

Arab American University

Faculty of Graduate Studies

The Role of Game Theory in Decision Making Process: Palestinian Oligopoly Companies as a Case study By: Oyoon Mohammad Khateeb

Supervisor:

DR. Hisham Jabr

This thesis was submitted in partial fulfillment of the requirements for the Master`s degree in

Strategic Planning & Fundraising

February / 2019

© Arab American University –2019 All rights reserved

The Role of Game Theory in Decision Making Process: Palestinian Oligopoly

Companies as a Case Study

By

Oyoon Mohammad Khateeb

This thesis defended successfully on February 27, 2019 and approved by

Committee members

- 1- Supervisor Name: Dr. Hisham Jabr
- 2- Internal examiner: Dr. Suliman Abbadi
- 3- External examiner: Dr. Omer Abed Al Razeq

Signature Lale'

Declaration

I declare that the content of this thesis is my own research work, unless otherwise referenced. I certify that this thesis does not contain any material published before by another person or has been submitted elsewhere for any degree or qualification.

Name: Oyoon Mohammad Khateeb Signature: ____

Arab American University, Jenin- Palestine

Dedication

To my beloved and supportive husband

To all those who contributed to the success of this scientific research

To all interested in the development and change in the institutions of Palestinian society

To all those who are seeking to discover all new and useful in the field of scientific research in order to improve the standard of human life

I dedicate this research.....

Acknowledgment

I would like to express my gratitude to my supervisor Dr. Hisham Jabr for the useful comments, remarks and engagement through the learning process of this master thesis.

Abstract

This study aims to highlight the importance of using game theory as a mathematical tool in decision making in the Palestinian oligopolistic market - the telecommunications sector, as it gives more accurate results than the other decision making mechanisms used, and this necessarily reflects positively on the profits and revenues and the share price of the company, In addition to reducing the risk that the company may suffer as a result of making a wrong decision or not based on a sound basis.

This study, based on numerical data from the consolidated financial statements and the published annual reports of Jawwal and Ooredoo Palestine, demonstrates the ability of the game theory to use these numbers and to put them in a framework of a state of nature and the possibility of these cases in exploring a sound strategic decision that reduces profit and risk.

The study answered a set of questions about the Palestinian telecommunication oligopoly market, as well as questions related to the game theory, such as its definition, its derivatives, its development and its divisions, and what is Nash equilibrium, which is the main axis of the game theory.

The study used Gambit Software and DPL as accurate tools in the analysis of the game theory and the decision tree. The data obtained from those two software were obtained through the published financial statements for two consecutive years for Jawwal and Ooredoo Palestine. Four case studies common between the two companies were analyzed: the mechanisms of call pricing, investment, increase the rate of return on sales, and a case related to the Palestinian consumer in determining any offers made by the two companies achieves his utility, in this latter talk about the estimation of the total utility and marginal utility and their association with the future offers by both companies.

Finally, recommendations were made to the decision makers in each of the two competing companies for the purpose of using this precise tool, and applying it in all areas that need to make a strategic decision aiming to achieve the permanent progress and development of the Palestinian telecommunications sector ,and achieve fair competition while preserving the rights of the Palestinian consumer and providing communication services to him.

Key Words:

game theory, Palestinian telecommunication oligopolistic market, telecommunications sector, Jawwal and Ooredoo Palestine.

Table of Contents

DeclarationII
Arab American University, Jenin- PalestineII
Dedication
Acknowledgment IV
AbstractV
List of tables IX
Table & FigureX
Chapter one1
1.1. Introduction1
1.2 Research problem:
1.3 Research questions:
1.4. Study objectives:
1.6 The significance of the study:2
1.6.1 Scientific importance:
1.6.2 Practical importance:
Chapter Two4
Literature Review
2.1 Introduction
2.2 Definitions of game theory4
2.3 Elements of game theory6
2.4 Hypotheses of game theory:7
2.5 Classification of game theory:9
2.5.1Categories of games
2.6 Nash equilibrium point:16
2.7 Oligopoly market

2.8 Collusion:	19
2.8.1 Explicit or overt collusion	
2.9 The problem of oligopoly in Palestine	24
Chapter Three	
Research Methodology	
3.1 Research Questions:	
3.2 The research hypothesis	
3.3 Data collection methods:	31
3.4 Data sources	
3.5 Obstacles:	
3.6 The research plan / Timetable:	
3.7 Research Model	
3.8 Research Strategy	
3.9 Population of Study	34
3.10 Data Analysis	34
Chapter Four	35
Findings	35
4.1 Introduction:	35
4.2 Players:	
4.2.1 Jawwal company:	
4.2.2 Ooredoo Palestine:	
3.4 The Game	
4.4 Case one: investment trends:	40
4.5 Case Tow: Revenues from sales	44
4.6 Case Three: Breaking down Advertising Budget	49
4.7 Case Four: Utility analysis:	53

4.8 Financial analyses:		
Chapter Five	60	
Summary and Recommendations	60	
5.1. Conclusion	60	
5.2 .Recommendations	63	
5.3. Future studies	65	
References	68	
Annex	77	
ملخص بالعربية		

List of tables

Table 1 (Jawwal) Payoff table analysis, Design by the researcher	42
Table 2 (Oredoo) Payoff table analysis, Design by the Researcher	43
Table 3 Revenues from sales (Jawwal) payoff table analysis, Design by the researcher	45
Table 4 Revenues from sales Table analysis: (Oredoo) payoff Design by the researcher	45
Table 5 Calls minutes by J & O:, Design by the researcher	47
Table 6 Prices resulting from the 4 different scenarios: Design by the researcher	47
Table 7 (O&J) Dominant strategy" using Gambit	48
Table 8 Jawwal offers Local call prices: Hala programs	54
Table 9 Jawwal offers Local call prices 2: Hala programs:	54
Table 10 Jawwal offers Local call prices 3: Hala programs:	55
Table 11 Ooredoo offers Local call prices Design by the researcher	56
Table 12estimated probabilities for duration of the use of calls by managers Design by the	
researcher	56
Table 13Total and Marginal utility Design by the researcher	57

List of Figure

Figure 1The Rock, Paper, Scissors Game (Kreps, 1990)	8
Figure2 Extensive form of games (Kreps, 1990)	9
Figure 3	42
Figure 4 (Oredoo) Solution by DPL	43
Figure 5 Revenues from sales :(Jawwal) Design by the researcher	45
Figure 6 Revenues from sales: (Oredoo):Design by the researcher	46
Figure 7 Breaking down Advertising Budget(J&O) Solution by Gambit	50
Figure 8 Solution by Gambit Design by the researcher	52
Figure 9Breaking down Markiting (J&O) Solution by Gambit	53
Figure 10 Utility Analysis Design by the researcher	56

Chapter one

1.1. Introduction

Game theory is a mathematical analysis tool of conflict of interest cases to determine the best possible options to make decisions under the given circumstances which may lead to the desired result.

This theory claims that there is a group of players, who may be two or more parties, a game in which there is a set of rules followed by all the parties in order to win.

There are different types of games, and this is due to the method used to classify them, between zeros and nonzero, which is the most famous, and also the cooperative and noncooperative, as time passes on new types of games as a result of the increase the interest of researchers have been shown to the extent that some of them won the Nobel Prize.

Oligopoly market is a form of market structure where a small number of producers control a certain commodity; they divide the market among themselves. Competition between the few usually goes away from prices, does not try any product to reduce the price for fear that others will follow, and therefore lose the opportunity to benefit from the reduction. The oligopolistic market usually has a kind of agreement among producers to follow a single policy, and it may even be the allocation of a production among them.

The presence of a few producers in the oligopolistic market and competition among them leads to the emergence of a new factor, the interconnection between producers and the commodity. This factor requires study of the action and reaction of the behavior of producers within the context of oligopoly. Therefore, each producer must assess and evaluate the impact of his decision on other producers and assess the likelihood of their reaction. Based on this assessment, the project makes its decision

Based on all the above, it is necessary to adopt a more effective mechanism in decisionmaking in oligopoly companies in the Palestinian market. This mechanism is to reach a win-win situation for both parties, which is reflected positively on the Palestinian citizen and on the Palestinian economy as a whole, and this mechanism without a doubt is the "Game theory

1.2 Research problem:

Many economists state that in the Palestinian community it is difficult to analyze the behavior of an establishment in the case of oligopoly. Among them, the analysis of the balance of enterprises in the case of full competition, monopoly or monopolistic competition is generally acceptable. How to determine prices and production of oligopolistic Palestinian enterprises is still not agreed upon. This is due to the situation of enterprises in the case of oligopoly. Some enterprises in the telecommunication industry are so large that their production and pricing decisions affect other enterprises. Therefore, an entity operating under oligopolistic conditions takes into account the reaction of other enterprises to its actions and monitors the actions of other enterprises to adjust their production or price policies in the light of their actions.

Thus, the research problem can be stated as:

Does the game theory model describe the decision making process oligopolistic Palestinian companies?

1.3 Research questions:

- ➤What is the importance of game theory in decision making in Palestinian oligopolistic companies?
- >What are the effects of applying game theory to the continuity and success of Palestinian oligopoly companies?

