

To What Extent Does Game Theory Influence Profit Maximisation in Organisations

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Abstract: Incentives of employees are a crucial factor for profit maximisation in organisations since they directly affect the productivity of products to be sold into the market. In order to maintain a positive working status, organisations must think of efficient methods such as reward systems, to enhance the relationship between all workers. This paper will investigate the importance of an efficient organisational working group, and the application of different reward systems to maintain high-level incentives through an analysis of game theory models. The prisoner's dilemma game and the boxed pig game will be introduced to analyse the advantages and disadvantages of reward systems, as well as the elimination of the free-rider phenomenon.

Keywords: social capital, game theory, profit

1. Introduction

Recent research has drawn interest in social capital studies from interdisciplinary views [1]. Social capital, primarily found in business operations, is a resource that exists in social interactions and networks. Organisational social capital is defined as a concept that is built up of “structural, relational, and cognitive dimensions” between members of a group [2]. Beyond this wide definition, academics have used the term in a variety of contradictory and perhaps inconsistent ways. According to researchers, social capital is the quality of individual actors who benefit from their position or status within a group or community [3]. Academics assert that social capital is a larger-scale trait of societies, nations, and economic networks (i.e. Companies or partnerships). Although more attention was drawn to methods through which social capital may improve firms' intellectual capabilities by Nahapiet and Ghoshal, social capital as an organisational phenomenon has received very little attention.

The concept that we call organisational social capital reflects the nature of social interactions within companies. Shared trust between members of a company and collective goal orientation enables employees' high incentives to work. Organisational social capital is a key factor that can be beneficial to both the company (i.e. increase profit for shareholders) and its employees (i.e. skills and wages). For instance, employees are individuals who are connected to the business in some manner, such as any form of employment including part-time workers and permanent workers. In an economy, ways of operation of businesses may seem relatively straightforward on the surface since requirements on business inputs (i.e. human, physical, financial, enterprise) are very similar. However, in the interior ecosystem, each company has its own core values that build up a unique and

sophisticated operating system. For instance, companies' standards for their workers may vary. Some may strive for unity, while others value the diverse thinking and creativity of employees. This causes companies to have their own organisational culture and create immense differences in their inner working system.

This paper will investigate the application of game theory models in employment practices in an organisation. This paper has been divided into four more sections. The first section examines the perspectives and strategies of employers and employees in the employment game. The second section introduces a real-life example of reward systems. The third section is made up of two analysed game theory models and solutions. Lastly, there is a conclusion to summarise what has been stated above.

2. Background

The most basic objectives of firms in a market are survival, social welfare, growth, and profit maximisation. The amount of money inputted for each company may vary due to the different values in the four factors of production, which are land, labor, capital, and enterprise. Some companies may provide digital services, which eliminates the cost of land and capital massively; Some may be agricultural-based companies that focus more on land input than entrepreneurship. However, organisations can never run without human resources (i.e. employees) no matter how capitalised or advanced it is [11]. Therefore, labor recruitment would be the most competitive factor for all companies.

Given that employment is a commercial relationship with at least two parties involved the employer and employee, negotiations between them are essential in order to maximise each of their payoffs. Industrial conflicts arise between employers and employees when they have strong differences of opinion about issues at work, whereas employees and employers must negotiate to come to a mutually beneficial solution in order to resolve conflict. In an employment game, employees can either work hard or slack off during working hours. Although it is expected for all employees to strive for productivity at all times, it is undoubted that they can not escape the nature of human beings since each person has their own attention span. It is very likely for employees to secretly slack off during working hours to maximise their own payoffs since the amount of salary usually does not change depending on how much work is done. On the contrary, working payoffs for the manager depends on both their own decision as well as the achievements of the employees under his/her responsibility. In order for managers to increase payoff, they must think of sufficient ways to motivate workers.

