Jurnal Infestasi
Vol. 3, No. 1, Juni 2007
Hal. 53 - 58

INFORMATION AND GAME THEORETICAL APPROACH IN BUSINESS STRATEGY

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Abstract: *This paper will concentrates in explaining the application of game theoretical approach to gain information in the business strategy. The brief explanation about game and strategies are particularly concern with applying the theoretical approach to the real life. Auction, decision making process and e-commerce are identifying the role of the game in helping manager or the player to win the competition in the market.*
Keywords: *Game theory, information, strategy, business process, decision making*

I. IINTRODUCTION

Information and game theory are complementary factors. The game needs information to find the best strategy in order to win the game. Players of the game have to be aware of the information provided by the enemies because they were probably gives wrong impressions. According to Davis, foreword from Oskar Morgenstern, 1930 : the special and the simply things from game theoretical approach is deals with decision making process, information gives choices of strategy to players to make decision with all possibilities condition that may happen. The blending of player's mutual and conflicting interests that makes game theory fascinating.

Game theory is a branch of mathematics with direct applications in economics, sociology, and psychology which first devised by John Von Neuman with his first publication in 1944 which is "*Theory of Games and Economic Behaviour*" then later contributions were made by John Nash, A.W Tucker and others (http://whatis.techtarget.com/definition/0,,sid9_gci803205,00.html)

IBM's Founder Thomas J. Watson said: "Business is a game , the greatest game in the world if you know how to play it ", (Mcmilan, 1996), however the business negotiations are essentially the game of predicting what other person will do. In addition, faced with employees, sub contractors, salespeople and others, manager are continually called upon to make strategic decisions based on how someone else will act and react. Finally, games, information, strategies and manager are the powerful tool of business strategy, therefore game theory is a valuable habit of mind and a way for executives to sharpen their thinking in business and in life. (Mcmilan, 1996). This paper is focusing in the role of the game in the business strategy and the needs of information due to the strategy to win the game.

II. THE NATURE OF THE GAME

A game is a formal representation of situation in which a number of individuals interact in a setting of a strategic independence. (Mas Collel, 1995). In the game normally there will be players, the rules, the outcome and the payoffs. *Players* which is normally formed as two peoples or two different agent with different characteristics which interacts each others, framing by the *rules* of the game an o*utcome* is concerning with the action of the player with respect to the *payoff* that become preferences over the possible outcome.

Basic assumptions of game theory are (Gibbons, 1996; Mas Collel, 1995):

1. Individuality (have their own interest)
2. Rationality (always want to maximize their interest / payoff)
3. Mutual interdependence (the action of each individual/ player depend on the action of other players)

According to Von neuman (1944) game theory divided into broad areas: non-cooperative game (strategic game) and cooperative game (coalitional) games. Non-cooperative game concentrate on individual motivation (individual as rational players); cooperative game concentrate on society as a whole, for example : wars, strikes, etc. but this is an inefficient game. In other hand, Nash (1950) claimed that one should be able to reduce all cooperative games into some non-cooperative form (http://cepa.newschool.edu/het/schools/game.htm), that position known as "Nash Programme" which are: Normal form game (static) and extensive form game (dynamic). The solution concept of the static game are : Maximum minimum, Dominance criteria, Strategic stability or Nash Equilibrium (NE) also can be with Mixed Strategy NE with best response correspondence.

III. INFORMATION AND THE GAME

Game is any decision under uncertainty (Colman, 1982); (Mas-Collel, 1995); in order to solve the game we need to know the type of information that we have. There are two types of information : a complete information and incomplete information. In this situation, complete means : we know the types of other players, know their preferences, and know their payoffs. Conversely, incomplete information do not have such those information that have been mentioned in the complete information.

