UNIVERSITY OF NOTTINGHAM

Evaluating Competition Strategies for Generic Drug Industries Using Game Theory

A supplement to report "Scenario Planning as a Tool for Long Term Strategic Planning"

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1 INTRODUCTION

This report is a supplement to the project titled "Scenario Planning as a Tool for Long Term Strategic Planning - The Generics Drug Industry in the European Union." The report will further evaluate the resultant scenarios and strategies build and recommended as part of the titled project mentioned above. Game theory perspectives will be used as a tool to analyse how economic agents (stakeholders of the pharmaceutical generic drugs industry) will react when what they do affects the actions of others.

The report will evaluate hypothetical actions taken by generic drugs industry players and their outcomes/payoffs relative to the competitions. It will draw on strategic and extensive forms of games to identify how to act and how to think about your rival's actions. What would be a more powerful in business strategy than this?

2 LITERATURE REVIEW

2.1 OUTLINE OF LITERATURE REVIEW

The literature review is divided into several subsections below. The first part describes the game theory origins, concepts and definitions. A considerable body of extant is revealed in the following sections, drawing on literatures, assumptions behind the practices and theoretical frameworks.

Later subsections describe game theory topology and processes. Various literatures are reviewed on the methodologies used to govern the gaming perspectives. These will describe elements, characteristics and models, and critically evaluate the findings.

2.2 ORIGINS OF GAME THEORY

Game theory was first developed as mathematical model by von Neumann and Morgenstern in 1944. The idea behind the theory is that in many areas of human activity, people solve problems like when they play games – they decide what to do based on what they think others will do, including decision making that tries to influence others what they should do. The concept initially was a military strategy that was used to design optimal battlefield strategies and gained popularity during the Cold War. The theory has been recognized by economists since the 1950's where it was used to study the rivalry between oligopolies (Regan 2007). From here onwards, the theory stepped into strategy and strategic management as economists developed more insight into the practical applications from the theoretical models

2.3 DEFINITIONS OF GAME THEORY

Game theory is a formal study for decision making where players must make choices that potentially affects the interests of the other players. It gives mathematical expressions to the strategies of the opposing players and offers techniques for choosing the best possible strategy. A formal definition lays out the players, their information, their preferences, the strategic action and how these influence the outcome.

In most popular games, it is relatively easy to define winning and losing, and on this black and white basis it is easy to quantify the best strategy for each player. However, it is not just a tool merely used by gamblers so that the person can take advantage of the odds; nor a method for wining polar games. Game theory can be more generalized while understanding how politics is handled (coalitions and power).

The process of formally modeling situations requires the decisions maker to enumerate explicitly the players and their strategic options, consider their preferences and reactions (Turocy et. al., 2002). Additionally, the process involved in constructing such a model provides the decision maker with a clearer perspective over the macro situation. Thus, game theory is a perspective bases application.

There are always two sides to the game: cooperation and competition. In business, both parts of the game have to be played as good to succeed. “Coopetition”, a term coined that means “simultaneously cooperate and compete with each other”, represents the greatest milestone for Game Theory development, as it leads to cooperative strategy which could be thought of as looking at positive sum game or turning zero sum games into positive ones using the game theory techniques. (Mintzberg et.al. 2008)

2.4 GAME FORMS: STRATEGIC AND EXTENSIVE

There are two forms in which games can be represented: the strategic form and the extensive form. The strategic form (normal form) is a simplified/reduced form of game representation where non-cooperative game theory is studied. A game in strategic form lists the individual player’s strategies, and the resultant outcomes from each possible combination of choices. The outcome of their choices is represented by a payoff for each player; usually a number is annotated to measure how much the player likes the outcome.

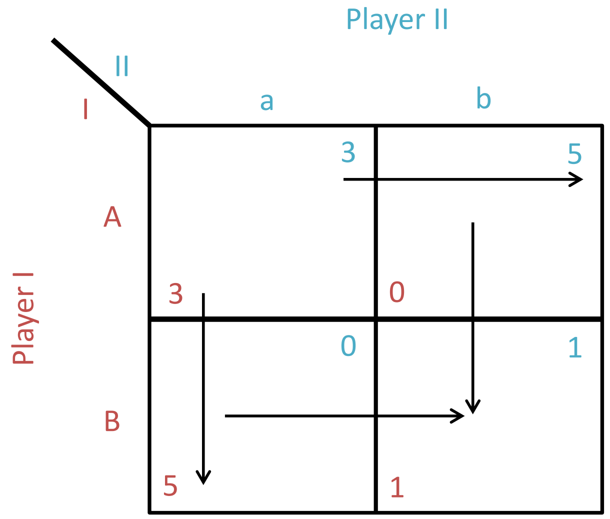
The second form is the extensive form (game tree), which is a richer representation of the game. It shows not only the players, the strategies and their payoffs, but also includes the order in which the players take action, the information that players have at the time the action is to be taken, and the time where any uncertainty is the situation is resolved. The timing element is related to the first mover advantage and will be explored in later sub-sections.

2.5 THE DOMINANT STRATEGY

Game theory assumes the players to be rational as they make choices which result in the outcome they prefer most against what the opponent does. In an extreme case, players might have two strategies, so that given any combination of strategies of the opponent players they resulting outcome from one is better than the other. In this case the outcome of the strategy which is yield better than the other is the dominant strategy. Rational players will never choose to play the dominant strategy, as in the case of 'prisoner's dilemma'.

The prisoner's dilemma is a strategic form of game which takes place between two players. Each player has two strategies, (1) cooperate, or (2) defect. Example below shows the strategic form of a game – prisoner's dilemma.

FIGURE 1: STRATEGIC FORM GAME



Source: Authors adaptations

Players I and II as represented in figure 1 above have two strategies, cooperate or defect, which are labelled *A* and *B* for player I and *a* and *b* for player II. Figure 1 above shows the resulting payoffs of this game. The strategy cooperate, has a payoff of 3 (A, *a*) for each player, and the combination of B, *b* gives the players a payoff of 1. However the combinations (A, b) or (a, B) give the player a payoff of 5 or 0 respectively.

In the prisoner's dilemma game, defect is the strategy that dominates over cooperative. Strategy B of player I dominates strategy A and vice-versa for player II. However, no rational player will choose the dominated strategy because both players are better off than the unique payoff of B, *b* resultant from defect the defect, and thus cooperate with A, *a* strategic decision.

The prisoner's dilemma is a classic case of the two prisoners held suspect of a serious crime. There is no evidence for the crime except if one of the prisoner's testifies. If one of them does, then he will be rewarded with immunity (A, *b* or *b*, A) whereas the other will serve prison sentence. If both testify then they will be reduced sentence (B, *b*), however is non-testify then there is no case (A, *a*). The defection here is the immunity option from testifying, which has a higher payoff thus this constitutes dilemma.

The dilemma arises in various contexts where the players individual defection at the expense of the other lead to overall less desirable outcomes. Example includes litigation instead of settlement, cut-price marketing, etc. where the resulting outcome is detrimental for the players. To tackle the obvious inefficiency caused by the outcomes of prisoner's dilemma games, theorists suggest repeated games, where patterns of cooperation's and rational behaviour can be established and the fear of punishment in the future outweighs their gain from defecting today.

2.6 EQUILIBRIUM IN GAMES

Game theory helps figure out what in the likely outcome of a game when all players interact. We considered dominating strategies in our previous example, however; there are no dominating strategies in many games, and so these considerations are not enough to rule out any outcomes or provide specific advice on how to play the game. In such players reach an equilibrium using strategies that are best responses to other's strategies.