Social capital represents the relationship between internal stakeholders of an organisation that has a huge impact on a company's profit-making. Organisations must generate a mutually beneficial working environment to reduce industrial conflict and maintain high-level engagement and productivity of all employees. It is applied in interactions, whether between individuals, organisations, networks, or societies. The majority of scholars claim that social capital must be managed properly, in order to fulfil its full potential. Unlike other types of capital, social capital is a type of capital that changes as relationships and rewards change over time and cease to exist when the relations break down. Thus, social capital has been seen as a moral concept, in which its value increases rather than decreases as it is used [4].

3. Example

One commonly used reward system is sales commissions [10]. In such a system, the manager determines the amount of reward for employees to complete and earn based on the number of sales they have made. This allows employees to decide how much effort to put forth in order to maximise payoffs, which usually people tend to be attracted to more rewards. This system showcased a change

from focusing on input hours to focusing on output created. Thus, offering an increase in payoffs to both the employer and employees. For instance, output-based systems decrease the cost of recruiting managerial characters since it is much easier to check how well employees perform with sales commissions. Nevertheless, the manager's responsibilities can also be decreased, which leaves more time for decisions in revenue making. Also, allowing companies to invest more into other factors of production to innovate or advance the company as a whole.

As a real-life example, Alibaba is a multinational company founded by Jack Ma, which is well known for its e-commerce operations. Companies operating with high technologies require the teamwork of highly skilled workers, which is sophisticated to ensure efficient interactions between workers, especially during the pandemic [5]. In order to maximise productivity and profit, Jack Ma came up with a restricted stock plan to motivate employees of Alibaba. However, employees must be examined by a manager for one year until being qualified as permanent workers. Alibaba claims that its reward system aims to inspire all employees to be results-oriented and form a self-disciplined, conscious, automatic, and progressive work style. Improve employees' work initiative and enthusiasm, and promote the improvement of employees' thinking and professional quality [6]. The restricted stock system aims to record employees' positive efforts and performances in the enterprise, which closely links employee growth and enterprise development. Thus, making the enterprise's evaluation of employees standardised, accurate, and objective. Regular reports and summaries of employees are also required to be counted as points in the reward system during a time period.

For instance, permanent employees will receive the restricted shareholding unit of Alibaba, which according to a report of ISCTE “the restricted shares issued by the unit is divided into four years in place, granted 25% per year.” [7]. Thus, in order for employees to increase profit, they will have to work hard in the extremely intense working environment of Alibaba, where salary is distributed based on their sales commission. Therefore, workers will strive for productivity by themselves to get rewarded with more profits, which at the same time, reduces the manager's workload to a massive extent. Therefore, this successful reward system of Alibaba creates a win-win situation and improves the payoffs of both workers and the company. However, if reward systems are not managed appropriately, there may also be some downsides such as the free-rider problem and decreased incentives for workers.

4. Prisoner's Dilemma Game

Table 1: Payoff matrix of the prisoner's dilemma game.

	Confess	Deny
Confess	-5, -5	0, -10
Deny	-10, 0	-1, -1

The Prisoner's Dilemma game is a model when there is information asymmetric between two cooperative parties with the choices offered. The Prisoner's Dilemma game works when there are two prisoners captured and sentenced for their crimes in separate rooms, not allowing them to negotiate through the whole process. There are two options for the prisoner, either to confess or deny. However, given the circumstances that when both of them deny the crime, then they will be sent to jail for one year each; If one confesses and one denies, then the prisoner who confesses will be set free and the prisoner who denies will receive ten years of jail time; When both prisoners confess, the payoff of both prisoners would be five years each. Given that both prisoners are rational in this theory and are only interested in maximising payoffs, a Nash equilibrium will be established in which both prisoners confess.

The prisoner’s dilemma game reflects the dominant strategy for individuals in a scenario that often is not the best choice in group considerations. For instance, the prisoner’s dilemma model can be seen in price competitions between firms and environmental protection issues. This game model is applicable in business management as it relates to the consideration of risk and also links to the choices and incentives of employees in an organisation. Scholars suggest that people tend to treat others the way others treat them, which such behaviour is called fairness equilibrium [8]. In an organisation, if all employees strictly follow the manager’s requirements, everyone will contribute equal amounts and receive the same payoff; If an individual does not follow the requirements while the rest does, then the individual will be fired and others will continue to work; Thus, if everyone disobeys the manager, then the manager will be fired giving less workload for employees. However, information between employees is asymmetric, making them worried that other colleagues will continue to work when they disobey, and the dominant strategy for individual workers is to continue working overloaded.

