



HOW HAS THE USE OF GAME THEORY AFFECTED BUSINESS INTELLIGENCE SYSTEM

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Abstract

Game theory is the study of strategic decision-making, while business intelligence systems are an attempt to apply the scientific method to the business world in order to determine the optimal course of action for achieving a desired result. Several disciplines come together in game theory, including mathematics, economics, philosophy, and psychology. However, a business intelligence system is an informational framework that makes use of business intelligence instruments to both disseminate and generate data. In order to generate novel business strategic directions, businesses utilize business intelligence technologies to process raw data into actionable insights for analysis. There must be a balance between facts and expert opinion when making business decisions (OberholzerGee, 2007). The paper then examines game theoretic tactics for strategic decision making, focusing on the prisoner's dilemma idea and Cournot models, and provides a glimpse into the potential of game theory to analyze historical data in light of present conditions and forecast the future of a company.

Keywords: Business systems, Cournot models, Decision making, Game theory

Introduction

Reflecting the extent and impact of data-related problems to be handled by modern business organizations, business intelligence studies has arisen as a major area for research, with both practitioners and academics committing significant resources to explore the opportunities it brings (Chen & Storey, 2012).

Business analysts are often tasked with weighing the pros and cons of potential solutions to pressing operational issues by determining which options are most likely to yield the desired results. Managers must work through uncertainty surrounding the specific situation with limited time and potentially critical implications. They have to give their best guess as to what will happen, calculate the likelihood of outcomes that differ from the best guess, and evaluate the potential impact of contingencies. In each case, it is desirable to reason out the factors at play and identify the actions that could be taken to alter or promote different outcomes; subsequently, this knowledge can be incorporated into long-term company strategies (Sonteya & Seymour, 2012).

Business analysis is a challenging profession. Every situation is different, there is never enough time to thoroughly investigate every angle, and there is always the risk of negative outcomes if an inaccurate assessment is made. While in-depth familiarity with the topic at hand is undoubtedly necessary for a thorough grasp of each given case, specialists should not rely solely on their own experience when examining crucially difficult issues. Such a situation lends a fresh point of view to boardroom discussions and encourages new ideas. How can managers be better informed about the possibility of various outcomes if game theoretic reasoning is paired with empirical (mainly quantitative) analysis? How can we use game theory to evaluate how different approaches to a problem could provide better outcomes? (Turocy & Von Stengel; Allen & Morris, 2001) Because of this, we turn to game theory to learn more about how to make tactical decisions in a strategic context. Examples of such limitations include managers always working with limited personnel, funds, and other information. The strategic interaction in which decision-makers choose their actions while of course considering expectations about how others will respond to them taking; they should also factor in their own possible actions is the focus of game theory models that can help us examine choices under these constraints (Allen & Morris, 2001).

To improve one's thinking and decision-making abilities in a complex and sophisticated world, it is essential to be familiar with both well-known and obscure game theory tactics. Take, for example, the evolutionary analysis of the adoption of e-Government services, which involves the interaction between a government and its citizens, in

which each party makes independent decisions based on the costs and benefits associated with using e-Government services. Since all players are assumed to be self-interested and rational (Bai & Mei, 2010; Schellong, 2007), this view holds that the game is played in a way that benefits the players. This explains why many countries' e-Government programs faltered before they stabilized, even though they had good intentions (Heeks, 2007). The process of BI analytical synthesis itself might shed light on previously unseen dimensions of the issue. In any case, game theory provides a novel lens through which to examine commonplace and out-of-the-ordinary instances of strategic choice. But there is a flaw with game theory: it does not factor in people's feelings. In order for the country to move forward, one side will have to lose. Some form of natural selection is at play, one could argue, that tends to steer a set of judgments in the direction of the rational and optimal. When it comes to strategic decisions involving citizens, game theory is not a suitable replacement for sound judgment.