1.4. Study objectives:

The objectives of the study are

- To explain the importance of adopting the Game theory in the decision-making process at oligopolistic telecommunication Palestinian companies.
- To contribute at Inclusion of the game theory as a mechanism of analysis in the policies and Procedures of oligopolistic telecommunication Palestinian companies.

1.5 The significance of the study:

A game is being played whenever human beings interact, but it only works when people play games rationally, so it can't predict irrational behavior, however, people don't always behave rationally, and so the decision makers in the Palestinian telecommunication oligopoly companies.

1.5.1 Scientific importance:

This study is important because of the following:

- 1. It is the first study in Palestine, which examined in depth the Game Theory and the mechanism of linking it to the Palestinian economy in terms of its use as a tool for analysis and decision-making.
- 2. Palestinian telecommunication oligopolistic companies will benefit from the results and recommendations of the study, by raising awareness of game theory as an effective tool in decision-making process, which produces numerical results for future policy and strategy development.
- 3. Colleges of business administration also will benefit from the study, because it will serve as a reference for them in learning a new tool in strategic planning and management.

1.5.2 Practical importance:

From the analysis of the behavior of the Palestinian telecommunication oligopoly market, the basic assumption is that there is no prior agreement between the enterprises operating in this market. If there is an agreement between the various establishments in the industry to assemble in a single organized manner that sets an acceptable price for all, and the distribution of acceptable production quotas for all enterprises, this situation is described as a cartel, where there is no room for competition between the different establishments. In the event that it is unable to assemble in a cartel due to lack of agreement, or due to legal restrictions, entities operating under oligopoly may agree with each other (directly or indirectly) that price leadership is given, so it determines the appropriate price for it and others, their approach is determined in light of the price given to them by the lead entity.

The applying of Game Theory is playing a very important role to explain the nature of the behavior of the oligopoly facility as each facility attempts to analyze the options available to other entities, and the options available to them to respond to the policies of another enterprise.

Chapter Two

Literature Review

2.1 Introduction

"Game theory is a branch of mathematics that is concerned with the actions of individuals who are conscious that their actions affect each other; it is a mathematical analysis of conflict of interest cases. It clarifies decisions under the circumstances given to obtain the desired result."

Game theory is a powerful tool for analyzing situations in which the decisions of multiple agents affect each agent's payoff. (Turocy&Stengel, 2001, p 4-5).

In 1921 mathematician Emil Borel developed a methodical form of the game and then put it into its theoretical framework, which was furthered by the mathematician John von Neumann in 1928 in a "theory of parlor games."

John von Neumann and Oskar Morgenstern are formally credited as the fathers of modern game theory. In their book "Theory of Games and Economic Behavior" published in1944; they explained the basic concepts of game theory, its branches, classifications, types, and applications. (Shi, 2011, p19-20).

John Nash (1950) when the central concept of non-cooperative game theory has been a focal point of analysis since then demonstrated that "finite games at which all players choose actions which are best for them given their opponents' choices have always had an equilibrium point" From that date game theory was broadened theoretically and applied to problems of war and politics. (Christiansen&Basligan, 2014, P216).

In 1994, Nash, John Harsanyi, and ReinhardSelten awarded of the Nobel prize in economics because of their high-profile application of game theory has been the design of auctions. (Nobel prize, 1994).

2.2 Definitions of game theory

"Game theory is a mathematical tool to study situations, called games, involving two or more players with different values and goals, involved in conflict and/or cooperation. It is the study of how players should rationally play games, the concept of game theory provides a tool to formulate structure, analyze, and understand strategic scenarios." (Straffin, 1996, p 244).

By reviewing the literature, the researcher reached that the game theory could be applied in any situation where there are several agents interdependent.

Game theory addresses the requirements of the formulation of strategic choices which enhances the need for these choices to be more efficient. The strength of game theory comes from that it is a mathematical tool provides the framework of structuring and analyzing problems of strategic choice process of modeling a situation as a game which requires the decision maker to calculate explicitly the players and their strategic options, and considering their preferences and reactions. (Turocy& Stengel, 2001, p 4-7).

The researcher believes that game theory determines the optimal choice of strategy for the rational players who are competing in order to optimize their outcomes and get high level of satisfaction; it uses mathematical modeling to study situations involving both conflict and cooperation, in which the strategic choices of one player affect all other players choices.

Game theory in the normal form consists of: players simply those people, organizations, or countries that are involved in varying degrees of conflict and cooperation (indexed by i = 1,2,...,n), a set of strategies available to each player (denoted by xi, i = 1, 2,...,n) since the players have two or more strategies to apply to given situations before they start, and finally payoffs (π i (x1,x2,...,xn), i = 1, 2,...,n) received by each player. Each player's choice of one strategy over all others results in an outcome, which is nothing more than the consequences of that choice. Each strategy space . Each player may have one dimensional strategy or multi-dimensional strategy. In simultaneous move games each player's set of feasible strategies is independent from the strategies chosen by the other player. The normal form can also be described as a static game, in contrast to the extensive form which is a dynamic game. If the strategy has no randomly determined choices, it is called a pure strategy; otherwise it is called a mixed strategy. (Varian, 1980, PP 651-659)

It was noted by the researcher, since a game with only one player is usually called a decision problem; the object of study in game theory is the game itself, because it's a

formal model of an interactive situation involves several players, their preferences, their information, the strategic actions available to them, and how these influence the outcome.

According to the literature review, the researcher reached out that game theory has two branches: cooperative game and non - cooperative game, which differ in their assumptions. The mutual assumption between them is that the players are rational who always choose an action which gives the most preferable outcome, with an expectation of what the opponents will do. The goal of game theory analysis is to predict how the game will be played by rational players.

"The most famous example about game theory is the prisoner's dilemma; it is the story of two criminals arresting while committing a crime, whose authorities investigated separately, and know that if neither of them talks, the case against them will be weak and the authorities will punish them for one year in prison. If both confess, each will get ten years in prison. If only one confesses and testifies against the other, the uncooperative prisoner will receive fifty years, while the cooperative prisoner will get parole." (Binmore, 2007).

According to David Kreps, the goal of strategic game is to help economists by explaining everything that results from different economic situations. There are important areas in which the game theory has been used; some of them are: Investment decisions, Promotion policies, Pricing, policies, Product development, Entering new markets, Salaries and wages policy, Sports Games, and Political decisions. (Ibrahem&Baqayyat, 1999, P.279).

The game theory aims to identify the optimal strategy for each player, so that it is considered important because it provides a logical amount method to choose the optimal strategy, describe and interpret conflict phenomena such as negotiation, partnership formation, or integration, and also it analyses the decisions in cases of competition.(Najjar, 2009, P 273-280)

2.3 Elements of game theory

A strategy game is a group of people (N) who share a set of rules so that each person tries to achieve his goals according to these rules.

The elements of this game are as follows:(Munier, 2008, P:1-2)

- The game: is a set of rules that determines what the player can do according to the available information.
- Players: An independent decision making unit does not necessarily have to be an individual, but may be a group working in an organization, team or state.
- Rules of the game: Each game rule predetermined and knowledge of a profit or a specific income where these rules determine the activities of the initial movements of the game.
- Payoff: The net result for each player, so that they not only depend on the strategy of the player, but on the strategy chosen from the other party, the payoff can be either cash or non-cash and reflects on the strategic value of the game.
- Payment Matrix: A set of possible strategies of each player's returns according to different decisions.
- Strategies: Strategy is the pre plan chosen by the player in his movement and his decision, there are two types of strategies in the game theory:
 - 1- Absolute or pure strategy: The strategy in which that the player takes the same method of play throughout the game.
 - 2- Mixed strategy: The player distributes his attention to a variety of strategies at different rates throughout the game time, namely, the probability distribution of each of the absolute strategies.

2.4 Hypotheses of game theory:

Game theory supposes the presence of many players in a competitive manner, so they have many formulas depending on the number of players and the results of the game. The most important of these assumptions depends on: (Apt, 2011)

- > The number of players cannot be less than two.
- > The return of all available alternatives to selected player strategies is known.
- The player's profit or loss depends on the choice of strategy, taking into account the strategy of the other party.
- Each player acts consciously and rationally.

Ways of representing game theory:

Game theory could be presented in two ways: The first and more simple is the so-called natural or strategic form, the second is extensive form games (tree shape)

• Strategic or natural Form Games:

This sort of model is comprised of three things:

(1) List of players.

(2)A list of strategies for each player.

(3) A list of payoffs that the players receive.

The researcher found that the popular game played by children called "rock, paper, and scissors" is a good example for strategic or natural form of games; in which the two players simultaneously choose one of three options under the following assumptions:

- There are two players, and each has available three strategies, the set of strategy profiles forms a 3×3 table.
- ➤ If the payoff to a child for winning is1, the payoff for losing is -1, and the payoff for a draw is 0.
- Child A's strategies will be represented as rows in the table, and child B's strategies as columns.
- ➢ For each of the nine cells in the table, the first payoff from a pair of the payoffs will be given to child A and then the payoff to child B. So if child A chooses rock (row 1) and child B chooses scissors (column 3), then child A receives a payoff of +1 and child B a payoff of −1.Since the sum of the payoffs in each cell is zero, this is called a *zero-sum* game.