This equilibrium concept is called the Nash equilibrium. Nash equilibrium prescribes strategies that are mutually the best responses that players cannot improve upon unilaterally. The rational is that each player plays his best strategy given the choice of the other player. By construction, Nash equilibrium is a stable, self-reinforcing equilibrium and no player has the incentive to change their behaviour unilaterally. Example below shows Nash equilibrium in the strategic-form game.

FIGURE 2: STRATEGIC FORM - NASH EQULIBRIUM

		Player II		
		Do not expand	Small expansion	Large expansion
Player I	Do not expand	19, 19	16, 21	10, 19
	Small expansion	21, 16	**17, 17**	9, 13
	Large expansion	19, 10	13, 9	0, 0

Source: Authors adaptations

Players I and II as represented in Figure 2 above and are deciding wither to expand their production at a large scale of a small scale. If Player I choose to make a small expansion, he has estimated the following scores, 21 if Player II does not expand, 17 if Player II makes a small expansion, and 10 if Player II expands and Player I does not expand. Similarly, Player II has the same rationale to expand. Here we notice no dominant strategies, but we do notice an equilibrium point (17, 17) before both players choose a large expansion strategy. In the above example both players will be better off if they do not expand and so a rational pursuit of self-interest is not advisable.

Nash equilibriums are stable equilibriums, but they are not necessarily efficient. Efficient outcomes are outcomes that usually maximize the collective interest of the players, but are not necessarily stable. There is no other combination of strategies that could make at least one player better off without making any other player worse off (Pareto Optimum) as discussed previously non efficient Nash equilibriums are called Prisoner's dilemma.

2.7 EQUILIBRIUM IN GAMES

In the previous example identified more than one Nash equilibriums, (19, 19) and (17, 17). In theory, strategic interaction should guide players towards "most reasonable" equilibriums. Many literatures suggest equilibrium refinement; an attempt to make one equilibrium more plausible or convincing than the other. In our previous example, it could be argued that an equilibrium that is best for both players in do not expand as shown in Figure 2.

However, this theoretical consideration for equilibrium is a more complicated process than described by game theory perspectives. Like in the second equilibrium under figure 2 (17, 17) although this is an inferior outcome, it still is a better worst-case payoff (0, 0). This is therefore referred as a max-min strategy as it maximizes the minimum payoff the players can get in each case. In this sense, investing in a small expansion is a safer choice than large expansion and as it's also a part of the equilibrium, and is a justifiable strategy is there is a similar expectation than the other player.

2.8 EVOLUTIONARY GAMES

Example discussed in Figure 2 can further give a different interpretation where we can assume large populations of identical players. In this case we can view the equilibrium as the outcome of dynamic processes rather than conscious rational analysis.

The evolutionary interpretation is set where there are large populations of individuals, each who can adopt either of the strategies. The dynamics of evolutionary games assumes that each strategy is played by a fraction of the individuals. Based on this distribution, players with better average payoffs will be more successful than others, so in the long-term their proportion in the population increases overtime. In the case of symmetric games with only two possible strategies the dynamic process will move towards an equilibrium.

If new players enter the example described in Figure 2 the options are between do not expand or small expansion as large leads to (0, 0) payoff. As new players come into the market, a certain fraction might choose not to expand, assuming that a quarter chooses not to expand then their payoff depends on this fraction factored against those who make a small expansion. Their payoff now would be $1/4 \times 19 + 3/4 \times 17 = 17.5$ which is still higher than 17 under the small expansion strategy. Overtime, the proportion of the individuals who won't choose to expand increases and eventually a new equilibrium will be established.

Evolutionary games are population dynamic views and are useful as it does not require the assumption that all the players are complicated strategic planners that they are rational which is often unrealistic. The notion of rationality is replaces with the concept of a weaker reproductive success (Smith, 1982).

2.9 MIXED STRATEGIES

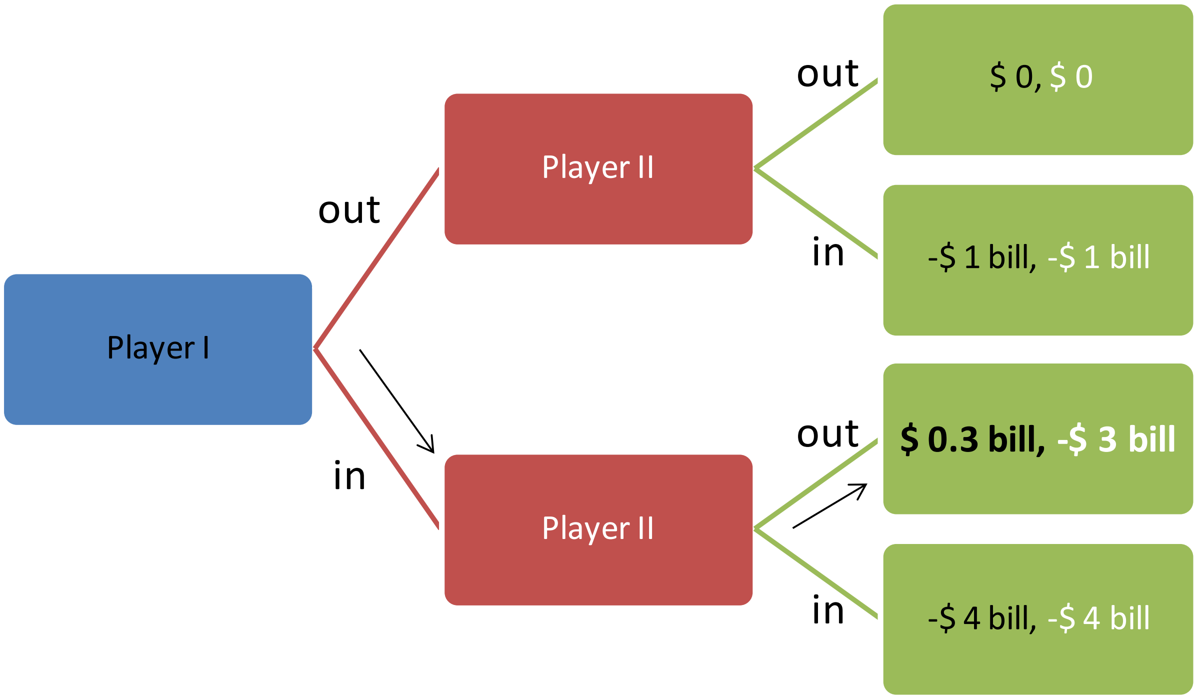
A strategic form game does not necessarily have Nash equilibriums where players deterministically choose their strategy. Many players may randomly select from these pure strategies one with certain probabilities. This randomizing of one's choice is called mixed strategies. An example of randomizing strategy is quality inspections, where random samples are inspected to ensure that the manufacturing meets quality standards. There payoff are different as inspections carried over those who already ensure quality standards is costly as opposed to the payoff of not complying, in which case we cannot reach an equilibrium. Thus randomizing inspections to create expectations of compliances is a mixed strategy which does not yield a fixed equilibrium.

In practice, mixed strategies are functions of the decision maker's attitudes towards risk. As discussed in the quality compliance and inspections example above, risk averse decision makers or players who have the capabilities to comply or default will comply to quality standards. However, their probabilities will be dependent not on their own payoffs but rather their opponents payoffs. Having said that, an increase in penalty would not have affects on the decision to comply or default but rather the frequency of the inspection, which would have dictate a different payoff. In this dynamic process, the long-term averages even in mixed strategies will eventually approximate equilibrium probabilities, although not Nash equilibrium.

2.10 EXTENSIVE GAMES – PERFECT INFORMATION

Strategic form of games lack temporal content as players choose their strategies simultaneously, without knowing what the choices of the opponent are. They lack detailed information and thus extensive form gaming is required; a model of such is the game tree. In this section we will discuss games in perfect information, all players at any given point are aware of the previous choices of all other players and player's moves are sequential (no simultaneous movements).

