflict and a non-zero-sum game as all other games and stated that in a non-zero-sum game, there are possible conflicts of interest and cooperation and that many game situations in society and economics are non-zero-sum games. Because the situation we considered is a team activity, players' goals are, at least to some extent, not in conflict. Therefore, I argue that a non-zero-sum game is applicable here.

## Players

As a minimum unit of decision making and action, a player is the most basic element of any game (Okada , 2014) . Because the situation considered here involves the interaction among human resources as a team for firm value creation, I argue that the minimum unit of decision making is each individual in a firm because, along with Barney and Felin (2013) , I contend that an individual is the starting point of organizational analysis. Moreover, in agreement with Foss and Lindenberg (2013) , Inamori (2010) , and Nonaka and Toyama (2007) , I argue that every individual of a firm, not just a small group of elites (e.g. , top management) , should be involved in effective value creation (Hoshino , 2014) . There are  $n$  players (i.e. ,  $n$  individuals at a firm) participating in this game. For simplicity, we selected two players (i.e. , two individuals at a firm) who have the same employment tenure, status, and wage level (i.e. , allocation of value) as representatives. I argue that they are realistic representatives under the traditional Japanese age-seniority employment system, where (1) most new employees are hired immediately after completing their undergraduate education , (2) status and wage are based on employment tenure, and (3) employees who started to work for firms in the same year ( " Douki " in Japanese) tend to compete and cooperate closely for value creation, which, in many cases, is the driving force for the improvement of firm performance. Referring to Okada (2011) , this can be written as  $N = \{1, 2\}$  , where  $N$  is a set of players.

## Strategy

Strategy is the action plan of players (Okada , 2014) . Borrowing concepts from Foss and Lindenberg (2013) , I contend that strategy sets are strategic goals and as such are selected by players according to their goal frames; the goal frames could be

- (1) hedonic goals that express the desire to improve (or preserve) the way one feels and are related to one's fulfillment;
- (2) gain goals that express the desire to improve (or preserve) one's resources; or
- (3) normative goals that express the desire to act appropriately in the service of a collective entity such as an organization.

Referring to Okada (2011) , a strategy set for two players could be written as follows:

$$S_1 = \{1(\text{hedonic goal}) , 2(\text{gain goal}) , 3(\text{normative goal})\}$$

$$S_2 = \{1(\text{hedonic goal}), 2(\text{gain goal}), 3(\text{normative goal})\}$$

### Payoff Matrix

Referring to Okada (2011), the payoff matrix of this non-zero-sum game can be written as the bimatrix as follows:

$$A = \begin{bmatrix} (a_{11}, b_{11}) & (a_{12}, b_{12}) & (a_{13}, b_{13}) \\ (a_{21}, b_{21}) & (a_{22}, b_{22}) & (a_{23}, b_{23}) \\ (a_{31}, b_{31}) & (a_{32}, b_{32}) & (a_{33}, b_{33}) \end{bmatrix}$$

Player 1 selects rows, and Player 2 selects columns. For example, in  $(a_{33}, b_{33})$ ,  $a_{33}$  indicates Player 1's payoff, and  $b_{33}$  indicates Player 2's payoff when both players select a normative goal frame strategy.

### Impact of Contagion Effect on Payoff Matrix

As per the contagion process stated in Foss and Lindenberg (2013), goal frames have a strong tendency to spread within organizations. In other words, in practice, the two individuals mentioned above select the same strategic goal as indicated in Foss and Lindenberg (2013:92, Fig. 1). I argue that matching strategy choices owing to the contagion effect is particularly realistic in typical successful Japanese firms because consensus building through discussion by participants (e.g., employees) is a predominant decision-making process. Therefore, I contend that components (bold faces below) are realized in practice.

$$A = \begin{bmatrix} (\mathbf{a}_{11}, \mathbf{b}_{11}) & (a_{12}, b_{12}) & (a_{13}, b_{13}) \\ (a_{21}, b_{21}) & (\mathbf{a}_{22}, \mathbf{b}_{22}) & (a_{23}, b_{23}) \\ (a_{31}, b_{31}) & (a_{32}, b_{32}) & (\mathbf{a}_{33}, \mathbf{b}_{33}) \end{bmatrix}$$

I argue that the practice of selecting the same strategic goals becomes an unwritten rule, or what Van de Ven and Lifschitz (2013) called collective institutional standards of reasonable behavior, because the everyday administrative behaviors of a firm follow this behavioral logic owing to the contagion effect. I contend that this rule works in the same manner as that of coalition game, identified by Okada (2014) as a strategic form, because selecting the same behaviors (i.e., strategy) as the other player (i.e., observance of a rule) brings about the highest payoffs for both players. In other words, payoffs in components in bold faces are larger than those in other components for both players.