Figure 1The Rock, Paper, Scissors Game (Kreps, 1990)

		Rock	Child B Paper	Scissors
Child A	Rock	0,0	-1,1	1,–1
	Paper	1,-1	0,0	-1,1
	Scissors	-1,1	1,–1	0,0

The researcher concludes that many games in strategic form indicate the first mover advantage; the player becomes a first mover when he commit to a strategy irrevocably and inform the other players about it, in this case he changes the rules of the game, and gets the advantage of being the leader, and avoiding to act simultaneously.

• Extensive form games

The researcher found that the second type of game modeling is an extensive form game which is used in non-cooperative game. In this type of model, and focuses on two main axes: the time to take action by each player, and the information that must be available for making that action.

Extensive form games in general are composed of some dots or nodes, vectors of numbers, arrows; which points from some of the dots of others, and to the victors, and labels for the nodes and for the arrows. Each node reflects a position in the game; in which the player must choose some action. The first position in the game should be an open nod, while the other nods are filled in, each nod is labeled with letter which represents the players in the game , who must choose an action if that position in the game is reached, arrows points to another position in the game, or to a vector of numbers. (**Kreps, 1990, p15-20**).



Extensive games with perfect information

The extensive form games formalize the interactions between players, who know and conscious over time the actions and the previous choices of all other players because only one player moves at a time, so that there are no simultaneous moves. Extensive games with perfect information can be analyzed by backward induction.(Aumann, et al, 1971, P 627).

2.5 Classification of game theory:

(Prisner 2014) see that Games can be categorized according to several criteria:

- The number of players in the game (more than one player).
- The type of play, if it is simultaneous or sequential, since in a simultaneous game, each player has only one move, which is made simultaneously, however, in a sequential game, no two players move at the same time, and players may have to move several times

- The game contains of random moves, which influence its outcome.
- The perfect information that the players have.
- The complete information that the players have, like the structure of the game, the order in which the players move and all possible moves in each position.
- If the game is a zero-sum, this occurs when one player has a positive payoff and the other has a negative payoff.
- The permeation of communication between the players before the game starts and between the moves.
- If the game is cooperative or non-cooperative.
- According to those criteria above, there are three categories of games: games of skill, games of chance, and games of strategy.

2.5.1Categories of games

By reviewing the literatures the researcher reached up that there are three main categories of games; which are: games of skill, games of chance, and games of strategy.

1- Games of skill:

They are games with one player who has complete control over all the outcomes; the existence of a single player is defining property of the game. Because the ingredient of interdependence is missing in these games; it should not really be classified as games at all, but they have many applications in management situations. (Anthony ,2003, p 6)

2- Games of chance:

They are also one player in the game, on the contrary of games of skill, the player does not have a complete control on outcomes, and these outcomes depend partly on the player's choices and partly on nature who is a second player, also strategic selections do not lead to certain outcomes. (Anthony 2003, P 6)

Deriving from that, there are two subcategorizations of these games: games involving risk, and games involving uncertainty. In the games that involving risk, the player knows the probability of each of nature's responses, and therefore knows the probability of success for each of his strategies. However, in games involving uncertainty, the player's outcomes are uncertain, and the probability of success is unknown, also the probabilities cannot be assigned to any of nature's responses. (Colman, 1982, P 9-11)

3-Games of strategy:

The researcher noted that the former games involve one player, however, games of strategy involve two or more players, who played under uncertainty, and also not including nature, each player has partial control over the outcomes.

Those games have also subdivisions and subcategories of these divisions depending on the way in which the pay-off functions are related to one another, in one hand the player's interests may completely coincident; completely convicting; on the other hand player's interests may partly coincident and partly convicting.

Subdivision of the strategy games

1- Two person's games:

Cooperative Games

The first appearance of the subject of cooperative games or what is known as coalition games was in the work of von Neumann and Morgenstern at 1944. In one hand it focuses on the outcome of the game in terms of the value created by cooperative players, on the other hand it does not specify the taken actions of the players. It could be used to model situations where there are no restrictions on the interactions between players, and they are free to make binding commitments, side payments and form coalitions. (Aumann, 1989, P 8-9)

Hence the researcher observed that, cooperative game allows the modeling of outcomes of complex business process such as negotiations, and determining the position of the firm against competition.

Also the researcher reached that cooperative game could be considered a structural rather than procedural one; because it appoints the structure of the game from the aspects of type of players, and what value they might appropriate, otherwise it does not appoint the procedures for creating and dividing value.

"One of cooperative game limitations; is the non-procedural nature, because in that situation in which the interactions of players must follow well defined rules, the free form nature of a cooperative game may not be desirable. Another limitation is the question of uncertainty, since that uncertainty has not been integrated into the application of cooperative game theory to business strategy" (Chatterjee& Samuelson, 2001, P 189-19)

Cooperative Games with perfect and imperfect information

The game has perfect information when the players are fully informed about each other's moves; because games with simultaneous moves have always imperfect information and only extensive games can have perfect information. (Puu, 2006, P 22).

> Cooperative Games with complete and incomplete information

The game could be judged as game with complete information when all the players in the game know all the utility functions, and all the preference of the players. In contrast, a game of incomplete information has at least one player who is uncertain about another player's preference. (Puu, 2006, P 29)

Coalition

"In the cooperative game; although players are independent decision makers, they may have an interest in making binding agreements in order to have a bigger payoff at the end of the game. This agreement or partnership is called a coalition and it is the basic ingredient of the mathematical model of a cooperative game".(Prakash, 1980)

The researcher concluded that the coalitional is a description of the payoffs obtained by cooperative members of a group .What is not made explicit is the process by which the coalition forms. A coalition is a subset of the set of players N could be denoted by S, and to form a coalition Sit is required the agreements of all players in the future coalition S.

When all players approve to form a new coalition there is no possible agreement between any member of S and any member not in S (set N\S). The empty coalition is a coalition made up of no members (the null set \emptyset). A coalition structure describes how the players divide themselves into mutually exclusive coalitions. Any exhaustive partition of the players can be described by a set S={S₁, S₂,...,S_m} of the m coalitions that are formed.(Perry &Reny ,1994 ,P 795-817)

The set S is a partition of N that satisfies two conditions:

 $_{j} \neq \emptyset, j = 1,...,m$ (Equation 1) $S_{i} \cap S_{j} = \emptyset$, for all $i \neq j$, and $\bigcup S_{j} = N$.(Equation 2).

2-Two-Person Total-Conflict (Zero-Sum) Games /Pure-Strategy Solutions

It could be concluded by the researcher that a two-person zero-sum game derived its name from the payoff of the game itself, since the payoff to one player is the negative of the corresponding payoff to the other, this type of games are played with certainty and uses pure strategies.

the payoff matrix of game theory in its strategic form consist of the pure strategy spaces, and the payoff function assigned to each strategy, the row player in this matrix has the choice of strategies "A" or "B," and the column player has strategy choices of "C" or "D." In total-conflict games, the value in each payoff strategy space represents the gain to the row player (steven & straffin, 1996)

The researcher reached out that for two-person games, every matrix game has a solution related to the mini-max theory proved by Von Neumann who claimed that it guarantees for each player a unique game value "v" and an optimal strategy, which may be pure or mixed and the prior knowledge of an opponent's move is not need in this type of games with saddle points. If the row player uses his optimal strategy, his expected payoff will be $\geq v$, no matter what the column player does, and vice versa.

Solution of games:

• Pure-Strategy Solutions: Cardinal Values

Assigning ordinal values to outcomes does not accurately convey the relationships between the various preferences. For example in the prisoner's dilemma, cardinal values of the degrees of 31 preferences between strategic choices could be used to represent the years in prison, both players may not equally value the utility of one year in prison. (Steven & Straffin.1979, P 80-83).

"Cardinal values recognize both the order of the numbers and the ratios of the differences between the numbers. It could be obtained when comparing cardinal values the differences between preferences instead of the uniform distribution of preferences found using an ordinal scale". (Steven & Straffin.1979, P 83-85).

• Mixed-Strategy Solutions

Players should hide their selected strategies from their opponent when they actually take place, but since most competitive games do not have a saddle point, the knowledge of that strategies do not add an advantage to other players. In repeated games, a player varies his selected strategy in order to achieve success through cheat (COMAP 1995, P 569).

Thus, the researcher observed that the player has a dominant strategy when he has one strategy that is always more advantageous as all other strategies, ordinal utilities in this case determines dominance and saddle points, the ratios of the differences between the values are essential in zero- and variable-sum games requiring mixed-strategy solutions.

"Utility theory uses an interval scale that recognizes both the order of the numbers and the ratios of the differences between the values, these numbers which reflect preferences on an interval scale are called cardinal values, and also are necessary to obtain a meaningful solution to any mixed-strategy game. When comparing cardinal values with ordinal values, cardinal utilities are significantly more difficult to determine accurately" (Straffin,1996,P 50-52).