FIGURE 3: EXTENSIVE GAME - GAME TREE



Source: Authors adaptations

For example, two players are exploring new markets i.e. car manufacturing firms looking to invest in the potential super hybrid cars market as shown in Figure 3. Since this is a sequential game process we assume that Player II will only get the opportunity to move after Player I has made the decision and the information has been made available. Extensive games in this form with perfect information can then be analyzed by backward induction.

This technique involves identifying the last possible choice that players would make; in our example Player II moves last as they know the game will end with their move and thus can safely choose their strategy. In both cases Player II will choose not to invest in the market as their best payoffs in whatever decision Player I takes are $0 and -$3 billon.

Once the last moves from are understood, Player I would then use backward induction to make the next-to-last move accordingly. In this case based on the outcome that Player II will choose not to invest into the market, Player I's payoffs are $0 or $0.3 billion. Clearly the decision here is that Player I does invest, given that he is the first mover and that Player II cannot move simultaneously and that Player II does not invest in either scenarios.

2.11 EXTENSIVE GAMES – IMPERFECT INFORMATION

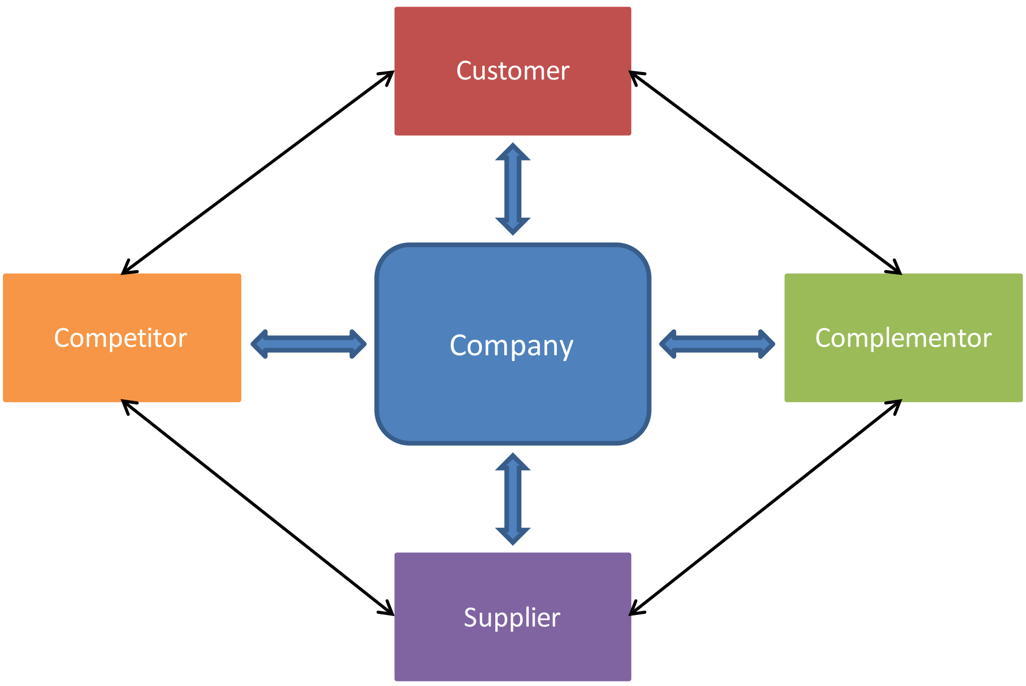
Typically perfect information does not exist and players do not have access to all the information relevant to their choices. In this case, modelling extensive games with imperfect information exactly identifies those imperfection information (Harsanyi, 1992). In this case probabilities are set to evaluate and identify weak and strong strategies and randomization is the best response.

Since there is no information as to what the last move would be, backward induction cannot be used to evaluate the decision on the next-to-last move and therefore decision makers would than evaluate probabilities against payoffs which would then be a determinant on the nature of the decision maker.

3 GAME THEORY TOOLS AND TECHNIQUES

There have been many attempts to produce strategic tools for business managers to use game theories. However, there has been little success as business problems are more complicated in reality. Business games are subject to many factors including decision maker's characteristics, difficult as to where the strategies are, who the players are and weather they are able to join the game or not. None the less there are ways of capturing these elements using the value net tool developed by Brandenburger & Nalebuff, 1995.

FIGURE 4: THE VALUE NET



Source: Brandenburger & Nalebuff, 1995

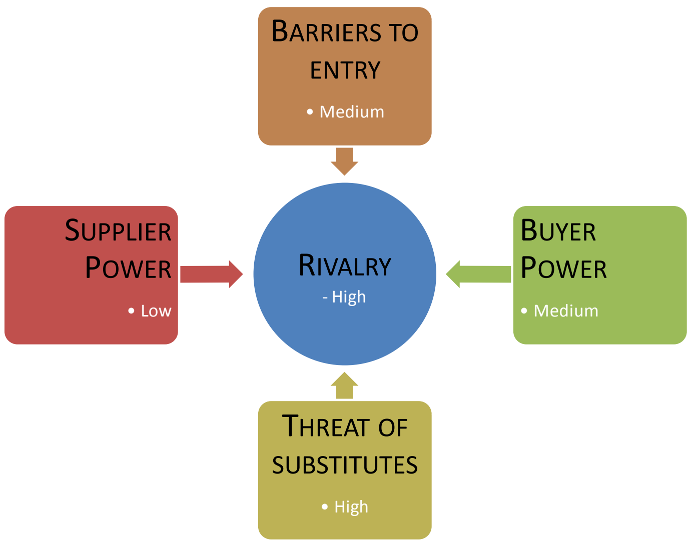
The value net framework as shown in Figure 4 is a good way to identify players in a game. The vertical axis represents the transactors and the horizontal axis identifies the interactors. By using the framework we can provide some structure to the game and identify the players and their relationships.

4 GAME THEORY AND SCENARIO BACKGROUND

Game theory can be used to gain an understanding of how players pursuing their own self-interest might respond to scenarios. As discussed in the project titled “Scenario Planning as a Tool for Long Term Strategic Planning - The Generics Drug Industry in the European Union” the authors created three unique scenarios. These three scenarios yielded different macro environments and strategies for EU generic drugs industry. The industry implications and the strategic recommendations have been extensively discussed in the report mentioned above. However a brief description of the scenarios and their implications are summarized below:

Scenario 1: Todo es bueno! This scenario describes an optimistic environment of the EU. The EU now has 32 members’ states and shows further positive expansion. The EU economy is growing and there is cooperation and harmonization amongst the member states. Euro is not the national currency which and there is business environment stability. Furthermore, political leadership has enforced stringent regulatory measures, and the EU is now open to international free markets promoting competition at a global scale. There is an ageing population as lifestyles have improved dramatically, however because of the high affluent societies and technological advancements there is less pressure on healthcare and insurances markets of healthcare now hold large market shares.

