Not just a game


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Abstract (Document Summary)

Game Theory is based on the premise that in any competitive situation (unless the outcome is determined by pure chance), there are factors at work which lend themselves to mathematical representation and analysis which will help explain how the result came about. A proper understanding of these relationships can only enhance a player's probability of success. Although the expression Game Theory passed into general use, its methods were for many years ignored by business. A few companies used Game Theory to help decide on the best strategy when bidding for contracts. Broader interest in the subject was rekindled in 1994, when the Nobel Prize for economics was awarded to 3 renowned game theorists - John Nash, John Harsanyi, and Reinhard Selten. While each has taken Game Theory forward, Nash has carved the most notable academic furrow as the originator of Nash's Equilibrium. Many companies that have shown interest in Game Theory are in tightly regulated industries like power-generation or they take part in restricted competitions such as auctions or bidding for contracts. When limited numbers of participants are playing by accepted rules and behaving in a rational way, Game Theory is best able to point up the most advantageous competitive moves.

Headnote

When setting business strategy, nobody can afford to ignore how their competitors, and even customers and suppliers, will behave. This is the point at which Game Theory comes into play. Stuart Crainer

The poker schools of an Ivy League college are an improbable point of origin for a business theory. Useful business ideas usually emerge from exhaustive studies in obscure factories, or as a by-product of other earnest endeavours. But while the well-heeled young men of Princeton were frittering away their trust funds in the early 1930s, they were being observed by a new member of the academic staff lately arrived from Europe, Johann (soon John) von Neumann, who happened to be a mathematician of genius. The result of his observations was Game Theory, a unique insight into the way people behave when presented with a range of options, or when subjected to pressures.

Game Theory is based on the premise that in any competitive situation (unless the outcome is determined by pure chance, as by dice), there are factors at work which lend themselves to mathematical representation and analysis which will help explain how the result came about. A proper understanding of these relationships can only enhance a player's probability of success. Whether he is playing poker, or bidding for a contract or launching a new product in a competitive market, he can use Game Theory to help shape strategies designed to promote his own interests by influencing the behaviour of others.
In 1987 the patents protecting Monsanto's NutraSweet - an important ingredient of low-calorie soft drinks like Diet Coke and Diet Pepsi - began to run out. Well before they expired, a rival supplier appeared on the scene. The newcomer announced its intention of manufacturing the sweetener in generic form and proceeded to construct the necessary plant - with tacit support from Coca-Cola. Despite this encouragement, however, when battle was joined and Monsanto responded to competition with aggressive price cuts, Coke (like Pepsi) remained loyal to its traditional supplier. Coke had achieved its end: for under a new agreement with Monsanto - a known and reliable supplier - it was able to buy its sweetener at a far lower price than previously.

This example was quoted in an article in Harvard Business Review last year (July-August 1995: The Right Game: Use Game Theory to Shape Strategy, by Adam M Brandenburger and Barry J Nalebuff), along with other cases indicating the growing popularity of Game Theory in American business. As a management aid it has come a long way since 1944, when von Neumann and economist Oskar Morgenstern published their ground-breaking Theory of Games and Economic Behaviour. Von Neumann was by that time applying his talents to the development of the atomic bomb. Later he worked on some of the earliest computers. And although the expression Game Theory passed into general use (along with simple concepts like 'zero-sum game', in which the winner's gain is equal to the combined losses of all other players), its methods were for many years ignored by business.

There were, it's true, exceptions. A few companies used Game Theory to help decide on the best strategy when bidding for contracts. However most situations involving several players call for a highly sophisticated level of analysis. This complexity undoubtedly held back the development of Game Theory as a management 'technique'. So for a long while it remained a preserve of academic theorists who amused themselves by inventing ingenious puzzles. Probably the best known of these is the Prisoner's Dilemma devised in 1950 by Albert Tucker, also of Princeton. But precisely because it is so neat and simple, the Prisoner's Dilemma provides an excellent illustration of how Game Theory works (see box, p68).