The researcher reached out that one of the common fallacy of utility theory is that there is no reliable method to compare two different players' utilities with precision, because each player determines his values on a personal level in determining the choices among alternatives.

"A mixed strategy is a particular randomization of all of a player's pure strategies according to optimal fixed probabilities. The probability of a player's pure strategy indicates the frequency with which to play that pure strategy, but using a mixed strategy, the outcome could be described in terms of the probabilistic concept of an expected value (EV). The EV of a set of payoffs is the weighted average of those payoffs, where the weights are the probabilities that each payoff will occur." (Straffin, 1996, P 13).

1- Multi person's games:

> Non-cooperative Games

"A game where the players try to do the best for themselves by choosing strategies simultaneously, and with no communication between players is called non-cooperative games" (*Straffin*, 1993, P 65).

The solution of non-cooperative game theory was formally introduced by John Nash in 1950. In this type of games, the players choose strategies simultaneously, and those strategy are not allowed to limit the feasible strategies of another player. Non-cooperative game theory is concerned with the specific actions of the players, but the players are

unable to make binding commitments before choosing their strategies. (Nash ,1950,P 48-49)

> Dynamic Games

Dynamic games which are also called repeated game, results from the interaction of players that are playing similar game abundant times. In contrast of simultaneous games, players have at least some information about the chosen strategies by others. There are three dynamic games that are often applied : The Stackelberg game, stochastic game, and differential game.(Basar&Olsder, 1998, P 2016).

Sequential Moves: Stackelberg Game

The economist Heinrich von Stackelberg formulated and introduced the concept of the first-mover advantage which also known as Stackelberg leadershipin 1934. In a Stackelberg game, the leader chooses a strategy first who already chooses the best possible point of the second player's best response function, and after the second player observes that he makes his own strategy choice; there for the first player can choose Nash Equilibrium. In a game with complete information being a leader is the preference of the player, if he was allowed to choose between making moves simultaneously and being a leader. (Simaan & Cruz, 1973,P 533-555).

The researcher thought that it is not always advantageous to be the leader, if new information is detected after the leader makes a play.

• Simultaneous Moves: Repeated and Stochastic Games

The two major types of multiple-period games are non-time-dependent dynamic games and time-dependent dynamic games. In the first type which is also called repeated games the player is playing the same game over a period of time and use the same strategy which is a sequence of actions taken in all periods. In time-dependent multi-period games, players' payoffs in each period depend on actions taken in the previous, as well as current, periods, the payoff structure does not change from period to period so it called stationary payoffs.(Simoan& Cruz, 1973, P533-555)

The researcher found that there is no separating line between static games and dynamic games; so that the game is dynamic if at least one player is allowed to use a strategy that

depends on previous actions. He also found that game with no information scheme, should be called static, in which the players act only once and independently of each other.

> Differential Games

The available literature in the field of game theory indicates that; differential games can be regarded as a natural extension of the optimal control theory, in which several players' select control variables that may affect the payoffs of all Players. To analyze differential games the standard tools needed are the calculus of variations or optimal control theory. (Kamien& Schwartz, 1981, P 271-288)

Types of strategies player in a different game

There are two distinct types of player strategies in a different game: open-loop and closed-loop.

- Open-loops strategy: in this strategy the players select their control variables once at the beginning of the game without depending on the other players' strategies and do not change them so that the control variables are only functions of time.
- Closed-loop strategy: sometimes called feedback, in this strategy the player bases his strategy on current time and the states of both players' systems.(Shi, 2011, P21-26)

2.6 Nash equilibrium point:

The researcher concludes that the assumption of players rationality in the game, leads to the expectation that they will make choices that are associated with some equilibrium outcome.

The precise definition of equilibrium depends on whether the game's depiction is dynamic or static and on whether the players have complete or incomplete information about one another's preferences.(Zagare, 2014,P 8-9).

From the researcher's point of view, in competitive game theory it is known that there is always at least one solution for strategic situations, which involves possibly randomize strategies.

That solution is known as the Nash equilibrium.

Nash equilibrium could be defined as "a solution concept of non-cooperative games involving two or more players, in which each player is supposed to know the equilibrium strategies of the other players, and no player has anything to gain by changing only their own strategy unilaterally" (Nash, 1950).

Nash equilibrium, also called strategic equilibrium, is "a list of strategies, one for each player, which has the property that no player can unilaterally change his strategy and get a better payoff." (Turocy& Stengel, 2001, P 3).

John Nash stresses that there are conditions that must be met to reach Nash equilibrium: first the players are rational, second each player is fully familiar with the game's methodology, and finally when the player determines his strategy, he must set his opponent. (Osborne, 2002, P 11).

Nash's model fits within the cooperative framework in that it does not scheme a specific timeline of offers and counteroffers, but rather than focuses just on the outcome of the bargaining process. A game theory analysis can focus on aspects of an interactive situation that could be changed to get a better outcome (Turocy&Stengel ,2001,P 6-7)

The researcher believed that with Nash equilibriumin some situations all the participants are totally know what they and others should do. So it is necessary that this explicit track of action shape Nash equilibrium, otherwise one or more of the individuals involved would see some other track of action as being in his best interests.

Mixed strategies

In 1951 Nash showed that "any finite strategic form game has equilibrium if mixed strategies are allowed, since a game in strategic form does not always have equilibrium in which each player deterministically chooses one of his strategies, instead players may randomly select from among these pure strategies with certain probabilities. This way in which the player randomly makes his own choice is called a mixed strategy."(Turocy, 2011, P3).

Many people believe that game theory is designed only for financial gain, but the researcher and through the knowledge of many applications of the game theory sees that profit is not necessarily money, the results can be valuable issues, such as avoid conflict, sympathy, reputation, and gain public opinion, And other values which called the expected interest rates.

2.7 Oligopoly market

"Oligopoly is a state of the industry where a small number of firms produce homogeneous goods or close substitutes competitively, this situation could be considered as a static, non-cooperative game, at any time period the profit of each firm depends not only on its outputs but also on the outputs of all other firms which are unknown to the firms when they make their production decisions. A firm in such an industry is known as an oligopolistic." (Okuguchi ,1977)

The researcher noted that each of the oligopolistic firms had some market power which enables them to affect market prices; so the competition in this industry isn't perfect. The other smaller firms in the industry is survived in the same industry with the giant firms because these smaller firms sell a line of goods that oligopoly firms are not interested in selling, also these lines are too small and too unprofitable.

A formal definition of oligopoly is: "market structures with a small number of sellers, in which they are small enough to require each seller to take into account its competitor current actions and responses to its actions, Oligopolies are markets where profit maximizing competitors set their strategies by paying close attention to how their rivals are likely to react". In these (OECD, 1999, P.17).

The Prevalence of Oligopoly

It's important from the researcher point of view to realize that an oligopoly isn't necessarily made up of large firms, size isn't the matters itself; but how many competitors there are. Oligopoly is so prevalent because it's the existence of economies of scale, which give bigger producers a cost advantage over smaller ones.

Features of Oligopoly market:

Oligopoly market has two unique features; they are mutual interdependent and repeated interaction.

Mutual interdependence:

Mutual interdependence exists when the actions of one firm have a major impact on the other firms in the industry, and when each oligopolistic firm realizes both that its profit depends on what its competitor does. (Nilsson, 2004, P 189)

Repeated interaction:

Often the oligopolists within an industry have been competing with one another for a long time, in other markets they might have competed with one another for a much shorter period of time, perhaps only a few years. In each of these cases, the oligopolists within these industries have experience with the others within the industry; each competitive firm remembers and takes into account, what happened in the past when they design their current competitive strategies. (Nilsson, 2004, P 189).

Modern theorists have used "repeat game" models in which participants interact repeatedly over time; where market uncertainties can be overcome, the short-term incentive to cheat can be outweighed by the long-term benefits of cooperation. (OECD, 1999).

2.8 Collusion:

Collusion is "a type of cooperation between firms when they will raise each other's profits. The strongest form of collusion is a cartel, an arrangement that determines how much each firm is allowed to produce. The world's most famous cartel is the Organization of Petroleum Exporting Countries" (Sloman& others, 2014, P 139-40).

2.8.1 Explicit or overt collusion

When firms directly communicate with one another in order to arrange a collusive outcome, this is known as explicit or overt collusion, the most straightforward, harmful and severely sanctioned type of anti-competitive cooperation is explicit collusion, explicit collusion is not equally likely in all market structures.(Raffaelli ,1995).

On one hand Competitors communicate in order to reach explicit terms of agreeing to reduce competition, but on the other hand explicit collusion includes more than agreements to raise prices through cutting output, and this is called a cartel. (Nilsson, 2004, P 195).

The researcher believes that the policy of implicit collusion between the monopoly market companies is a smart phenomenon where companies agree to fix the price and production volume in the market through direct contact and periodic evaluation of the general situation in the market. This implicit collusion aims to restrict competition by dividing the market to maximize profits from through shared market sharing. The researcher also thought that explicit collusion may not be much different than other forms of cooperation among leading firms; leading firm frame the subset of suppliers whose competitive behavior significantly depends on what they think rivals will do in response to their own decisions.