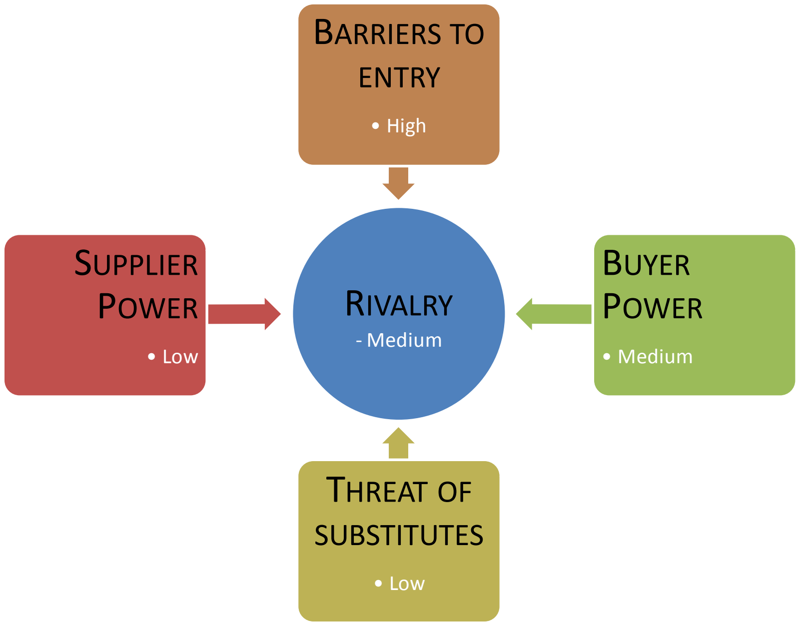
FIGURE 5: PORTER'S 5 FORCES EVALUATING SCENARIO 1



Source: Authors interpretations

Scenario 2: Nein, Nicht Gut! This scenario describes a pessimistic environment of the EU. The Euro zone has disintegrated and member states have reverted back to their old currencies. There is disparity amongst the EU member states and a protectionist stance has further fragmented policies, regulations and political stability. International competition poses a constant threat to national industries and low GDP, business confidence and volatile business cycles has impacted business confidence as organizations struggle to survive. Furthermore high unemployment, ageing populations and depression has pressured healthcare public spending.

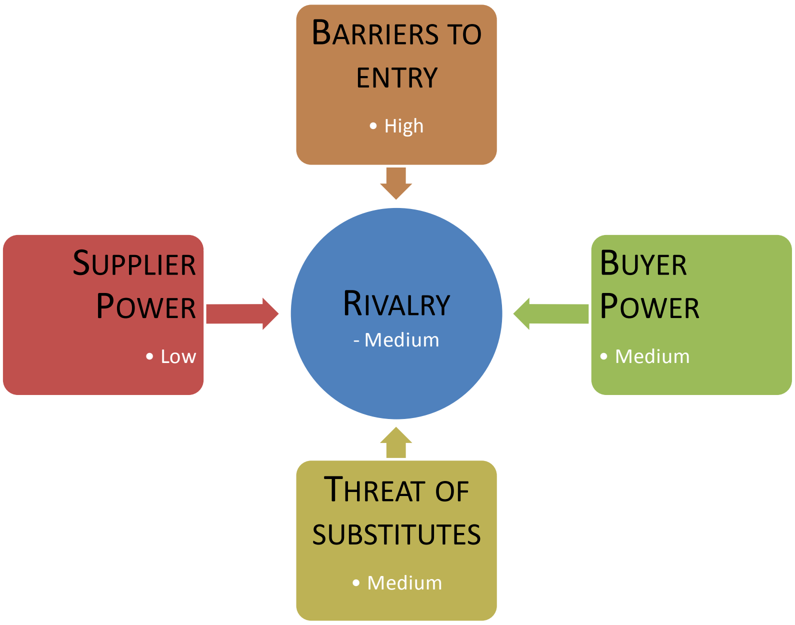
FIGURE 6: PORTER'S 5 FORCES EVALUATING SCENARIO 2



Source: Authors interpretations

Scenario 3: Deux Union Européene! This scenario represents two distinct EUs. The strong Euro zone that now comprises of only strong member states i.e. Germany, Italy, France, UK, etc. where there are strong economies and business stability and the periphery non-Euro zone where the economy is weaker and business instability. Euro zone now has a strong EURO that was factored from cooperation, harmonization and political stability from the member states. There have been dramatic technological improvements and business confidence is high due to a stable economic environment. The Euro zone members are now international free markets where market information, consumer protection and stringent regulatory frameworks ensure a quality lifestyle. Ageing population pressure is weak because of improved healthcare systems. However, the non-Euro zone member states have an opposite economic environment. These member states have united under a protectionist stance against international competition; they suffer from low GDP, and often have political instability. Due to the macro environmental instability, business cycles are volatile and thus leading to high unemployment and low morality with an ageing population and poor healthcare systems. Strong unions have formed that are further detrimental to the overall growth of the member states.

FIGURE 7: PORTER'S 5 FORCES EVALUATING SCENARIO 3



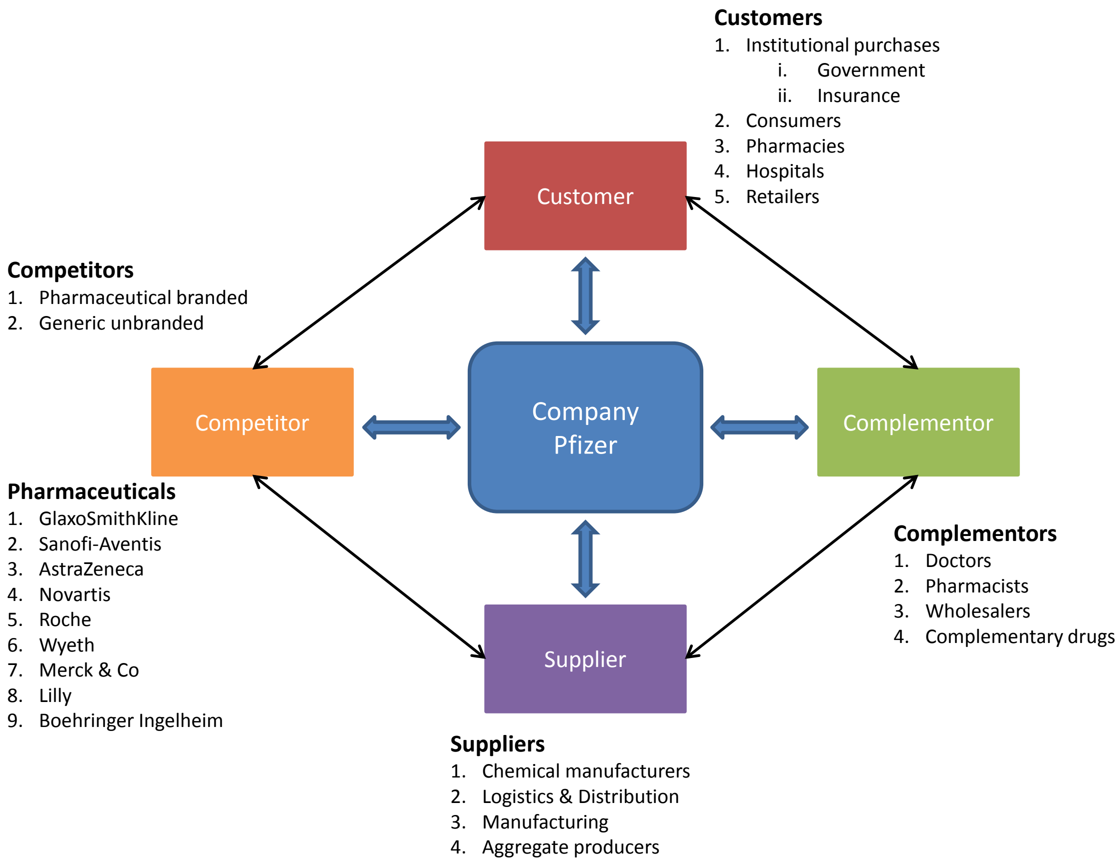
Source: Authors interpretations

4.1 EU GENERIC DRUGS MARKET – VALUE NET

In order to formulate a game the first step is to identify the strategies, the players and their willingness to join the game. This can be done by evaluating the value net for a sample organization. For exemplary purposes, Pfizer has been used to test the strategies recommended as part of the project titled "Scenario Planning as a Tool for Long Term Strategic Planning - The Generics Drug Industry in the European Union."