Limitation of the study

This study has limitations, but so does any other study. So far, all we have done is analyze the prisoner's dilemma from a business perspective. Game theory's potential applications to BI have just begun to be investigated. In order to provide a comparative study of choice, future research could investigate additional Game theory techniques, such as ultimatum games and battle of the sexes. Since Ultimatum games put an emphasis on human emotions, it would be fascinating to examine them and determine what role they play in strategic decision making.

Methodology

This study would benefit best from a qualitative research technique. Phenomenology is the theoretical approach most commonly associated with qualitative researchers. Following the phenomenological methodology, researchers attempt to comprehend the significance of events and human relationships. This method demands the researcher to focus on gaining an understanding of the significance others assign to their own experiences. A qualitative study collects information beyond words, including attitudes, feelings, vocal and facial expressions, and other activities. The data, which may include interview transcripts, field notes from observations, a vast array of records and historical documents, and memoranda, are subjected to a thorough analysis that is continuing. The study incorporates three processes: data gathering, coding, and analysis (Shapiro, 1989).

Literature review

Better decision making is enabled by business intelligence (BI), which encompasses a wide range of knowledge domains, methods, tools, and techniques. Business intelligence mostly provides information about the present, but with enough data analysis, it can also provide information about the future (Ranjan). This can also be thought of as the availability of timely and relevant information for making sound strategic judgments (Stackowiak *et al.*, 2007). Incorporating another school of thinking, Kumari *et al.* describes BI as an organization's power to combine all processes and capabilities, including human capacity and technology, and convert this into knowledge, obtaining the appropriate information for the right people at the right time (Kumari, 2013). Included in this category are efficient data warehousing systems that incorporate modules for monitoring mission-critical activities and so enabling tactical and strategic decision-makers to fine-tune their actions in accordance with the organization's plan (Golfarelli *et al.*, 2004). The term "business intelligence" (BI) can also refer to the practice of conducting in-depth analyses of data using various methods, such as those made possible by application software and database management (Gangadharan & Swami, 2004) When operational data is transformed into a corporate asset for strategic decision making, it provides a significant competitive edge, he explains. To top it all off, Howard Dresner, a Gartner Research analyst widely regarded as the industry's "father of BI," proposed the definition of "business intelligence" as "a broad category of software and solutions for gathering, consolidating, analyzing, and providing access to data in a way that lets enterprise users make better business decision." Corporate intelligence, then, is a catch-all term for the various tools and techniques used to enhance decision-making in the business world. The study of interactive decision-making, in which the outcome for each participant (here, a decision maker) depends on the actions of other players, can be greatly aided by game theory. To put it simply, game theory is a set of analytic techniques developed to better comprehend the feelings observed in the interactions of decision-makers (Osborne, 1995). In the business world, companies always keep their competitors' moves in mind when formulating their own plans. That is why some businesses merge while others try to stay competitive by going head-to-head with one another. The more the success of a plan the more it depends on anticipations and reactions of competitors, suppliers or customers, the more valuable it is to employ game theoretic analysis (Oberholzer-gee & Eichenberger, 2008) To have a better knowledge of the game theory principles it's vital we look at some game theory strategies first.

Game theory offers a variety of tactics that can be implemented while making important choices. Here are some examples: the Prisoners' Dilemma, the Cournot Competition, Matching Pennies, Deadlock (Social Dilemma), Centipede Game, Travelers' Dilemma, Battle of the Sexes, Peace War, and the Volunteer's Dilemma (Watson, 2013). The popular game Prisoner's Dilemma investigates the decision-making process of two individuals who, when they individually act in their own self-interest, produce a poorer outcome than if they had cooperated. The strategy game helps us learn what factors regulate the right amount of competition and collaboration in company. Two alleged criminals are being confined in isolation, unable to contact one another, in these plans of action. Here's the deal: the prosecutor has told (prisoner A) that he can go free if he and (prisoner B) work together and make confessions against one other, but that if (prisoner A) does not cooperate and (prisoner B) does, (prisoner A) will serve three years in prison. He goes on to explain that if they both confess, they will do two years in prison, but if they don't, they will just serve one. The wisest course of action for the two inmates here appears to be to work together (Aldhous & Reilly, 2006)