When there are only two or a few sellers and each competitor seeks his maximum profit rationally and intelligently, then he will realize that his own move has considerable effect upon his competitors, and this leads it to be inactive to suppose that they will accept without retaliation the losses he forces upon them. (Chamberlin, 1933).

Types of explicit collusion:

There are three types of explicit collusion: price fixing, market division, and bid rigging, we will discuss each in turn.

1- Price fixing:

When competitors agree to increase, fix, or maintain the price at which their goods or services is sold, it's called price fixing, it also involves any agreement to restrict price competition. Conspirators do not always agree that they will all charge the exact same price, and also establish some system for monitoring compliance to the price fixing scheme in order to catch those who attempt to cheat on the others in the conspiracy. There is a wide range of instruments and processes of fixing prices, such as the common agreement to increase or keep prices unchanged, or by refraining from disclosing real prices to the public, or by setting a minimum price for the commodity.(Connor ,2001). 2- Market division:

Otherwise, when competitors agree to divide the market among them, it is called market division; this involves firms allocating different consumers, product lines, or geographical regions among themselves. (Nilsson, 2004, P195).

3- Bid rigging:

Sometimes sellers compete for a sale by submitting bids. This is often the case when private firms sell large quantities of goods/services or very expensive products to local, state, and federal governments. Also In some situation, firms can increase their profits by rigging the bidding process; firms have been very creative in how they have rigged bidding processes in order not to be caught.(Nilsson, 2004, P195)

2.8.2 Implicit Collusion:

Implicit or tacit collusion is happening when the firms in the industry achieve the collusive results without actual agreements. Many different types of tacit collusion exist. The best known is price leadership. (Nilsson, 2004, P 198).

When the prices change made by a firm recognized as the "price leader" as a set of industry practices or customs in which the price leader knows that the other firms in the industry will most likely follow the price change that it initiates and also the firms throughout the industry follow it is called "Price leadership" which is a type of implicit collusion. These practices evolve over time in the give and take of competition within the industry. In this type of collusion the price leader can act without violating the law to slowly increase prices throughout the industry and so increasing profits for all because firms are merely following the customs of the industry

(Nilsson, 2004, P198).

At a later stage the price leader can significantly increase the prices in an industry and boost profits for all in the industry if he recognizes that everything works well, but the stability of the leader's position, there are wide possible variations; the reasons for its effectiveness as leader, its effectiveness in leading the industry to prices that maximize joint profits, and its influence over the other firms. (Nilsson, 2004).

The researcher believed that each explicit or implicit successful collusion leads to high profits also cheating by firms which offer secret low prices to some buyers is rewarded highly, but collusion still very fragile since there are differences over what prices to set, total industrial production, and over market shares of participant firms. If other firms discover that cheating; it might be provoked to increase their competitive aggression, which could be lead to a very competitive environment for firms.

The researcher noticed that most of the theoretical work on collusive behavior in oligopolistic markets assumes unchanging environment. This assumption is useful in clarifying both the process by which collusion can be supported and how it can break down.

To analyze collusion it should be focused on the balance between the short-run gains from undercutting one's competitors and the expected long-run losses from the possibility of a breakdown in the collusive agreement caused by the deviation. (Abreud , 1986 , P 191-225).

An oligopolist must always be concerned about whether a non cooperative rival firm will respond by undercutting her price or not, and that a rival firm will take some action that allows it to steal some of her sales and capture a larger share of the market. (kurgman&wells ,2006, P 369).

Fershtman &Pakes tried to illustrate that "Over time the different firms will find themselves in different states facing different incentives; that because the outcome of the investment and entry processes is random, which allow to analyze the interaction between market structure and the ability to support collusion, and to generate price wars or price vectors whose components all fall in response to a small change in structure.(Fershtman&Pakes2000)

The researcher believed that when oligopolistic industry achieved implicit or tacit collusion, individual producers have an incentive to behave carefully in order to do nothing to disrupt the collusion. Because under tacit collusion there is no safe communication channel between producers, oligopolists must behave carefully. if any oligopolists change his output, a danger that implicit collusion will collapse is arise, since the rival interpret this action as a non cooperative move. This indeed leads to unresponsive to the changes in marginal cost in the output of an oligopolist as a sequence.

He also thought that Oligopoly and duopoly are two cases of two competitors; an oligopoly consisting of only two firms is a duopoly. They are the same cases in terms of substance, but are different in terms of analysis, and also they are more complicated than either monopoly or competition. Oligopoly takes into account the market demand and attempts to equate marginal revenue to marginal cost. Because each of the competitors is large enough to influence the market price; the marginal revenue for each firm depends not only on its own supply, but on the supplies of all the competitors as well.

Multiplicity of Attractors

The Fixed points or equilibrium can be unique or multiple, coexist with each other and/or with other types of attracting orbits, such as periodic. Any linear model has just one unique attractor, but nonlinearity opens up for coexistence. (Puu, 2011, P 3-4).

Robinson argued that, assuming linear demand functions for each group of consumers representing a certain income class, market demand would display as a straight line segment of increasing elasticity as price is lowered. When the commodity is with a high price, it will be a luxury reserved for consumers with high incomes. (puu, 2011).

A smart oligopolist doesn't just decide what to do base on the effect on profits in the short run, but may engages in strategic behavior, taking into their account the effects of today's action on the future actions of other players in the game. (Kargman& Wells, 2006, P 374).

"Tit for Tat" strategy starts of behaving cooperatively, but does after whatever the other player did in the previous period; "it is a form of strategic behavior, intended to influence the future actions of other players. This strategy offers a reward for cooperative behavior and also provides a punishment for cheating" (Fetchenhauer. & eat all ,2006, P 236).

The researcher concluded that when oligopolists expect to compete with each other over a longe period of time, each firm will realize that it is in its own best interest to be beneficial to the other firms in the industry, so it will limit its output in a way that raises the profits of the other firms, in order to get that back from rivals in the future.

Legal Framework

The researcher believed that the advantages and privileges of the few are important means used by states to intervene in the organization of economic and commercial life. As it has a positive impact on the development of services and productivity sectors, stimulating trade movement, increasing the revenues of the state, and providing efficient services and goods to society. Many countries have resorted to controlling oligopolies that hinder economic development

In view of the above, the researcher sees the extent of the harm caused by oligopolistic monopoly because of the lack of full competition, following the approach of privatization

and the use of trade concessions rather than the monopoly of oligopolies. Best practices have been developed to regulate business and economic life so as not to harm markets and society

It is necessary from the researcher point of view to clarify the difference between oligopolistic and privilege oligopolistic; where it is difficult to distinguish between oligopoly in its literal sense and privilege oligopolistic or so called legal, administrative privilege, arising from all kinds of trade and oligopoly due to the failure of the market economy to produce certain goods and services. The state intervenes directly by giving privilege to the private sector to encourage domestic investment and attract foreign investments, or it creates an oligopoly managed by the state or by referring it to the private sector on specific terms. Facilities and incentives are granted once an exclusive right is given to a particular party to produce a good or to provide a service.

Two types of oligopoly could be distinguished in terms of objective: the oligopoly, which aims to increase the revenues of the state treasury, which is managed and controlled by the state, such as the exploitation of natural resources products, second: oligopoly controlled by the society as a whole, which aim to produce goods and services that are difficult for the state to produce for reasons of management, efficiency and cost. This means that parties other than the state are entrusted with the task of producing goods and services, infrastructure projects, and other projects that serve the general public, and these are usually managed through oligopoly contracts granted by the state. (Jamil&hejazi 2017, P 4-7)

2.9 The problem of oligopoly in Palestine

The legal problem

In the post-1994 period of the Palestinian National Authority (PNA), the Palestinian Basic Law amended in 2003 established the constitutional framework for privileges, contracts to define the rules and procedures for granting privileges through a law issued by the Legislative Council. In 2005, the draft privileges law was drafted and not ratified until 2017. It should be noted that all privileges, contracts granted under various laws relating to the bodies and departments established, for example, in the electricity and power sector were awarded contracts on the basis of the Palestinian Energy Authority Law of 1995, In

the water sector, based on the establishment of the Palestinian Water Authority in 1996, this law did not mention privileges, but rather, granting licenses through a system issued by the Water Authority. In the industrial sector, privileges are granted under the Free Industrial Cities Act, 1998 (Jamil&hejazi, 2017, P 3-7)

Many privileges contracts have also been granted in the form of a license based on agreements between the Palestinian Authority / Ministries and the beneficiary, such as the PALTEL Agreement to grant a license to establish, manage and operate fixed and mobile telecommunications in 1995 (Kassem&Firas,2005)

Based on the previous talking the researcher can note the absence of a legal provision relating to privilege rights, in spite of the explicit call in the Palestinian Basic Law, that oligopoly rights were granted under agreements between the Authority and the private sector, such as telecommunications law and so on. Since article 5 of Law No. (5) for the year 2015 on the amendment of a law income tax No. (8) of 2011 amending paragraph (2) of Article (16) of the original law to become as follows :The tax on taxable income shall be collected for any legal person at a rate of (15%) excluding telecommunications companies and companies that have a monopoly or monopoly in the Palestinian market, subject to 20%.(Majalat alwaqayie alfilastinia 2015)

There were many privileges granted by the British Mandate government. The Jordanian government granted the West Bank privileges, contracts for public utilities in accordance with Article 117 of the Jordanian Constitution, which stipulated that special laws governing the rights of the franchise should be issued; eight special privilege laws were issued, including oil companies, potash, tanning, transportation and tourism. That privilege that inherited from the British Mandate Government of Palestine is like the privilege of the Jerusalem Electricity Company. (Jamil&hejazi, 2017, P 3-7)

The researcher noticed after reviewing literatures that Privileges are sometimes granted for a specified period of time, to allow the investor to build a network of high quality services without worrying about the recovery of his invested funds. Privileges are usually accompanied by the control of the prices and quality of the concessionaires' by the government or the regulator. The cost price is added to the permissible profit returns in the
absence of competition in the market, and the government must ensure that the market is not exploited by the concessionaire.