5. Boxed Pig Game

Table 1: Payoff matrix of the boxed pig game.

	Press	Wait
Press	5, 1	4, 4
Wait	9, -1	0, 0

The boxed pigs game model is when there are two pigs in a cage, one big, and one small with a trough on one end and a button that controls the supply of pig food on the other end of the cage. In order for both pigs to have access to food, they must press the button and run to the other end to eat the food in the trough. Given that every press of the button supplies 10 units of pig food into the trough and costs the pig who travels to press the button 2 units every time. Under the circumstance that the big pig eats faster than the small pig, in the first scenario where the big pig arrives first at the trough, the supply ratio of pig food will be 9:1, which the net payoff of the small pig is -1 unit (pay 2 units of cost) and the big pig’s net payoff will be 9. In the second scenario where both pigs have the same amount of time at the trough, the ratio will be 7:3, in which the net payoff for the small pig is 1 unit and the net payoff for the big pig is 5. In the third scenario where the small pig arrives first, then the ratio will be 6:4, whereas, the net payoff for the small pig and the big pig will both be 4 units. Therefore, when both pigs are wise and rational in this theory, a Nash equilibrium will be established leading to a situation in which players definitely will not cheat or have no better pay-offs. Thus, the dominant strategy for the small pig will be to wait at the trough to get free food, while the big pig will be the one to press the button every time, or else both pigs will starve to death.

Nevertheless, there are some solutions to avoid being stuck in the Nash equilibrium of the boxed pig game and eliminate the free-rider phenomenon. The first solution is to decrease the food supply, letting the food supply be half the original amount. When the small pig presses the button, the big pig will finish the food before the small pig travels back; When the big pig presses the button, the small pig now can also finish the food before the big pig gets back. Having said that, in this solution, whichever pig chooses to press the button contributes food to the other pig and costs itself 2 units per travel. Thus, both pigs will have a negative payoff if it presses the button and a zero payoff if it waits at the trough, therefore, although this solution helps players escape the Nash equilibrium, it is not applicable in organisations since it discourages workers.

The second solution is to increase the food supply to two times the original amount, which provides enough food for either pig to press the button and return to eat. As a result, whichever pig wants to eat will be the one to willingly press the button since the other pig will not finish all the food alone. This result is similar to a communist society with plentiful resources and less competition [9]. This solution is applicable for organisations aiming to enrich organisational culture and build a peaceful relationship between their workers since not only is there an increase in cost, but the incentives of workers will also decrease.

The third solution is to reduce the distance between the trough and the button, as well as decrease the food supply. This will lead to both pigs desperately competing to press the button since the food is much easier to attain, the pig who works hard will achieve it, while the pig who waits will not. For game designers (i.e. employers), this will be the best solution for the free-rider phenomenon since a better payoff can be achieved at a lower cost. Applying the original rule of the Boxed Pig Game to competitions, the weaker player (i.e. small pig) has a dominant strategy to wait. However, in society, if any player fails to contribute to a competition, there will be an unbalanced allocation of resources and leading to market failure. In order to maximise productivity and efficiently allocate resources, free-rider phenomena must be eliminated.

6. Conclusion

The major aim of for-profit organisations is to maximise profits by reducing costs such as employee wages and production machinery. However, these factors conflict with the employees' aims as it decreases their income and worsens working conditions. Therefore, organisations must think of other ways to maximise production with minimised conflict and cost. For instance, introducing reward systems, emphasising organisational culture, and setting ultimate goals can all be ways to improve workers' productivity. The goal of these methods is to influence all internal stakeholders (i.e. employers and employees) to work together efficiently, which creates positive social capital. The prisoner's dilemma and boxed pig game model reflect the vulnerability of organisations regarding its own employees, which states the fairness equilibrium and free-rider phenomenon.

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