Augustin Cournot, a French mathematician, invented Cournot competition, another approach in game theory, in 1838. It is used to characterize a business sector where firms make decisions about their production volumes independently of one another and in tandem (Solomon, 1992). Let us pretend X and Y are two firms capable of mass producing the same goods while also catering to niche markets. They can maximize their profits by agreeing to manufacture only a small quantity and working together to keep the market supply low. What would happen if they did the opposite—defectively produced in large quantities—is that the market would be inundated, the price would be low, and profits would be slim. In contrast, if just one firm works together (Company X produces at a low level) and the other firm defects (Company Y produces at a high level), then Company X breaks even and Company Y earns a bigger profit than if they both work together. If, on the other hand, Company X cooperates (by producing at a low level) and Company Y defects (by producing at a high level), then Company X breaks even, and Company Y gets a bigger profit than if they both cooperate. Table following displays the pay-out matrix for Companies X and Y (the figures represent profits in millions, for the sake of clarity). Breakeven for X and \$10,000,000 for Y are illustrated in cell (b) if X cooperates and produces at low levels while Y defects and produces at high levels (Shapiro, 1989).

		Company Y	
		Cooperate	Defect
Company X	Cooperate	(a) 6,6	(b) 0,10
	Defect	(c) 10, 0	(d) 3,3

Figure 1: Cournot Payoff Matrix

For maximum returns, businesses' management must take calculated risks. On the other hand, success in business does not always depend on chance but on the skill of the management team. Positive effects of game theory on business intelligence have resulted from the development of a more methodical approach to studying the dynamics between companies and their customers, suppliers, employees, and other "players" in the industry. When we take a more critical look at Business intelligence and analytics, we appear to have a lot of interesting topics to discuss, such as locating problems and anticipating their solutions. Easy and quick problem-solving as a result of this is guaranteed (Azevedo, 2012).

Discussion

Entrepreneurship is a risky game. How Managers describe this game in their own words reveals much about their attitude to it. Many common business terms have their origins in either sports or the armed forces. Nonetheless, the paradox is that business is not always about winning or losing, nor is it always about how well you play the game. When we examine the most prosperous corporations, we find that their success did not hinge on the failure of others. If they choose the wrong game, though, even the best players might end up with a disastrous loss. Success in business, then, boils down to timing and location: playing the right game at the right time. You might be wondering how we can be sure this is the right match. If it turns out to be the wrong game, what are your plans? Managers will be able to find the answers to the two questions with the help of game theory, a mathematical construct that is set to alter the way firms operate. Game theory has matured since its inception in 1944 with the publication of "Theory of Games and Economic behavior" by the famous mathematician Von Neumann and the economist Oskar Morgenstern. Thanks to their efforts, we now have a methodical framework for analyzing player conduct (Turocy & Von Stengel, 2003). They have made a clean distinction between two varieties of Games: In games with defined rules of conduct, player actions must adhere to a set of guidelines. Contracts and commercial agreements are two possible forms of such rules. Second, in "Freewheeling games" like those found in the marketplace, when buyers and sellers create value through unstructured transactions, players interact with one

another without any external constraints. The complexity arises, however, when we consider the fact that businesses of all sizes combine the two approaches.