He also observed that some governments in developed countries build or contribute to the construction of infrastructure without resorting to granting concessions to private investment companies. The privilege of managing the use of this infrastructure is granted to an independent, non-profit entity to provide equal opportunities for licensed companies to compete and provide different services to consumers. In all cases, the Ministry or the regulatory body monitors the development of the infrastructure to ensure technical neutrality and the monopoly of any technical system, thus forcing competing companies to use the same techniques.

The researcher believes that the granting of unilateralism to the Palestinian Telecommunications Company was intended to give it the opportunity to develop the infrastructure of Palestinian communications and investment in it intensively without being negatively affected by competition, although there is no real unilateral in the field of mobile phones due to the competition of Israeli mobile phones during this period.

Antitrust strategies are complex and difficult, especially since companies possess multiple ways to defraud antitrust systems, through implicit and public policies of collusion, or through merger policies.

2.10. Previous studies:

The researcher finds that these previous studies contain important and valuable information about the effect of applying Game theory of decision making at Palestinian Oligopoly companies.

These studies contain the strategies and concepts of game theory, methods of analysis used, and decision-making strategies, as well as the concept of oligopoly and decision-making, especially in terms of pricing.

The researcher will try through these studies and references to reflect the impact of applying game theory as a tool to make decisions in the Palestinian oligopoly market, this study will be the first one in Palestine as the researcher thought.

Leino (2003): Master's thesis in Finland Stated that game theory "is a branch of mathematics that studies the interactions of multiple independent decision makers that try to fulfill their own objectives." He also reflected the application of game theory at telecommunications as the users try to ensure the best possible quality of service, and to model the interaction between a single node and the rest of the network as a game.

Dragasevic, Rakocevic, &Glisevic (2011), Montenegro: They mentioned that decision makers can use game theory to select an optimal strategy on the oligopolistic market, because the profit of the business depends not only on its behavior, but also on the behavior of the other opponents.

Scott (2015): In his study about collusion, Scott discussed a model of tacit collusion with imperfect public information in the tradition of Stigler's theory of dynamic oligopoly; he claimed that collusion is supported by the threat of punishment, while in the situation of imperfect information perfect collusion is impossible.

Chah, **Elizabeth**, **Kibuh** (2012), **Sweden**: In their study they identified external and internal factors that may influence entry mode decisions in an oligopolistic market situation, he focused on external factors related to the environment because the firm usually has little or no control over them, those factors are: business environment, cultural distance, market barriers and competition intensity.

Bayar (2003): He stated that Corruption is "an important social and ethical problem; which requires changes in values, norms and behavioral patterns of the society to be fought."

In his study, Bayar tried to examine the features of the system providing a fertile environment for corruption by using game theoretical models. He describes three models examine corruption as a kind of bribe in privet and public sector.

Stolwijk (2010), Netherlands: Stolwijk In his study raises a very important issue about the theory of cooperative games, where cooperative games can achieve the common profit of the parties, The study included multiple applications about cooperative games, their characteristics, results and characteristics and types , On the other hand, we look at all

possible outcomes where players can make binding commitments. Assume that there are some mechanisms that impose these obligations.

Nayyar (2009): He explored the theory of repeated games and how cooperation sustained through repeated interaction, even when economic agents are completely self interested beings.

He describes how every player tries to achieve as many points as possible and assumes that all players deal rationally with a certain logic that makes all current trades, profits and losses move more profitably in the near or far future. Strategy and Policy for Players (Economists)

He also analyzed two models that involve repeated interaction in an environment where some information is private. He characterized the equilibrium set of the following game

Coccorese(2010): He illustrated an extension of Smale's analysis of the "repeated prisoner's dilemma" with imperfect information. He claimed that firms achieved stable, long run by employing a dynamical system concern with repeated interactions between firms and a set of behavioral rules, however the initial conditions.

Cellini &Lambertini (2005), Italy : Intensive study, specialized and deep in the applications of game theory on the oligopoly in terms of goods and sticky prices. We examine the open and closed loop in the thinking and interpretation of Nash, where it turns out that the closed balance needs a higher level of production of permanent and stable states compared to the open balance as it is clear that both open and closed balance needs a higher level of production in the steady state of the game fixed. Also, they discussed the process of product differentiation and its relation to the price and volume of production They showed that the social welfare of the country rises and stabilizes in the case of price adjustment and adjustment, The economic growth of the countries which depends on the competitiveness of the production resulting from dynamic competition as it has a positive impact on social and economic life

Song (2015), Georgia: In his study, song achieved deeply theoretical approach to the" problem of product line evolution". He developed a model of joint improvement between stakeholders and followers to take advantage of the conflicting objectives of marketing and

engineering concerns within a coherent framework of theoretical improvement of the game. A dual-level interlocking genetic algorithm he was also developed to effectively solve the joint improvement model;" a case study of the evolution of the smart clock production line" he was also reported to illustrate the feasibility and potential of the proposed approach.

Menezes&Quiggin (2007): They presented a diverse and intelligent set of ideas, focusing on a range of outcomes, where strategic interactions are included, as the idea of a strategic interaction may be an expanded version of another interaction. In addition, Nash's balance, which grew up in such extensions, was described in a deep and precise manner and showed a popular type theory "that states that any individual rational element in the resulting space is a Nash equilibrium".

Horn & Persson (1999): He highlighted how the international pattern of ownership of productive assets could depend on the attributes of trade and the cost of production, and suggested how high commercial costs might lead to national ownership of assets, while international firms might arise at lower commercial cost with differential induction leaps. He showed how special incentives and social incentives for integration and acquisition can differ for the "integration" of weak integration but converges when synergies are stronger.

Chapter Three

Research Methodology

The importance and multiplicity of the use of game theory in many fields of human and applied sciences in the field of scientific research, which is what requires more than the curriculum is due to the richness of the field of game theory and applications and their diversity and interpretations on the economic dimension, and starts the researcher from the analytical descriptive approach where the concept of descriptive research Analysis and interpretation of the reality of events, phenomena, attitudes and opinions to arrive at useful conclusions. These conclusions can correct, update, or develop this reality.

The analytical, descriptive approach aims at describing the phenomenon and identifying its components and analyzing them through the collection and analysis of data and information, including providing an accurate and objective picture of the phenomenon or the subject of research.

As it is indicated in the title, this chapter includes the research methodology of the thesis. In more details, in this part the researcher outlines the research Questions, research method, the research approach, Study tool, and the methods of data collection.

3.1 Research Questions:

This study aims to answer the following

- What is the importance of game theory in decision making in Palestinian oligopolistic companies?
- What are the effects of applying game theory to the continuity and success of Palestinian oligopoly companies?

3.2 The research hypothesis

The research hypothesis is outlined from the main research question, as follows: "There is a relationship between increasing dependence on the use of game theory as a tool in strategic analysis and increasing profits and returns in Palestinian oligopolistic telecommunications companies"

3.3 Data collection methods:

To answer the research questions and collect data to analyze them in this study; for achieving the study objectives, the researcher obtains data from different sources and make comparisons between them, and so does the following:

- Review literature related to game theory, economic and market analysis, as well as review plans, strategies and financial lists of two Palestinian oligopoly companies (Jawwal and Ooredoo Palestine).
- Review the experiences of some international companies in the application of the theory of games in the decision-making process and the consequences thereof.
- Collect secondary data from Palestinian oligopoly companies in telecommunication sector (Jawwal and al Ooredoo Palestine mobile) about decision making mechanism, as well as collecting data about the actions that are relied upon in the decision-making process.

3.4 Data sources

The sources of these data are as follows:

- Secondary data sources:

1- Palestinian oligopoly companies in telecommunication sector (Jawwal and al Ooredoo Palestine mobile):

- > The financial statements of each company and disclosed for a period of two years.
- Annual administrative reports published on the company's website for a period of two years
- > Review the mission, vision and objectives of each company.
- Different Palestinian studies specialized in oligopoly and decision-making methods were followed at these companies, in addition to the reports issued by MAS Institute.

Primary data: analysis of the financial statement of the two companies (Jawwal and Ooredoo Palestine)

3.5 Obstacles:

- The practical limitation that hinders data collection:
 - > There are no similar research experiments in Palestine.

- > The high financial cost for buying books and international research.
- The lack of response of the target companies, and the difficulty of meeting with decision makers.