The value net framework as shown in Figure 5 is populated using the information provided under Appendix 1 – Stakeholders in the European Pharmaceutical market, and Appendix 2 – Pharmaceutical process flow mind map.

FIGURE 8: THE VALUE NET - GENERIC DRUGS INDUSTRY



Source: Authors interpretations

The value net framework (Figure 8) lists the players in each of the categories for Pfizer pharmaceuticals in the EU. For demonstration purposes the achievable payoffs are estimated to range between -5 to 10 respectively.

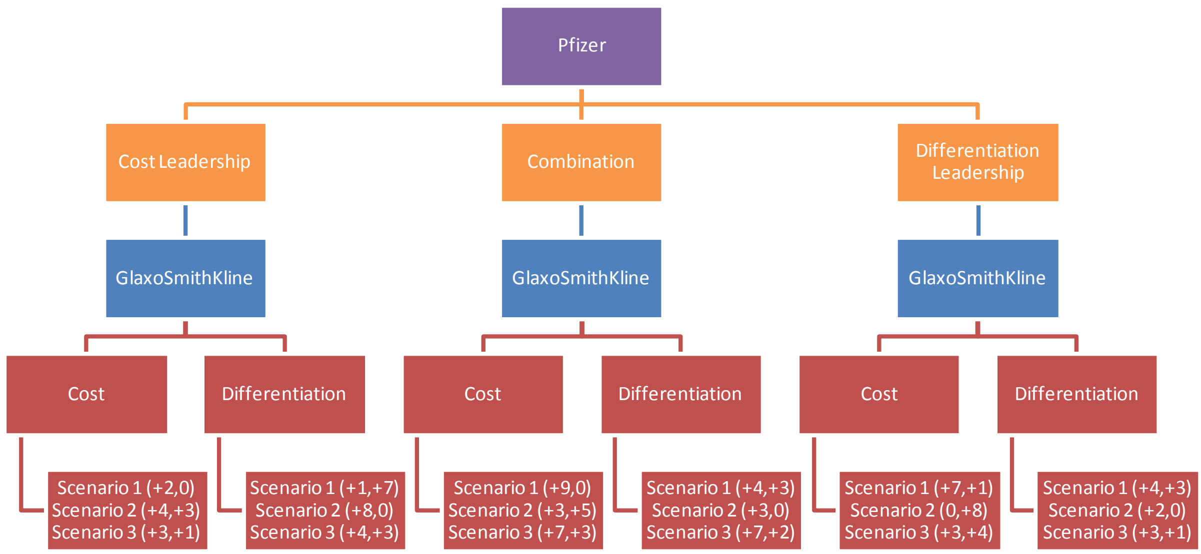
5 GAME FORMULATION

The project titled "Scenario Planning as a Tool for Long Term Strategic Planning - The Generics Drug Industry in the European Union" has listed seven strategies. Each strategy is unique and aims to maximize market share and competitive competency of the EU generic drugs players. Seven games have been formulated to evaluate the seven strategies against respective players and stakeholders identified by the value net framework as show in Figure 8.

Strategy 1: Revisit your generic strategies. The report identifies that players of the generic drugs industry in the EU are using cost containment strategies to compete on pricing for winning institutional purchases. The most dominant generic strategy is to achieve cost leadership and focus efforts on upstream activities as the industry suffers from high buyer power that are cost incentive. Although this is a justifiable strategy, the report argues that this is not a sustainable strategy in the long-run and advocates cost and differentiation leadership strategies should run parallel. The rationale justified to use parallel strategies is based on the hypothesis that costs focused strategies lack innovation, are susceptible to price wars, and often overlook quality. To balance these trade-offs differentiation strategies and activities will strengthen dynamic inefficiencies, endorse brand equity and customer/stakeholder value proposition and/or innovation would promote new product development and further create new markets.

To evaluate this strategy Figure 9 shows an extensive form game where the player evaluates polar strategies; cost leadership or differentiation leadership and the third parallel strategy combination against the competitors in the plausible scenarios described in previous sections.

FIGURE 9: GENERIC STRATEGY GAME



Source: Authors interpretations

The game tree as shown in Figure 9 is a sequential game and hypothesizes that GlaxoSmithKline will not use combination strategies but polar strategies, and there is perfect information. These assumptions have been purposely made due to the complex relationship between the scenarios, the players, and various external factors. Based on this assumption using backward induction technique is used to evaluate the Subgame Perfect Equilibrium. Each player is assumed to move optimally at each node and is expected to act in their best interest. The payoffs calculated for GlaxoSmithKline are represented in Table 1 below:

TABLE 1: STRATEGY 1 PAYOFF'S GLAXOSMITHKLINE

Pfizer	GlaxoSmithKline	
Strategy	Cost	Differentiation
Cost Leadership	4	10
Combination	8	5
Differentiation Leadership	13	4
Total	25	19

Source: Authors interpretations

Based on the results calculated in Table 1, the best strategy for GlaxoSmithKline is Cost containment strategies which has an overall payoff of 25. Using backward induction, we then eliminate differentiation strategy as the option dominant by GlaxoSmithKline and identify the best strategy Pfizer should choose. Thus payoffs calculated for Pfizer are represented in Table 2 below:

TABLE 2: STRATEGY 1 PAYOFF'S PFIZER

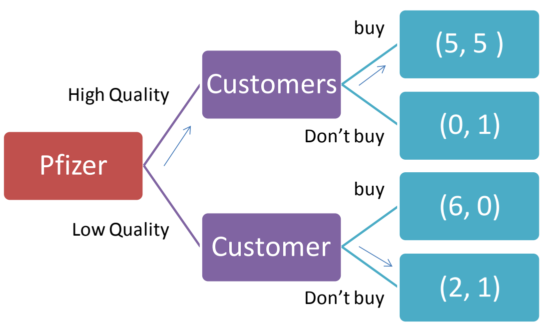
Strategy	Payoff
Cost Leadership	9
Combination	19
Differentiation Leadership	10

Source: Authors interpretations

Based on the results calculated in Table 2, the best strategy for Pfizer is the combination strategy which has the highest payoff of 19. This strategy not only secures the largest payoff but also hedges against the scenarios.

Strategy 2: The key ingredient. This strategy is based over the growing threat of counterfeit drugs identified explicitly in the scenarios. The strategies and recommendations identified to EU generic drug manufacturers are to improve quality standards and strengthen marketing activities to improve their brand equity and value proposition. Additionally various value added recommendations are also identified. However, the key element here is quality and Figure 10 represents the quality choices using the extensive form game.