You might be wondering how game theory is related to corporate strategy. The key problem that game theory solves is identifying and implementing the most effective business strategies. When there are multiple governing forces, game theory shines; in such a situation, no choice can be taken in a vacuum. During the muddle of decision-making, game theory simplifies the process by isolating its essential parts, making it easier to understand what is happening and how to respond (Turocy & Von Stengel, 2003). Analyzing the sales impact of a generic milk advertising campaign in Japan. Milk pricing in Japan are negotiated between dairy cooperatives (known as prefectural milk marketing boards) and the factories that buy their product. Generic advertising on a national scale is funded by government grants and voluntary assessments from businesses such as grocery stores, farm supply stores, and wholesalers. Although the processors involved in non-fluid manufacturing have clout in pricing negotiations, many processors involved in fluid processing have limited sway in these situations. They have concluded that the boards' market power is minimal and declining (Suzuki & Judson, 1991). In 1981, the projected marginal rate of return to promotion was 6.04 percent, whereas by 1989, it had dropped to 4.33 percent. There was a decline in market dominance, which led to this drop. Similar to a game of milk promotion efficacy, Suzuki presents an imperfect competition model as a viable foundation for understanding this (Suzuki & Judson, 1991). Adding value is the name of the business game, which can be expressed mathematically as follows: Gross Profits
Market Penetration Market Size Increasing market share or expanding into new markets are both viable strategies for growing a company's bottom line. Inversely, if competition causes a decline in either a company's market share or market size, overall revenues will also decline as shown in the above equation. (Brandenburge, 1996).

It can be difficult to determine the best course of action for a company in today's complicated business climate. Since businesses, academics, and even public relations firms must contend with increased competition and a more globally interconnected marketplace, alliances are often seen as the most effective method of doing so (Leek et al., 1996). Coopetition is an innovative approach to competitive markets that merges elements of management theory, cooperative frameworks, game theory, and traditional forms of competition. As the old adage goes, "if you can't beat 'em, join 'em" and this new strategy is intended to help businesses keep their competitive edge. New markets can be created as the old market is expanded through cooperative techniques. Competitive tactics, once developed,

can be put into action in the marketplace. (Garaffo, 20002) From what has been said, it is clear that business is not always a win-lose proposition. It is possible to have a win-win situation with some cooperation and a lose-lose one without it. Without cooperation, all parties involved will end up losing, as none of the competitors will be able to gain a foothold in the market. The same market will be short-changed as well, as consumers will be deprived of a product that may have been of real value to them.

Game theory provides a rigorous theoretical grounding for collaboration; managers can use this knowledge to improve their own communication skills and their ability to negotiate win-win situations. At long last, companies can no longer operate with the "what's in it for me?" mentality that has plagued them for so long. Business leaders should inquire of their rivals, "How can $1 + 1 = 3$?" component that multiplies rather than adds. When we take a more critical look at BI and analytics, we seem to have a lot of interesting topics to discuss, such as locating problems and anticipating outcomes. This yields extremely astute answers in record time. However, there are certain pitfalls that businesses may encounter if they spend money on these BI solutions. There is a growing mountain of data that has no value until it is analyzed. More data processing is required as businesses begin to deal with this formerly unstructured data. This is a problem for huge data (data deluge). (Chen & Storey, 2012) Things are shifting, as evidenced by IBM's big data analytics research on the historical development of data beginning in the nineteenth century. Data sizes range from the terabyte to the zettabyte, and we regularly work with both. Consider the soaring popularity of sensor networks (Palpanas, 2013) and the ever-increasing total amount of time spent online. (Global & trends, 2010) How often do we actually use an ATM to get cash these days, to put things in context? Just how often do we buy your things and put them through a cash register? Consider your cell phone: how often do you make calls or send texts? (Global & trends, 2010) Consider how regularly we use the Internet in comparison. The internet and smartphones have become indispensable tools that we simply cannot live without. This illustrates how the data deluge is affecting us even on an individual level. There is a great need for this kind of analysis from a commercial standpoint, therefore having access to this data is crucial. There are existing options; it is up to each individual firm to determine which resources best suit their needs. Future data will change the way we work, think, and even live (Lavalle, 2011).

Conclusion

These principles from game theory can help CEOs and managers utilizing business intelligence tools create a game that is optimal for their own firms. More benefits may result for the business than if it simply kept things as they were. Since there is no one, universal solution to any given problem or scenario within an organization, no single game-theoretic method can hope to achieve optimal results. Whatever the context—political, psychological, economic, personal, or business—game theory is a powerful instrument for decision making. This is not meant to replace sound judgment when making strategic decisions, but rather to facilitate it. Businesses' motivations for their actions and the methods they choose can only be understood with the help of game theory,

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