### Pareto Optimal under Group Rationality

Figure 1 from Foss and Lindenberg (2013:92) can be expressed as the inequity as follows:

Value created under normative goal > Value under gain goal > Value under hedonic goal

Assuming that all values created by two players are allocated to themselves, the inequity that can be drawn from that stated above is as follows.

$$a_{33} + b_{33} > a_{22} + b_{22} > a_{11} + b_{11} . \quad (1)$$

Referring to Okada (2014) , this inequity can be expressed as follows:

$$\sum_{i=1}^2 fi(3) > \sum_{i=1}^2 fi(2) > \sum_{i=1}^2 fi(1) ,$$

where  $i$  indicates player, and the numbers inside parentheses indicate strategies; payoff is a function of strategy.

Assuming that group rationality is the maximization of total payoffs of individuals of a firm represented by two players, as indicated by Okada (2014) , Pareto optimal under group rationality is both players' choice of normative goal. In other words, both players choose the same strategy (i.e. , combination of the same strategy) stated as bold faces among strategy set below.

$$\begin{aligned} S_1 &= \{1(\text{hedonic goal}) , 2(\text{gain goal}) , 3(\mathbf{\text{normative goal}})\} \\ S_2 &= \{1(\text{hedonic goal}) , 2(\text{gain goal}) , 3(\mathbf{\text{normative goal}})\} \end{aligned}$$

### Nash Equilibrium Point and Pareto Optimal under Individual Rationality

Individual rationality means the maximization of an individual's payoff (Okada , 2014) . Based on an equal allocation of value (i.e. , payoff, wage) to each player stated above and inequity marked as (1) , the equity and inequity that are drawn are as follows:

$$a_{33} + b_{33}/2 = a_{33} = b_{33} > a_{22} + b_{22}/2 = a_{22} = b_{22} > a_{11} + b_{11}/2 = a_{11} = b_{11}$$

Referring to Okada (2014) , the inequity and equity presented above can be expressed as follows:

$$fi(3, 3) > fi(2, 2) > fi(1, 1) , \quad (2)$$

where  $i$  indicates player, and the numbers inside parentheses are strategies; payoff is a function of strategy.

Referring to Okada (2014) , combination of strategy expressed as  $s^* = (s_1^* , \dots , s_n^*)$  is nash equilibrium point when for all players' all strategies expressed as  $s_i \in S_i$ , the following equity and inequity are drawn, where  $s^*/s_i$  means combination of strategy when only player  $i$  changes strategy to  $s_i$ .

$$fi(s^*) \geq fi(s^*/s_i) , \quad (3)$$

I argue that both players' choice of normative goal, which is expressed as  $fi(3,3)$  stated

above and inequity marked as (2) is nash equilibrium point because this combination satisfies equity and inequity marked as (3) stated above. Pareto optimal is also the normative goal of both players because the nash equilibrium point is the same as the Pareto optimal in a coalition game (Okada , 2014) .

## CONCLUSIONS, CONTRIBUTIONS, AND LIMITATIONS

### Conclusions

Under both group and individual rationalities, the choice of normative goals by both players, which is a combination of strategy 3 , has been shown to be pareto optimal. The key reasons why the choice of normative goals becomes pareto optimal are as follows.

The first reason is the selection of the same strategy as a rule to be observed, which I argue is because of the strong contagion effect owing to consensus building through discussion by participants (e.g., employees) , which is typical in successful Japanese firms.

The second reason is the equal allocation of value (i.e., payoff) to players; I contend that this describes the prevailing employment system (i.e., age seniority-based) of successful Japanese firms where (1) most new employees are hired immediately after completing their undergraduate education , (2) status and wage are based on employment tenure, and (3) employees who started to work for firms in the same year (“ Douki ” in Japanese) tend to compete and cooperate closely for value creation, which, in many cases, is the driving force for the improvement of firm performance.

### Contributions

The conclusions stated above could imply that consensus building through discussion by participants (e.g., employees) and the age-seniority system remain prevalent among successful Japanese firms and might contribute to add the highest level of value creation through maintaining a normative goal frame. Although Foss and Lindenberg (2013) argued that this is a highly precarious strategy, this study might imply that it is relatively easy to maintain in the case of successful Japanese firms.

This could be the reason why successful Japanese firms, such as Eisai, state a normative goal in their vision (“ Keiei rinen ” in Japanese) which is simply “ human health care. ” This vision allows Eisai’s employees to recognize that the company views itself as being on the side of patients and their families and not that of doctors or pharmacists (Nonaka and Toyama , 2007) .

### Limitations

Because this is my first step analysis<sup>3</sup> of game theory, I have limited my research to very

<sup>3</sup> I started research on game theory in February , 2015.

simple problems. I have also heavily depended on Okada (2014) because the study attempts to explain both basics and most recent research results in a simple manner while maintaining a robust standard of quality.

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4 References in Japanese are translated by the author.