FIGURE 10: QUALITY CHOICE GAME

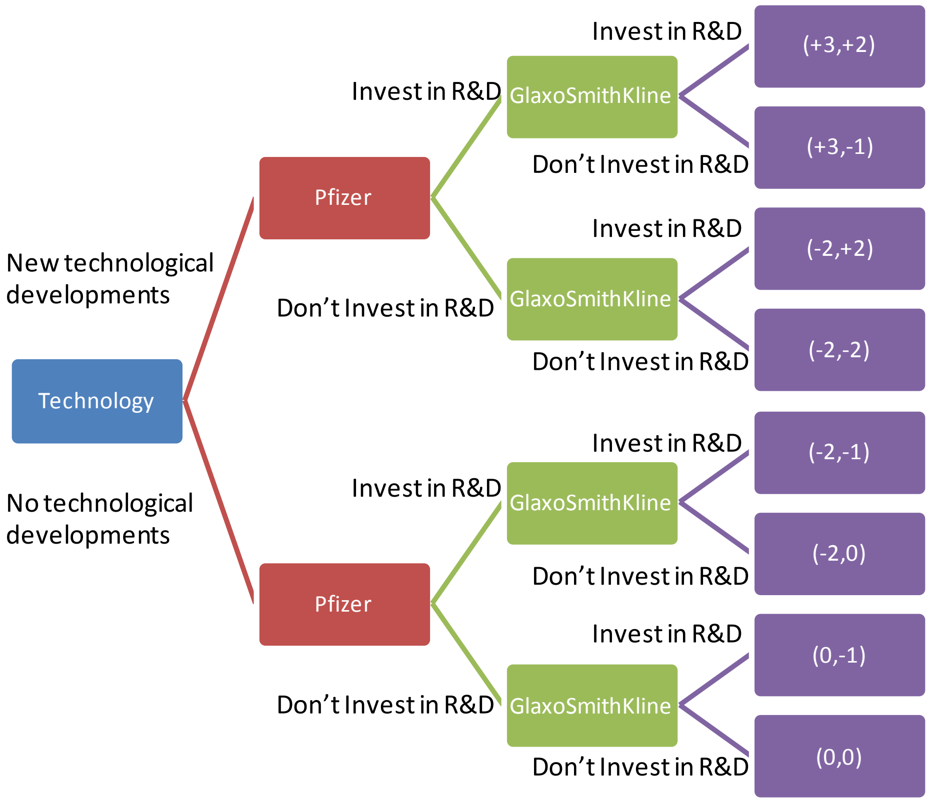


Source: Authors interpretations

In this game we have identified Customers i.e. government purchasers, insurances, etc. preferences to quality in light of the growing counterfeit concerns and generic drugs producers payoffs respectively. Similarly to the previous game, using backward induction, the decision between high quality and low quality is effectively between the outcome payoffs (5, 5) of (2, 1) as these are the customers last most preferred moves. Clearly, Pfizer in this case would choose high quality as it presents a higher payoff thus justifying the strategic recommendation.

Strategy 3: Don't be penny wise with research. This strategy suggests players to invest in research and development to identify possible risks and/or create new markets i.e. new product development. Figure 11 show the extensive form game of players investing in research and development against those who are not investing and their payoffs.

FIGURE 11: R&D INVESTMENTS GAME

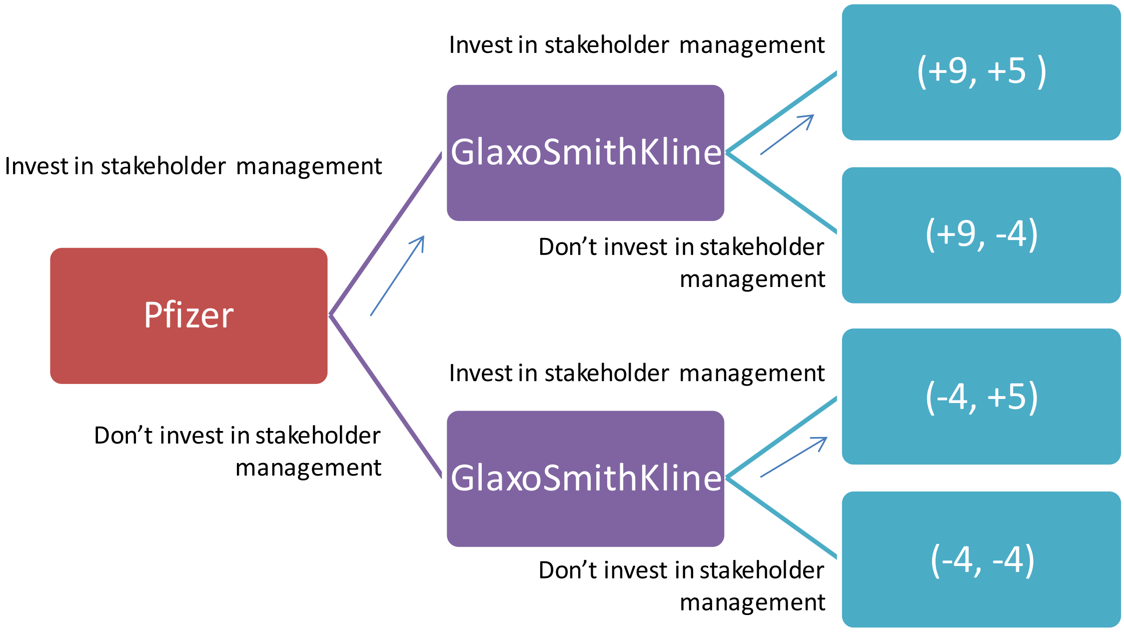


Source: Authors interpretations

This extensive form game is deterministic to technological development i.e. biotechnological breakthroughs, etc. and thus the payoffs calculated are subjective to these technological developments. Using backward induction GlaxoSmithKline's desirable payoffs in the scenario where there are new technological breakthroughs the desired payoffs are (+3, +2) and (-2, +2) which reinforces the investing in R&D decision. However in the event of no new technological breakthroughs the desired payoffs are (-2, 0) and (0, 0) and this argues against investing in R&D. In this case we thus compare the aggregate payoffs which yields positive the payoff off +1 for investing in wither scenarios and -1 for not investing in either scenarios. Thus Pfizer's next-to-last move is investing in R&D irrespective of the scenarios. Additionally this move is a sequential move and thus there is a first mover's advantage of +3 as opposed to GlaxoSmithKline's payoff of +2

Strategy 4: Stakeholder Management. This strategy recommends EU generic drugs players to invest in stakeholder management. The rationale behind this recommendation is the growing influence of stakeholders over the generic drugs industry in the scenarios identified. Here the extensive form game is intended to identify the long-term (20 years) payoffs of players investing early in stakeholder management. Figure 12 represents the extensive form game of players investing in stakeholder management.

FIGURE 12: STAKEHOLDER MANAGEMENT GAME

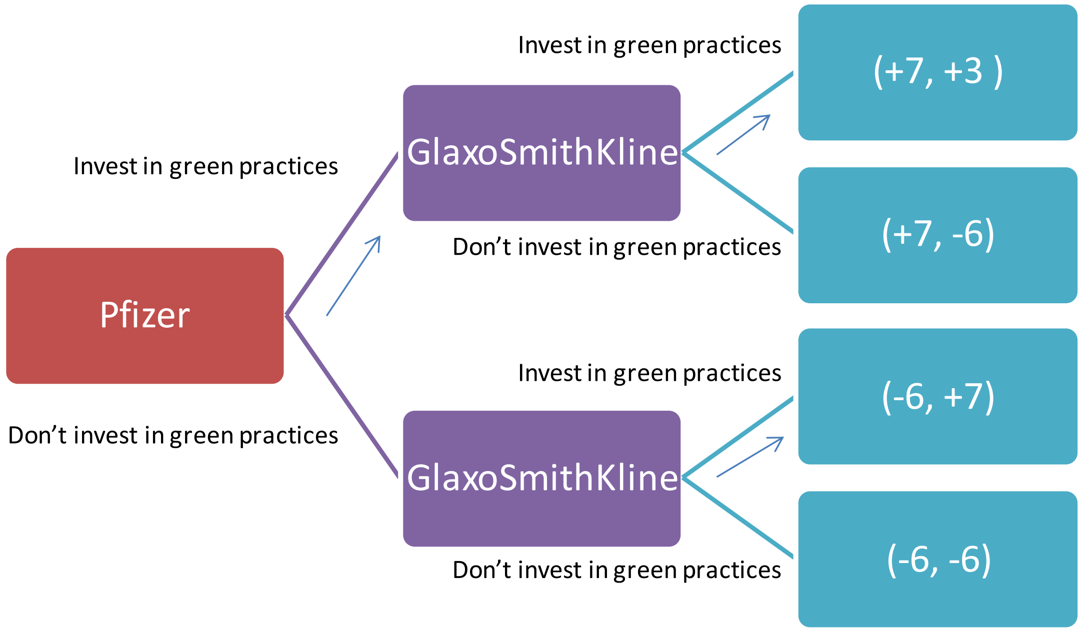


Source: Authors interpretations

Using backward induction the best payoffs for GlaxoSmithKline are (+9, +5) and (-4, +5) that dictated the dominant strategy is to invest in stakeholder management. Thus the best next-to-last strategy for Pfizer is to invest in stakeholder management also, however since this is a sequential game there is a first movers distinctive advantage where Pfizer has a higher positive payoff of +9 as compared to GlaxoSmithKline's +5.