3.6 The research plan / Timetable:

Spatial boundaries: The research handles tracing, analysis and clarification of the effect of applying Game theory of decision making at Palestinian Oligopoly companies Time boundaries: This research extends from 2016 to 2018 the reason for the study within this time period is to address the decisions taken by the Palestinian oligopoly companies and apply the theory of the game to them.

3.7 Research Model

The researcher introduced the subject by considering a very simple game with two opposing players. It is called a 'zero-sum game: The total profit of a party equals the total loss of the other party. As information about the game is not known to both players, both teams play within the limits of informatics; so it is a game with "imperfect information". With a game theory model, the researcher provides a mathematical description of a social situation in which two oligopolistic companies jawwal and Oredoo "two players" interact, the players may be competitive or cooperative.

In his research, the researcher will restrict attention to the simplest model; "zero-sum game". Players choose their strategies at the same time, when player "X" uses strategy "a" and player "Y" uses strategy "b", player X receives the payoff "pab" from player Y. thus providing the zero-sum feature. Each player knows all strategies available well known to the other, and both of players agree on the payoff matrix." To analyze this game, the researcher will use a decision tree created by DPL 9, and Gambit Version 16. Gambit is an open-source collection of tools for doing computation in game theory. It is cross-platform: could be got for Microsoft Windows, Mac OS X, or Linux. With

Gambit, the researcher can build, analyze, and explore game models.(Marc, 2016)

Gambit is a set of software tools for doing computation on finite, non-cooperative games. These comprise a graphical interface for interactively building and analyzing general games in extensive or strategy form; a number of command line tools for computing Nash equilibrium and other solution concepts in games; and, a set of file formats for storing and communicating games to external tools, The advantage of this format is that Gambit may be able to compute equilibrium exactly.(Marce, 2016)

Gambit's graphical user interface provides an "integrated development environment" to help visually construct games and to investigate their main strategic features.

The frame presenting a game consists of two principal panels. The main panel, to the right, displays the game graphically; and the player panel to the left, which lists the players in the game; here, Jawwal and Ooredoo Palestine.

The color assigned to a player can be changed by clicking on the color icon located to the left of the player's name on the player panel. Player names are edited by clicking on the player's name, and editing the name in the text control that appears.

Gambit stores all payoffs in games in an arbitrary-precision format. Payoffs may be entered as decimal numbers with arbitrarily many decimal places. In addition, Gambit supports representing payoffs using rational numbers.

Gambit supports the specification of payoffs at any node in a game tree, whether terminal or not. Each node is created with no outcome attached; in this case, the payoff at each node is zero to all players. These are indicated in the game tree by the presence of a (u) in light grey to the right of a node. The payoff to a player for an outcome can be edited by double-clicking on the payoff entry.

The DPL 9 modeling environment was designed to give the capabilities needed to maintain focus on the problem at hand "the decision and not the tools".

The major DPL 9 Release serves to underscore Syncopation's commitment to providing analysts, consultants, managers, and analytic teams with an intuitive, graphical decision-tree based modeling environment for performing robust decision & risk analyses, Monte Carlo simulation, real option valuation, and portfolio prioritization.

DPL has provided analysts with a set of tools that can help to: Graphically describe, communicate and analyze complex decision-problems, Visualize downside risk, while maximizing upside potential, Increase stakeholder value in the face of uncertainty, and Build a shared understanding among stakeholders in order to make smart, confident decisions.

3.8 Research Strategy

The researcher will depend on cases study of two Palestinian oligopolistic companies (Jawwal and Oredoo) Through the use of various applications and used globally, In order to understand more deeply the role of applying game theory to the Palestinian monopolistic market companies by focusing on (Jawwal and Oredoo) also to answer the research questions.

3.9 Population of Study

The study population consisted of two Palestinian oligopolistic companies in telecommunication sector; Jawwal and al Ooredoo Palestine.

Through conducting a study, a researcher used some Quantitative and Qualitative tool; quantitative tool that the researcher used are:

- The analyses of published financial statements and annual reports for each Jawwal and Ooredoo Palestine, for a period of two years.

Otherwise the Qualitative tools are:

- Review annual administrative reports published on the company's website for a period of two years.
- Review the mission, vision and objectives of each company (Jawwal and Ooredoo Palestine a mobile).
- Review the reports issued by the MAS Institute or other local and international bodies.

3.10 Data Analysis

The quantitative data obtained was analyzed by using two software programs DPL 9 and Gambit, the results were presented using tables and charts in chapter 4 in details manner, while the qualitative data were analysis through the following technique

- ➢ Data recognition.
- ➢ Select a frame for information.
- ➢ Indexing or selecting specific categories.
- ➢ Filling tables or matrices.
- > Interpretation: Interpretation of what has been found.

Chapter Four

Findings

4.1 Introduction:

There is a strong correlation between engaging business and profit, because the profit of a business depends not only on its own behavior, but also on the other opponents behavior in the decision making process. Therefore, the decision maker should analyze the strategies that have been chosen or will be chosen by their opponents. Decision makers on the oligopolistic market can use game theory as a tool for formulating, analyzing and understanding different strategies.

Analysis of the decision helps to make the important decision by choosing one decision from the set of possible alternative decisions when there is no certainty of what will happen in the future. The objective here is to find the best possible payoff in the form of a decision criterion. One of these criteria may be maximizing the expected profit when it is possible to determine the probability of this or the criterion maximizing the interest or utility function is used in the event of a risk in the decision.

When a telecommunication system is modeled using game theory, there are some interested properties that are: Is there Nash equilibrium? Is it unique? Does the system converge to the equilibrium point? Does it maximize the social welfare?

In 1994, the Israeli side handed over the Palestinian National Authority (PNA) immediately after the establishment of the communications and postal sector. The work was formally organized between the two sides through a transitional agreement in 1995. This agreement caused great damage to the telecommunications and postal sector; it gave the Israeli side the right to full control of the spectrum in the sector Gaza and the West Bank, including telephone, radio and television frequencies, satellite broadcasting and the digital range of telephone services. (Wafa Palestinian official gazette, 2011)

The agreement imposed restrictions on the construction of Palestinian networks and power stations in Area C, which hindered the integration and interconnection of Palestinian networks by hiring Israeli operators at unreasonable prices and conditions. This hampered

communication between the governors, especially between the West Bank and the Gaza Strip.

Within the limits of the Interim Telecommunications Agreement, the Palestinian National Authority (PNA) allocated almost entirely to the telecommunications sector in 1996, and the Palestinian Telecommunications Company was established under a license granted to the Company to operate telecommunications networks throughout the Palestinian territories for a period of 20 years without giving other operators the opportunity to submit a public tender. (Wafa Palestinian official gazette, 2011)

The license stipulated the right of the telecommunications company to operate the mobile phone, and did not set conditions or operating provisions and left the door open without restriction. It granted the telecommunications company a ten-year monopoly of the fixed-line network. The license limited the mobile market to five years or 120,000 lines, whichever is earlier, after the agreement was reached with the Israeli party and the necessary frequencies were obtained (Wafa Palestinian official gazette, 2011)

The company's unilateral award was aimed at giving the company the opportunity to develop and invest in the Palestinian communications infrastructure in an intensive manner without paying attention to market competition.

The entry of the national company for the Palestinian cellular market represents a quantum leap for the telecommunications sector, but this step was not complete because the PNA could not grant cellular companies sufficient frequencies controlled by the Israeli side, especially 3G frequencies that allow subscribers to access the Internet. It is well known that the national company obtained a license in 2007 and began operating in 2009 after receiving enough second generation frequencies only to start work. (Wafa Palestinian official gazette, 2011)

In this chapter the researcher will reflect how the key aspects of game theory have been used to show how it can be implemented for understanding the development and functioning of the Palestinian telecommunication oligopoly market and how managers need to think about the strategic decisions. The payoff matrix will show how the payoff for each of the participants in a two player game (which will be Jawwal Company and Ooredoo Palestine Company) depends on the actions of both. Such a matrix helps us to analyze interdependence.

The researcher in this chapter used the following criteria of the decision; first is making a decision under the condition of certainty where it is necessary to know the future state of nature, second is making a decision under the condition of risk where there is some knowledge about the possibility of the occurrence of future nature.

Also in this chapter, the methods of calculations will be used in well-known computer applications used in the field of analysis and decision tree generation, since the computer has become an ideal alternative to manually calculation methods. These applications are Gambit version 16, DPL 9, and also financial analysis and forecasting by excel sheet.

4.2 Players:

4.2.1 Jawwal company:

The company began its services in 1999 as the first Palestinian cellular communications company. In 2007, the company exceeded one million subscribers. In April 2010 it exceeded the two million mark. Currently, Jawwal offers its services to over 2,750,000 subscribers, with a market share representing 77% of the Palestinian market, having obtained the certificate of "Quality of Environmental Management" (ISO14001) in 2004.(jawwal, 2018)

The company has 29 service centers equipped at a higher level, more than 1,000 main and branch distributors and more than 10,000 outlets in the West Bank and Gaza Strip. In addition, Jawwal has provided roaming services to more than 436 operators in more than 170 countries, with a coverage level of 98% of the West Bank and Gaza Strip.(Jawwal, 2018)

Jawwal vision could be stated as: To remain at the top of the leading companies in the Palestinian market that provide mobile communication services efficiently, effectively and reliably to all its subscribers, overcoming all the difficulties and obstacles. And we have the largest role in bringing everyone together, reuniting and running their businesses, and that our growth continues along with the growth of the national economy.