Broader interest in the subject was rekindled in 1994, when the Nobel Prize for economics was awarded to three renowned game theorists-John Nash, John Harsanyi and Reinhard Selten. Each has taken Game Theory forward but the precociously brilliant Nash has carved the most notable academic furrow. He is the originator of Nash's Equilibrium, an idea developed in his PhD thesis delivered at the age of 22. (Nash's Equilibrium is the point at which no player can improve on his or her position by changing strategy: in the Prisoner's Dilemma it is where both prisoners confess - if either of them changes his mind he will get the heavier sentence.)

Another classic example of equilibrium concerns an industry dominated by two closely matched and competing companies. Each determines the price of its product. If both were to set a high price, they would maximise their profits. If both set their prices somewhat lower they would still remain profitable. But trouble comes when they choose different price levels. If one company sets a high price which is undercut by its competitor, the latter is likely to make far more money. The first company will be forced to lower its prices. Eventually both will end up with reduced profits.

This hypothetical scenario is not far removed from the reality of the 1994 Soap War between Unilever and Procter & Gamble. The two corporate giants had been engaged in fierce competition over many decades, yet an equilibrium existed supported by expensive advertising and, surprisingly, some sharing of information. The tacit understanding was that any sudden and major shifts in policy would merely produce a 'negative-sum game'. If one company massively increased its advertising budget, for example, the other would have to follow suit with the result that, for both of them, the cost of doing business would rise.

This stability was sorely tested when Unilever launched its new detergent, Persil Power. Unilever (ironically a long-time Game Theory enthusiast) claimed that the new product was a huge technological leap forward. In financial terms, too, it represented a 200 million attempt to capture the initiative. Unilever's first error was not to have learned lessons from its arch rival. P&G had tested the key ingredient, manganese, and found that it could attack fabrics and accelerate bleaching. It had, as a result, put a stop to the research.

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Second, Unilever underestimated the ferocity of P&G's response. P&G had very soon analysed the composition of the Unilever detergent, and its research indeed suggested that the new Power products created holes in clothes after repeated washing. The finding was made public and followed by an ill-tempered war of words. 'Only Ariel washes so clean yet so safe' ran P&G's advertisements in the papers. A year after the initial fanfare, Unilever announced that it was writing off L57 million of stock. One costly lesson for Unilever was that, in mature markets, dramatic breakthroughs are rare. A second was that it is dangerous to change long-established rules.
Nevertheless, if the consequences are correctly calculated, a deliberate change in the rules can bring enormous prizes. Coke clearly adjusted the rules in its dealings with Monsanto - and without doing vast damage to its 68 supplier. Tesco changed the rules of its competition with Sainsbury by introducing its Club Card, giving a discount on accumulated purchases. Rupert Murdoch attempted to rewrite the rules relating to serious newspapers when he slashed the price of The Times - although whether this will restore the paper to profitability remains to be seen.

All too frequently, businesses seem to be unaware that the rules have altered - no matter how drastic the change. Thus IBM ignored its upstart competitors, and the US car makers dismissed the Japanese threat by continuing to build gas-guzzling monsters. Even though they may recognise the new situation, companies often respond with self-defeating strategies. Take the battle between the cross-Channel ferry operators and Eurotunnel. In the end there can be only one winner of this particular game. In theory the ferry operators should keep their prices up, since they must lose any price war. Game theorists suggest that at some stage this will happen. At present, however, they are employing diversionary tactics designed to postpone the inevitable.

The ferry operators know that, whatever they do, that tube under the ocean is likely to remain. A ferry can be decommissioned with ease; a large and expensive tunnel cannot. But Eurotunnel could go bust, and the ferrymen are pushing the tunnel's management as far as they dare. This is a game of brinkmanship in which the tunnel's management is being tempted to join a price war which it can ill afford, but which it (or its successors) are bound to win. For if Eurotunnel were to be pushed over the brink, the business would be reconstituted in a different form.

