

## СЕКЦІЯ 11. ТЕОРІЯ ІГОР

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### GAME THEORY APPLICATION TO THE CSR PRACTICE

Corporate social responsibility (CSR) can be presented in the form of normal (strategic) games, which include: sum of players, sum of strategies for each player, the sum of winnings for each strategy. Additionally, the probability of a player choosing one or another strategy can be introduced for games with CSR, for optimization of the mathematical expectation of winning (Bayesian games).

Based on the rational nature of the players, each of them will choose a dominant strategy, which is to increase profits and/or the value of the firm. In this case, since a zero sum game cannot be used with CSR, the maximin equilibrium cannot be applied either.

A. Smith accepted the selfish human interest as a factor of social progress, that is why social responsibility could not be applied to Smith's theory of competition. He claimed that during the competition personal ambition serves the general good, and therefore everyone has to act according to their own interests.

Accordingly, to determine the dominant strategy we need to use other approaches, the most viable among them being Nash equilibrium. In other words, it is necessary to select not one strategy, but a combination of strategies, when it's not profitable to change your strategy, provided that the other players, too, will not change their strategies to improve their results. Nash Equilibrium will not include the strategies driven out by the dominant strategy in this case, and the players' choice will remain rational. Moreover, in the absence of a dominant strategy Nash equilibrium will exist<sup>1</sup>.

In Nash equilibrium, each player's egotistical thinking leads to a global loss in the long-term. The result is optimal when each member of the group is doing their best for themselves and for the other players. A decision that contradicts Nash equilibrium leads to that player's defeat. What's more: Nash equilibrium requires that each of the players trusts the other in his rational actions concerning their own benefit and in case one of the players acquires information about Nash equilibrium he must inform other players about strategies they should follow to increase their winnings.

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<sup>1</sup> Nash equilibrium will always exist for games with CSR, since it is impossible to apply a zero-sum game to it. In addition, it's mathematically proven that each statistic game has a Nash equilibrium – at least in the mixed strategies.

Let's look at an example. There are two companies in one of the market's sectors (let's call them A and B), the income of which is 10 million euro. Each of them decided to run a social-responsible marketing campaign separately, the cost of which is 2.5 million euros. Let's assume that the following is not associated with either an increase in sales of products, or with the increase in the volume of the market. As a result of socially responsible marketing, each company plans to increase market share to 80%, provided that no other company will run a similar campaign.

This situation gives us conditions for the use of game theory: 1) Players: Companies A and B; 2) strategy: use or not use of socially responsible marketing; 3) game rules: companies make decisions at the same time, not knowing about the actions of other companies. Game results.

1) Both companies use socially responsible marketing. Thus, each company will have net income of:  $5 - 2,5 = 2,5$  (mln euro).

2) None of the companies use socially responsible marketing. Each company will have net income of:  $\frac{10}{2} = 5$  (mln euro).

3) Only one of the companies uses socially responsible marketing. In such conditions, the company that uses CSR will increase the market size to 80%, so net income will be:  $8 - 2,5 = 5,5$  (mln euro), and for a company that doesn't use CSR net income will be 2 million euro.

Let's show the results in a form of game theory matrix:

Table 1

**The matrix form of the game theory**

Company	B		
	Strategy	Used CSR	Did not use CSR
A	Used CSR	<b>2,5 / 2,5</b>	<b>5,5 / 2,0</b>
	Did not use CSR	<b>2,0 / 5,5</b>	<b>5,0 / 5,0</b>

Efforts of each of the players to act in their own interests leads to the classic dilemma, shown in table 1. Each of the companies will receive maximum profits if they don't use socially responsible actions (5.0/5.0), but Nash equilibrium (2.5/2.5) indicates that the application of CSR is the optimal choice for players.

Talking about the selection of Nash equilibrium as the optimum choice for rational players, it is worth to point out that "there are different kinds of balance, and taking that into account is especially important when analyzing the flow process in time, i.e. from the dynamics point of view of. Mechanical physics distinguishes three basic types of equilibrium:

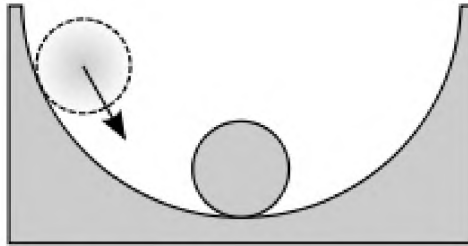
1) stable equilibrium (if equilibrium is violated, balancing factors start to work);

2) unstable equilibrium (if equilibrium is violated, unbalancing factors start to work);

3) indifferent equilibrium (external factors do not violate the state of equilibrium).

The Nash equilibrium in CSR is essentially an example of an unstable equilibrium, since a change of strategy for one of the players will lead to a loss of balance.

The application of social responsibility in business practice is a dynamic game, i.e. the game, when players in making their actions will know about the actions of other players. Because the players are rational, their actions will be in response to the actions of the other players. Moreover, the players who go first will have expectations concerning the following actions of other players. So, they both of them will adjust their actions regards to the upcoming events. Thus when socially responsible practice is a single occurrence in the work of the company the rational choice would be to not use CSR, which leads to a stable equilibrium (Figure 1).



**Figure 1. An example of a stable equilibrium**

In this case, when we look at the situation one time only stable equilibrium represents a dilemma of prisoners. Everyone would benefit more if nobody uses CSR, no matter what the other player does. Acting rationally on their own, the players come to an irrational solution together. If both of them betray each other, they will get less profit than if they work together (singular equilibrium in this game does not lead to Pareto-optimal solution). This is a dilemma. In all situations, the cooperation is not profitable, so all rational players will choose the non-responsible business for balance. That is the paradox – individual rational strategies can lead to collectively irrational results.

So, using the game theory lets us conclude that even though the use of CSR is not the most profitable, and hence not the rational strategy for a company in the short term, but in the long run it is a rational choice. The implementation of projects with CSR takes time, especially if they require a capital investment. However, it doesn't mean that a project that's beneficial from a social point of view, is also the most profitable, although a rational player is wants quick results and is mostly interested in projects that bring profits in a short-term period. Therefore, the Nash equilibrium as a "irrational balance" is not a static short-term balance period, but a dynamic structure that manifests in the long period. Violation of this balance is not a deviations from a certain point, but a deformation of the whole structure.