Strategy 5: Invest in Green. This strategy recommends the EU generic drugs industry players to invest in green practices. The rationale behind this recommendation is based on the global concerns over sustainable practices and the predicted carbon monitoring regulations. Figure 13 represents an extensive form game of players investing in green practices and their respective payoffs.

FIGURE 13: GREEN PRACTICES GAME

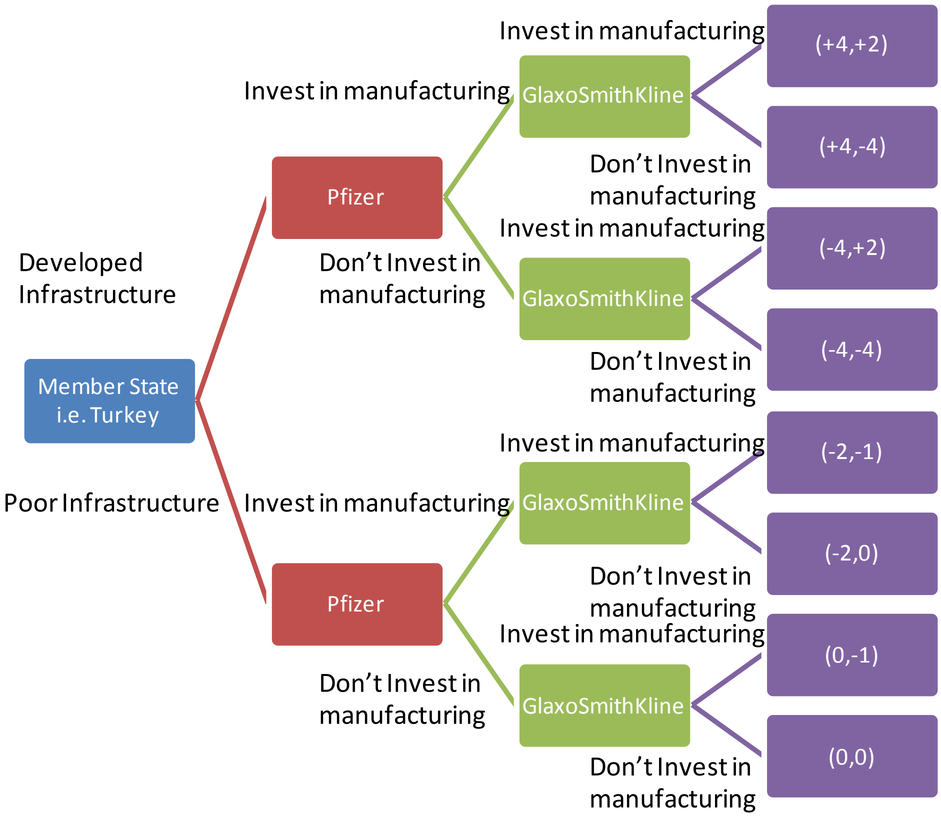


Source: Authors interpretations

Using backward induction the best payoffs for GlaxoSmithKline are (+7, +3) and (-6, +7) that dictated the dominant strategy is to invest in green practices. Thus the best next-to-last strategy for Pfizer is to invest in green practices also, however since this is a sequential game there is a first movers distinctive advantage where Pfizer has a higher positive payoff of +7 as compared to GlaxoSmithKline's +3.

Strategy 6: Strategic Location: This strategy suggests EU generic drugs players to investigate the possibility of sourcing manufacturing from EU countries. The rationale behind this recommendation is the distinctive proximity advantages players can gain by manufacturing in these member states. Figure 14 represents the extensive form game for players investing in sourcing in EU member states.

FIGURE 14: STRATEGIC LOCATION GAME

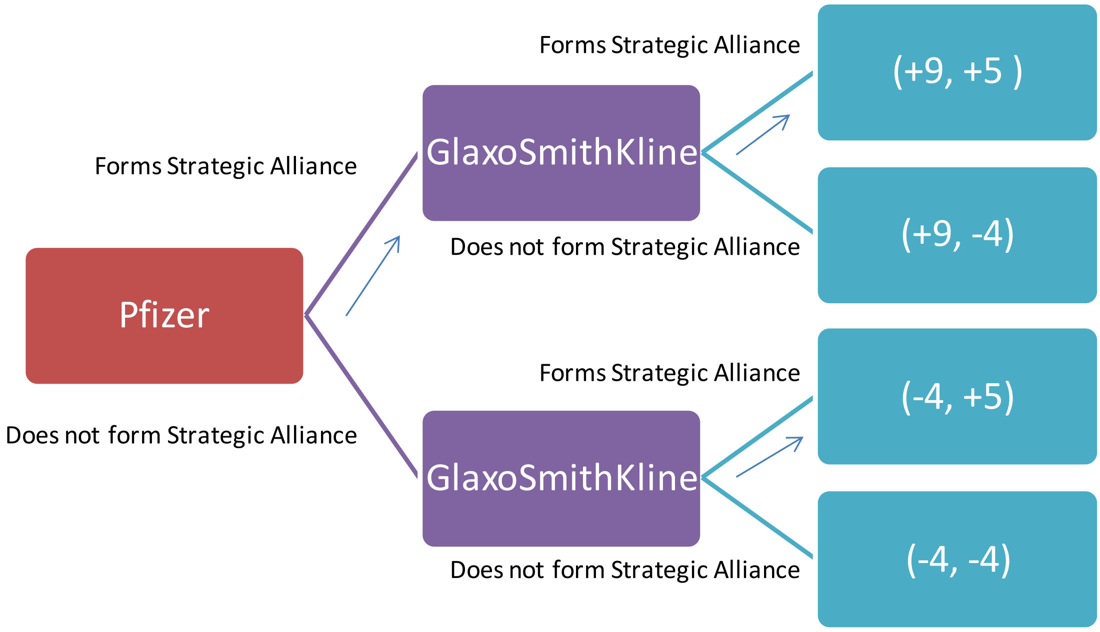


Source: Authors interpretations

This extensive form game is deterministic to the member states infrastructure i.e. logistics, etc. and thus the payoffs calculated are subjective to these technological developments. Using backward induction GlaxoSmithKline's desirable payoffs in the scenario where there are new technological breakthroughs the desired payoffs are (+4, +2) and (-4, +2) which reinforces the investing in member states decision. However in the event of no new technological breakthroughs the desired payoffs are (-2, 0) and (0, 0) and this argues against investing in member states. In this case we thus compare the aggregate payoffs which yields positive the payoff off +1 for investing in wither scenarios and -1 for not investing in either scenarios. Thus Pfizer's next-to-last move is investing in member state irrespective of the scenarios. Additionally this move is a sequential move and thus there is a first mover's advantage of +4 as opposed to GlaxoSmithKline's payoff of +2

Strategy 7: Face the enemy. This strategy recommends players to form strategic alliances either by mergers & acquisitions of joint ventures with strong foreign competitors to reduce the industry rivalry and promote organizational learning in achieving economies of scale and dynamic efficiencies. Figure 15 represents the extensive form game for players forming strategic alliances with foreign competitors.