Many companies that have shown interest in Game Theory are in tightly regulated industries like power-generation - or they are members of cartels - or they take part in restricted competitions such as auctions or bidding for contracts. When limited numbers of participants are playing by accepted rules and behaving in a rational way, Game Theory is best able to point up the most advantageous competitive moves. Auctions for franchises and broadcasting rights, for example, are now common, and second guessing other people's bidding strategies is ideally suited to the game theorist's blend of human dynamics and economics.

The behaviour of cartels is rich in material for game theorists. Members of OPEC - the best known cartel of them all - club together to fix the price of oil and, since the two are intimately linked, to agree on how much of the stuff each country will produce. In theory, the negotiations should result in an equilibrium; a price that is realistically calculated to maximise the long-term benefits of all producers. But it only takes one rogue member to destabilise the equilibrium.

A key lesson from this and other scenarios is that the actions of businesses and all similar economic entities are interdependent. What one player does impacts on the choices available to others in a like situation in a related industry. Therefore, if a company decides to make an investment, say, it should consider not only how its competitors will react but also associates, suppliers, customers, etc.

All businesses are irrevocably self-absorbed. Putting yourself in the shoes of competitors, and focusing on their probable reactions to your moves (and therefore on what moves you can make to provoke certain responses) is called in the jargon 'allocentrism'. 'Everything is interdependent, every company's development is a fruition of major moves by it and other companies,' says David Stout, director of the centre for business strategy at London Business School. Stout attributes some of the increasing interest in Game Theory to economists coming to terms with the fact that they are dealing with real people.

`Game Theory is about making predictions about behaviour if people follow their own best interests,' summarises Stefan Szymanski, senior lecturer in economics at Imperial College Management School. Yet the insistence on rationality can produce interesting paradoxes. A player locked in competition with a rival, for example, might find it advantageous to be regarded as totally irrational. If he could persuade the rival that he would be prepared to pursue a price war to the extent of ruining his own business, the rival might be less likely to initiate such conflict lest it ruin him too.

Further, a company's 'own best interests' are not invariably served by doing down the opposition. A business might be fully justified in pursuing win-win strategies promising benefits to itself, customers, suppliers - even competitors. Indeed, Brandenburger and Nalebuff propose a new emphasis on 'co-opetition'. 'Looking for win-win strategies has several advantages,' they argue. 'First, because the approach is relatively unexplored there is a greater potential for finding new opportunities. Second, because others are not being forced to give up ground, they may be less resistant to win-win moves, making them easier to implement. Third, because win-win moves don't force other players to retaliate, the new game is more sustainable. And finally, imitation of a win-win move is beneficial, not
harmful.'

Game Theory, notes Szymanski, 'doesn't provide a solution - it's a way of thinking about the future, a tool for getting people to think'. At best, it should assist any player of the game of business to pick up additional points here and there. At very least, it should enable managers to understand the nature of the games they are involved in. Ignoring game theory may leave you playing poker when the competition has moved on to bridge.

Insight into a non-zero sum situation

Two men have been arrested on suspicion of committing a crime. The evidence against them is scant, and the prosecution needs a confession. Each prisoner is -- separately, for they are held in different cells- offered a deal: if he confesses and incriminates his fellow (this assumes that the latter continues to protest his innocence) he will rapidly be released; and for turning state's evidence he is promised a reward [which rates a value of 11. The prisoner convicted on this evidence will receive a hefty punishment [-2].

However if both men confess, both will receive a lesser sentence [-1]. If neither confesses, charges will have to be dropped and both will go free - but of course there will be no reward [0].

What should either prisoner do? There is no correct solution: Game Theory, like poker, matches numbers with psychology. If each man neglects to consider what the other might do, he will confess. But separate confessions [-1, -1] ensure the worst outcome for both of them together. Had they been able to communicate they would have made a pact to persist in claiming innocence [0,0], so this must be the most rational course.

But what if one of them is confident that he himself will not be betrayed by his partner in crime?