Players of the game have to do some action for their strategy because strategy is a predetermined 'programme of play' that tells her what actions to take in response to *every possible strategy other players might use* (http:// plato.stanford.edu/entries/game-theory/#Mot), and information is needed to do an action which can be classified as perfect and imperfect information. Perfect information means that we know who move first, and imperfect information we do not know the action of other player movement, It might be move simultaneously or sequential. There are four types of the game:

1. Strategic games (= normal form games)
2. Bayesian games (= games with incomplete information)
3. Extensive games (= games with perfect information, we know who moves first)
4. Repeated games (the game is repeated. The players observe the outcome of previous game before deciding their optimal response).

A crucial aspect of the specification of a game involves the information that players have when they choose strategies. The simplest games (from the perspective of logical structure) are those in which agents have *perfect information*, meaning that at every point where each agent's strategy tells her to take an action, she knows everything that has happened in the game up to that point. A board-game of sequential moves in which both players watch all the action (and know the rules in common), such as chess, is an instance of such a game. By contrast, the example of the bridge-crossing game of *imperfect information*, since the fugitive must choose a bridge to cross without knowing the bridge at which the pursuer has chosen to wait, and the pursuer similarly makes her decision in ignorance of the actions of her quarry. Since game theory is about rational action given the strategically significant actions of others, it should not surprise you to be told that what agents in games know, or fail to know, about each others' actions makes a considerable difference to the logic of our analyses, as we will see. (http://plato.stanford.edu/entries/game-theory/#Mot)

IV. INFORMATION, DECISION AND GAME THEORY

Game theory is concern with the logic of decision making in social situations in which the outcomes depend on decision of two or more autonomous agents (Colman, 1982). Type of information is very important to the chosen strategy. However the action of the players has to pay attention with the information that they have. Symmetric and asymmetric information are important things that influence the action of the players. Decision theory can be viewed as a theory of one person games, or a game of single player against nature. (Levine, http://levine.sscnet.ucla.edu/general/whatis.htm)

Choice under uncertainty has involves on that matter, means that information for decision making process in this case as the formation of expected utility functions and beliefs. Probability also can be used to represent the uncertainty outcomes and Bayes law is frequently used to model therefore the new information is used to revise beliefs. Decision theory is often used in the form of decision analysis, which shows how best to acquire information before making a decision (Levine, http://levine.sscnet.ucla.edu/general/whatis.htm)

V. PRISONERS DILEMMA

Prisoners dilemma is one of most famous example of game theory. Although it was a classic example, it captures the critical features of many public resource problems such as grazing ranges and ocean fisheries. But classically in the game, a prisoner is better off confessing no matter what he thinks his accomplice will do. Hence the outcome of the game has both prisoners confessing and serving 5-year sentence. Note that both would have been better off if neither confessed, but there is no way guaranteeing this "cooperative" outcome, because each of prisoner has a strong private incentive to fink on the other.(Whinston, et all, 1997)

The game among network competitors has some characteristics of "Prisoners dilemma, everyone would be better off if each network manager adopted optimal dynamic pricing, but each has a strong private incentive to lower prices to attract more customers. The outcome is that everyone over utilize the public

resource and is much worse off. Internet and the numbers of competitors in other words could say:

> *"The classic assumption of many small price taking suppliers will be far from the true, instead the internet market will be better describe as a game with small numbers of strategic players."*
> (Whinston, et all, 1997)

Unfortunately, beyond rather simplistic model the "Prisoners dilemma" has no virtually predictive power in the complex dynamic environment. Even with extremely simplified competitive network model may have no pure-strategy non cooperative equilibrium. (Whinston, et all, 1997). Here is an example of classical prisoners dilemma problem with using robin and collin as prisoners who have been arrested for a crime action. (Prisoners' Dilemma)

Consider two criminals, Robin (player I) and Collin (player II), who have been arrested for a crime and are being interrogated separately whether the other did the crime. If neither of them confess against the other, the evidence against them is weak and they will be punished only for lesser charges. If this happens, each will get three years in prison. If both testify against the other, each will get two years in prison.
If only one testify against the other, the one who did not cooperate with the police will
get four years in prison and the one who did cooperate will get no prison sentence. Describe a strategy space of the players.

