Application of game theory in strategic formulation marketing essay

This particular article talks about the application of game theory in the business world. In today's highly competitive market it has become harder and more complicated to decide about the pricing strategies and budgeting of the advertisements. This article explains the concept of game strategy with various examples.

Keywords: strategy, pay offs, prisoner's dilemma.

Introduction

Game theory, a branch of applied mathematics that is used in the social sciences, most notably in economics, biology, engineering, political science, international relations, computer science, and philosophy attempts to mathematically capture behavior in strategic situations or games, in which an individual's success in making choices depends on the choices of others. While initially developed to analyze competitions in which one individual does better at another's expense (zero sum games), it has been expanded to treat a wide class of interactions, which are classified according to several criteria. Today game theory is widely used in the business for solving situations in which there are a number of players.

Companies are using the science of Game Theory to help them make complicated strategic decisions in this highly competitive market with least possible risk. History of Modern Game Theory is more than 50 years old and has demonstrated an ability to generate the ideal strategic choice in a variety of different situations, companies and industries. Principles of game theory are applied through the use of strategy games.

Game theory and its applications:

A powerful tool for predicting outcomes of a group of interacting firms where an action of a single firm directly affects the payoff of other participating players.

Enables a company to formulate their optimal strategy.

Ideal for strategic situations where competitive or individual behaviors can be modeled.

For example:

Auctions (sealed project bids),

Bargaining activities (union – management negotiations),

Product decisions (entry or exit markets),

Principal-agent decisions (compensation negotiations, supplier incentives) and

Supply chain design (capacity management, build vs. out source decisions).

Multiple strategy games are analyses to model different competitors, various payoffs and potential strategies. The objective of these games is to deliver

A recommended set of strategic decisions to guide competitive behavior to a desirable outcome, and;

An analysis of how a series of possible strategic moves can predict various competitive outcomes.

Various types of games can be used and analysed based on the strategic situation, the number of players, the amount of information available and the timing constraints.

Classification of game theory:

There are basically three types of games

Fully co- operative game: to explain this game we can take the example of two cyclists coming towards each other. it is in their best interest to avoid the collision and If they have to avoid the collision each of them has three strategies:

move right

move left

maintain direction

The strategy followed by one person in this case depends on the other person. As they both don't want a collision they will change their direction based on the opponent's strategy. This type of game is called full co operative game.

Zero – sum non co operative game: to explain this case we can take the example of the retail outlets in one locality. All of them use different pricing strategy to attract customer. in this case if store is able to attract customers it is on the account of the other retail store. In this particular case a strategy followed by one player affects the other player always. In simple words the win of one person comes on the account of other person's loss.

Mixed strategy game: this type of game explains the situation where the interests of both the player are interdependent. But they are partly opposed and partly coincident. This kind of strategy is followed mostly in the case of union – management feuds. In the case of union and the management their benefits are interrelated. At the same time they have conflicting interests as well.

Other classification: game theory has been divided into following categories:

Static games: this basically deals with anticipating rivals' move. These kind of games involve pricing strategy, prisoners dilemma, the concept of dominant strategy, fixing up of advertisement budget etc.

Dynamic games: deals with the concept of perfect and sub perfect games.

Prisoner's dilemma:

Below given diagram depicts the prisoner dilemma.

Figure 3: Prisoner's dilemma

Prisoners' dilemma is a beautiful concept of game theory that explains various complications that firms face while taking the decision regarding fixing the price or on deciding on the budget for the advertisement. The evidence available with police is not sufficient enough to convict these criminals to convict. Though they are supposed to get 20 years of imprisonment if the crime is proved, they will get only one year of imprisonment if the crime is not proved. if they apply the best strategy they both can avoid the conviction. The strategies that they can follow are:

' A' confesses ' B' remains silent: A gets an imprisonment of 5 years and B gets an imprisonment of 20 years.

B confesses A remains silent: B gets an imprisonment of 5 years and A of 20 years.

Both of them confess: both get an imprisonment of 5 years.

Both remain silent: both get an imprisonment of 1 year.