FIGURE 15: SRATEGIC ALLIANCE GAME



Source: Authors interpretations

Using backward induction the best payoffs for GlaxoSmithKline are (+9, +5) and (-4, +5) that dictated the dominant strategy is to form strategic alliances. Thus the best next-to-last strategy for Pfizer is to form strategic alliances also, however since this is a sequential game there is a first movers distinctive advantage where Pfizer has a higher positive payoff of +9 as compared to GlaxoSmithKline's +5.

6 CONCLUSION

Game theory is a unified disciplined language for a range of strategic decision making problems. The unified language allows strategic decision makers with a range of modelling options when faced with facts of a particular industry, i.e. repeated games, mixed games, informed and non informed games, etc. By using the tools and techniques of game theory perspectives the report has evaluated the strategic recommendation advocated by the report titled, "Scenario Planning as a Tool for Long Term Strategic Planning - The Generics Drug Industry in the European Union" and further reinforced the strategies and recommendation. The evaluation yielded higher payoffs for first movers and therefore recommends EU generic drugs players to test their internal strategies against the scenarios and further evaluate the strategic recommendation using other economic perspectives i.e. transaction costs perspectives, agency cost perspectives and resource based view.

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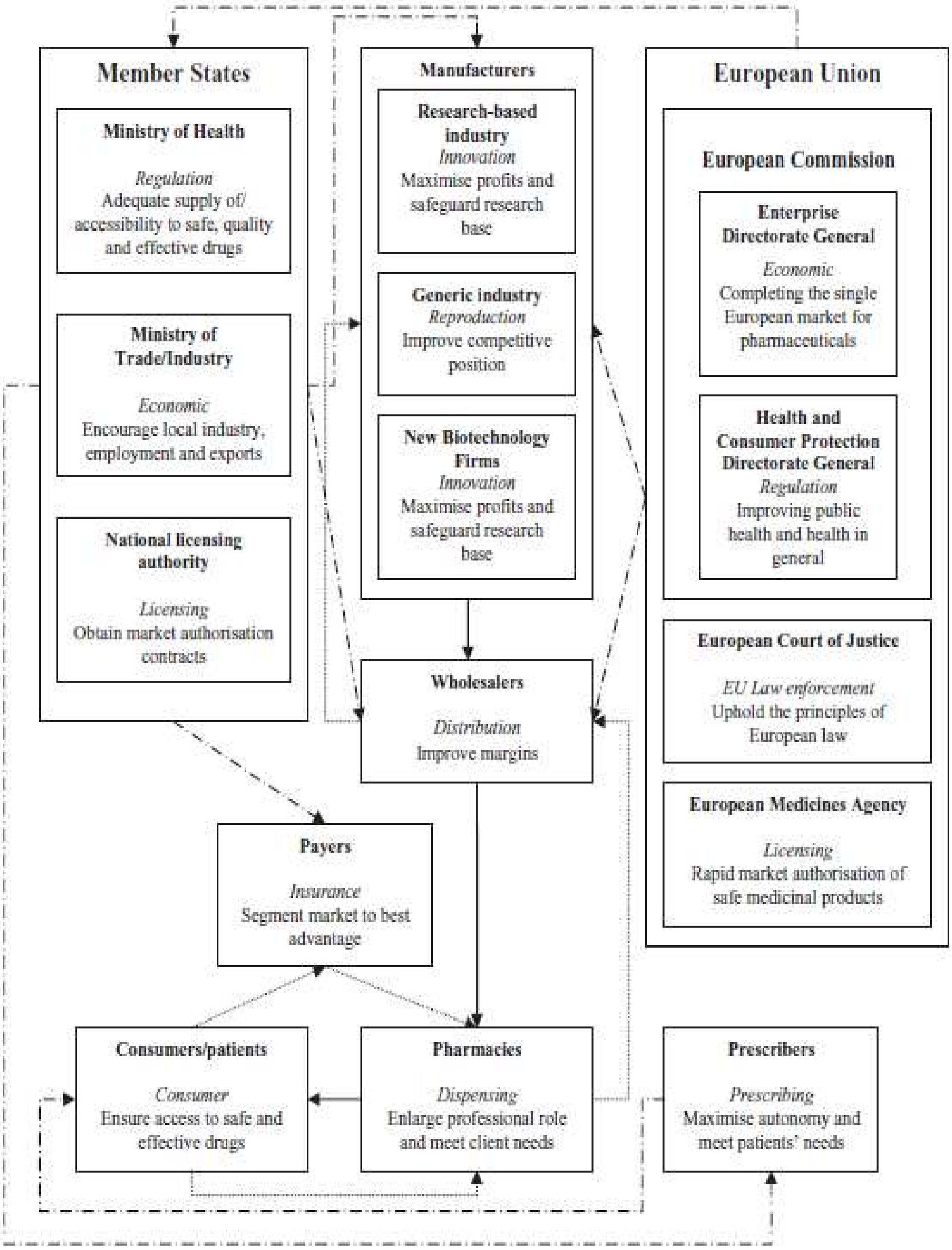
APPENDIX 1

There are several direct/indirect stakeholders involved in the pharmaceutical industry and Figure 1 (below) is a diagrammatic representation of the stakeholders and their interactions. It is important to understand these interactions in order to populate the value net framework.

FIGURE 1: STAKEHOLDERS IN THE EUROPEAN PHARMACEUTICAL MARKET

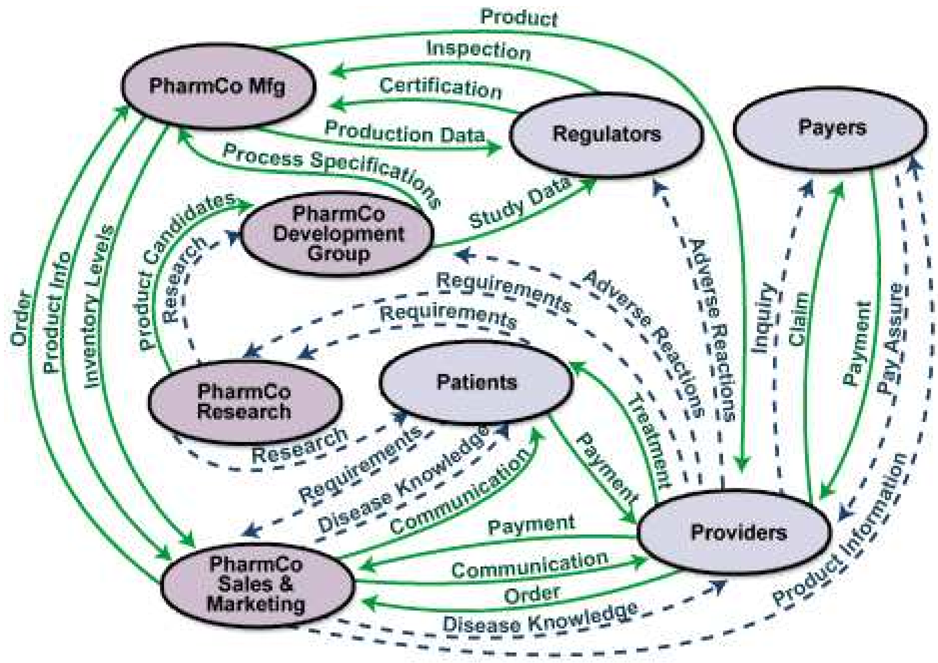


Source: Ginneken & Busse (2010).

APPENDIX 2

Figure 1 below shows the pharmaceutical industry stakeholder mind map that represents the relationships between the various stakeholders and their interactions.

FIGURE 1: PHARMACEUTICAL INDUSTRY STAKEHOLDER AND INTERACTIONS MIND MAP.



Source: Allee (2010).