		Player II: Confess	Player II: Refuse
Player I	Confess	2,2	4,0
	Refuse	0,4	3,3

(Mas-Colell,1995); (Osborne, Martin J.,2004),
(http://plato.stanford.edu/entries/game-theory/#PD)

The depicted picture of strategy profile of the game in prisoners dilemma has shown the important of strategy feature and information needs. With the asymmetric information like prisoner, they have to search for the decision solution which make them better off or even better if they can make pareto solution (better off without making someone else worst off). In the business strategy like in online or internet business they use to have asymmetric information from the competitor. The idea of prisoners dilemma could give an alternative solution for decision making process.

VI. AUCTION

In the past, the way people sell the things are commonly using auction. For example like English auction or Dutch auction for "Tulip". But now, most of the selling process moving to online transaction in order to optimizing the increasing of information technology. Electronic buying with auction system like "e buy" has a big influence in the e-commerce market. They made people like to have bidding continuously, and many people realized that "e buy " is the best solution and also the cheapest way to sell or to buy something instead of going to the shop, but still in this case physical shops are still appropriate for the customer.

Look for the definition of auction, can be a market mechanism in which an object, service, or set of objects, is exchanged on the basis of bids submitted by participants. Auctions provide a specific set of rules that will govern the sale or purchase (procurement auction) of an object to the submitter of the most favorable bid. The specific mechanisms of the auction include first and second price auctions, and English and and Dutch auctions.
(http://www.gametheory.net/dictionary/Auctions/Auction.html)

English auction is A type of sequential second price auction in which an auctioneer directs participants to beat the current, standing bid. New bids must increase the current bid by a predefined increment. The auction ends when no participant is willing to outbid the current standing bid. Then, the participant who placed the current bid is the winner and pays the amount bid. A second price auction is also known as a Vickrey Auction after William Vickrey who first described it and pointed out that bidders have a dominant strategy to bid their true values. While the highest bidder pays the amount bid, an English auction is termed second-price since the winning bidder need only outbid the next highest bidder by the minimum increment. Thus the winner, effectively, pays an amount equal to (slightly higher than) the second highest bid.
(http://www.gametheory.net/dictionary/Auctions/EnglishAuction.html)

Dutch auction is a type of first price auction in which a "clock" initially indicates a price for the object for sale substantially higher than any bidder is likely to pay. Then, the clock gradually decreases the price until a bidder "buzzes in" or indicates his or her willingness to pay. The auction is then concluded and the winning bidder pays the amount reflected on the clock at the time he or she stopped the process by buzzing in. These auctions are named after a common market mechanism for selling flowers in Holland, but also reflects stores successively reducing prices on sale items. (http://www.gametheory.net/dictionary/Auctions/DutchAuction.html)

Auction is the game with incomplete information, because player I do not know the preferences of player II. They have only asymmetric information, they only do the action with the strategy that they feel can make their win or better off.

In the first price auction, the bidder has the probability 1 or 0 and uniformly distributed [0, 1], the bidding procedure moves simultaneously. The higher bidder wins the good and pays the price she / he bid. In the second price auction, all the characteristics are the same except the winner of the bidding procedure only pay the second highest price from the bidders to get the things.

The best response equilibrium solution is the best way to find the solution of the game, therefore with the incomplete information we do not have so much information from the competitor or in this case we can call as the other bidder.

In the case of online bidding like e-buy, we are facing very difficult situation with the lack of information about the competitor, incomplete and asymmetric information, in this case even though we play with the simultaneously but we have to choose an exact time to bid in order to win the game.

VII. KEY ISSUE

The important key issue that we can emphasise for this paper is the role of the game in the business strategy and in every day life. It is necessary to think about the advantages for using the game theory to find the solution of every problem that we have. In the business strategy although we found argument like "cooperation may generate more ideas and better communication than competition and lead to a more profitable business in the long run" (Daryl Koehn,1997) , we can not always be so sure to choose strategy " cooperate-cooperate" instead of making better strategy with the help of information and solution probability in facing the problem. Whilst, the condition of market is become more conducive conducting to the condition of asymmetric and imperfect information.

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