The dilemma here is that they don't know about each other's strategy and they end up confessing the crime as both of them want to avoid the 20 year of imprisonment. But if they know about the strategy of the opponent they can decide about their strategy and can get best equilibrium possible that is one year for both of them. The same theory applies for many firms in the corporate world and they end up choosing the wrong strategy because of the opponent or the apprehensions in their mind.

The Concept of Dominant Strategy: Dominant strategy is the strategy followed by any player that will supersede all the strategies followed by the opponent.

Eliminating Dominant Strategy:

It will in the best of interests of both the rivals to eliminate the dominant strategy. One beautiful example of this is the OPEC.

Nash Equilibrium: A Nash equilibrium is a combination of strategies such that no individual player can deviate unilaterally from his or her to improve his pay offs.

Few examples of game theory in the practical corporate world:

Price wars: this can be explained by the following example: imagine there are two pizza providers in the city and they have different pricing policies namely- high, low and medium. There are two restaurants in a small town, pizza hut and dominos.

They are in competition with each other for customers. They have three price slabs: high (H), medium (M) or low (L). The customer base is 1, 000 of which 300 only ever buy at Dominos and 300 only buy at Pizza hut. The other 400 are price-sensitive and always buy the cheaper pizza and choose at random if they charge the same price. Both providers make a margin of £12 per pizza if they charge high prices, £10 per pizza if they charge medium prices, and £5 for low prices. Both Dominos and Pizza hut cannot guess what the other player has chosen before they choose themselves. We can calculate profits by multiplying the number of customers with the margin per customer. For example, if dominos charges a medium price and Pizza hut a high price, Dominos will sell to his 300 ' loyal' customers and the 400 ' price sensitive' customers at a margin of £10 each, giving him pay-offs of £7, 000. Pizza hut only sells to his 300 loyal customers, but at a margin of £12 per pizza, giving him profits of £3, 600.

Figure 2: pricing war between two suppliers

P&gIn this case three equilibrium arises one of 6/6 , 5/5 other one of 2. 5/2. 5. the noble picture for both the firms is 6/6 but becausee of the price wars between them none of them are able to extract

ad

No ad

Ad wars:

No ad

$5m

colgate

$5, m

$5. 5m,

$2m

Ad

$2m

$5. 5m

$2. 5m

$2. 5m

Figure 3: advertising war between P & G and Colgate

This particular situation is of the two brands of toothpastes in which both of

them follow different ad strategies. The decision of going for an ad and not

going for an ad depends upon the opponent. They have four possible strategies:

Both of them go for ad

None of them go for ad

P& G goes for ad but colgate does not go for ad

Colgate goes for ad but P & G not.

In two cases the equilibrium exists one for 5, 5, and the other for 2. 5, 2. 5. the firms can make more money without going for any ad but as both the firms want to capture the non loyal market they go for ads and finally end up by lower margins. The dilemma here is that if one firm does not go for the ad and the other goes, then it will lose money. So guessing rivals move becomes very important here.

Assumptions:

Players and rational and they select strategies based on their interest.

The market is equally divided in the players.

Other factors are constant.

Shortcomings of Game Theory:

Game theory has many short comings as well and that needs to be considered.

Assumes the players are rational and they play in their self-interest. This might not be the case all the time.

Assumes players act strategically and consider the competitive responses of their actions. But every manager does not think within a strategic context.

The concept of Game Theory is most effective when managers understand the expected outcomes of the strategies they are following and the strategy that their competitors will follow.

To be little precise most of the companies often do not have enough knowledge of their own payoffs let alone those of their competition.

Despite its shortcomings, a properly constructed game can perceptibly reduce business risk, can produce valuable competitive insights, improve internal alignment around decisions and maximize strategic utility.

According to the " The Economist magazine" " Managers have much to learn from game theory provided they use it to clarify their thinking, not as a substitute for business experience."

Conclusion:

Game theory is a beautiful concept of applied mathematics. Though it has got shortcomings and its assumptions might not be applicable in all the cases it can help firms and industries in finding the appropriate strategies. Based on the pay offs, number of players and other strategic situations game theory can be helpful in developing the optimum strategies for the firms.

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