The mission statement of Jawwal is:

- Listening to our subscribers, individuals and companies, and meeting their renewable needs
- Continuing to develop a strong and secure communications network throughout the country
- Qualifying high-performance team who become role models in their professionalism and transparency
- Skip and overcome obstacles to our progress to achieve our vision on the ground

Jawwal Identity and values could be stated as:

Attention, smooth, trustworthy, continued, vision is not limited by impossible

4.2.2 Ooredoo Palestine:

On May 15, 2006, the (PNA) announced the opening of the tender for a second mobile operator in the Palestinian territories. In June 2006, Wataniya International submitted a \$ 355 million license for the second mobile operator. Ooredoo Palestine International wins the second mobile operator license. (Ooredoo,2018).

On October 11, 2006, the Palestine Investment Fund (PIF) and Wataniya International signed the agreement to establish a mobile telecommunications company in Palestine, Wataniya Palestine Mobile, a subsidiary of Ooredoo Group, and acquired Ooredoo on March 15, 2007On 51% of the national international.(Ooredoo,2018).

Wataniya Mobile, one of the Ooredoo Group companies, has signed the second mobile operator license with the Palestinian Ministry of Communications and Information Technology on 15 March 2007.

Ooredoo Palestine Mobile received the necessary frequencies to operate and build its network in 2008 and launched its business in the West Bank in November 2009 and in October 2017 officially launched its business in the Gaza Strip (Ooredoo, 2018)

Ooredoo Palestine launched its commercial services in November 2009 in the West Bank, previously known as Wataniya Mobile.

Ooredoo Palestine was established in partnership between the National Company and the Free Zone, wholly owned by (NMTC), the majority owned by Wataniya International Group and the Palestine Investment Fund.

In 2010, the capital was raised and 15% of Ooredoo's capital was issued to the public under a public offering. In 2018, the company's capital was raised by \$ 35 million under a public secondary offering. (PIF) is equivalent to 34.6% and 16.1% owned by the public. The company is the largest shareholder in the Palestine Stock Exchange with a total value of 293 million shares issued and paid up. (Ooredoo, 2018)

Ooredoo Palestine vision could be stated as: "Enrich the lives of our subscribers to be the best communication option in Palestine and enrich the experience of the subscriber and meet his expectations and needs in full."

Ooredoo Palestine values are: "Attention: Ooredoo Palestine is always interested in providing its services to its subscribers, in accordance with the highest standards and specifications, because it cares about its subscribers and wants to provide the best Internet experience and contacts in Palestine."

"Communication: Ooredoo Palestine communicates with its subscribers very carefully to prioritize them."

3.4 The Game

The players are decision makers, who choose how they act (here are Jawwal company and Ooredoo Palestine). Players try to ensure the best possible winnings, according to the profit rule, As Nash Nash described them "player's preferences can be expressed either as a utility function, which determines each result to a real number, or with preference relationships, which determine the order of effects which define the ranking of the consequences" (Nash, 1950).

In this game, the researcher assumed that the players are rational, and assumed to maximize their expected payoff. If the game is not deterministic, the players maximize their expected Payoff. Since in telecommunications, the players usually are devices programmed to operate in a certain way, and thus the assumption of rational behavior is more justified.

• Repeated extensive game:

From now on, the players will be referred to symbol (J) for Jawwal Company and the symbol (O) for Ooredoo Palestine.

An extensive game with perfect information has the following components.(Leino 2003 p 23-25)

- "A set N (the set of players : J/O) "
- A set H of sequences (finite or infinite) of actions that satisfies the following three properties:
 - "The empty sequence Øis a member of H."
 - "If (*a^k*) k=1....,K ∈ H (where K may be infinite) and L < K then (*a^k*) k=1,...., L∈
 H."
 - "If an infinite sequence (a^k) ∞k =1 satisfies (a^k) k =1..., L ∈H for every positive integer L then (a^k) ∞ k =1 ∈ H."

"(Each member of H is a history; each component of a history is an action taken by player.) A history (a^k) k=1,..., K \in H is terminal if it is infinite or if there is no a^k+1 such that (a^k) k=1,..., K+1 \in H. The set of terminal histories is denoted Z."

- A function P that assigns to each non terminal history (each member of $H\backslash Z$) a member of N.
- The player function, P (h) being the player who takes an action after the history h.
- For each player $i \in N$ a utility function Ui on Z. (see appendix #1 for explanation)

4.4 Case one: investment trends:

Jawwal and Ooredoo Palestine decided to determine the best investment strategy for the coming year 2019. There are three options available to them: Available for sale, investment (AFS) and Held for trading investment (AFT), Real Estate Investment, and Investment as deposits with banks, that's under four states of nature be excluded from each other and must occur one of them.

Decision makers in both companies expect a large return on their investment, and at the same time they want to minimize their risk. At the present time, they need to decide between the previous options.

- The researcher will assume that all Palestinian banks pay the same Interest for deposits in dollars.
- The decision makers are rational.
- The researcher will use Expected Value Criterion or Expected Monetary Value (EMV), probability estimates are used for each event of nature in the search for the optimal decision.

$$EMV_i = \sum_j r_{ij} p_j$$
 Equation 3

According to the PMBOK Guide 5th edition "Expected monetary value analysis is a statistical concept that calculates the average outcomes when the future includes the scenarios that may or may not happen." (PMI, 2013). It helps in calculating the amount required to manage all identified risks, and also It helps in selecting the choice which involves less money to manage the risks.

Σ : Summation

ri: Risk Impact

The impact is the amount that you will have to spend if any identified risk occurs

P: Probability

Probability is the measurement of the likelihood of the occurrence of any event

```
Expected monetary value (EMV) = probability * impact
```

EMV of all events = "EMV of the first event + EMV of the second event + EMV of the third event , \dots ."

- Each company has the freedom either to appoint an economist consultant or not to evaluate the potential one-year returns, and also estimate the probability of each economic condition occurring.
- P(Consultant predict approval) = 0.60
- P(Consultant predict denial) = 0.40

The researcher also will use the Payment analysis tables in the following cases:

- 1. There is a set consisting of a limited number of separate alternative decisions.
- 2. The result of the decision is a function of one future event.

In the table of decision shall be:

- 1. Lines contain possible alternative decisions.
- 2. Columns contain possible future events.
- 3. Events (called situations of reality are excluded from each other and must occur one of them (at most one possible event of events occurs or at least one event occurs).
- 4. Table contents are the payments.

Decision Alternatives	State of nature (profit /lose thousands of \$)				
	Large rise	Small rise	Small fall	Large fall	
Available for sale investment	250	200	-100	-150	
(AFS) and Held for trading					
investment (AFT)					
P(Consultant predict approval)	0.40	0.30	0.15	0.15	
P(Consultant predict denial)	0.10	0.20	0.35	0.35	
Real Estate Investment	200	150	-200	-150	
P(Consultant predict approval)	0.20	0.30	0.30	0.20	
P(Consultant predict denial)	0.35	0.35	0.15	0.15	
Investment as deposits with banks	150	100	-250	-120	
P(Consultant predict approval)	0.25	0.40	0.20	0.15	
P(Consultant predict denial)	0.40	0.30	0.17	0.13	

Table 1 (Jawwal) Payoff table analysis, Design by the researcher

• The values for each state of nature were assumed by the researcher

• The total probability for each state of nature must equal one

By using DPL for analyzing the above payoff table, a decision tree will be created; which is a map of the possible outcomes of a series of related choices. It allows weighing possible actions against one another based on their costs, probabilities, and benefits. It could be used either to map out an algorithm that predicts the best choice mathematically.

A decision tree typically starts with a single node, which branches into possible outcomes. Each of those outcomes leads to additional nodes, which branch off into other possibilities. This gives it a treelike shape.

There are three different types of nodes: chance nodes, decision nodes, and end nodes. A chance node, represented by a circle, shows the probabilities of certain results. A decision node, represented by a square, shows a decision to be made, and an end node shows the final outcome of a decision path.



The figure above indicate that AFS and AFT is the best choice with the highest payoff, but it should be taken in the decision maker consideration that the AFS securities are nonstrategic and can usually have a ready market price available, and the gains / losses derived from an AFS security is not reflected in net income, but show up in the other income comprehensive category until they are sold, it still the best choice for investment in the short run to Jawwal company ; since it is the more liquid in its nature rather than the other alternatives in the table above, it could be converted into cash faster than the others, also it gains more returns.

Decision Alternatives	State of nature (profit /lose thousands of \$)					
	Large rise	Small rise	Small fall	Large fall		
Available for sale investment (AFS)	200	150	-200	-150		
and Held for trading investment						
(AFT)						
P(Consultant predict approval)	0.20	0.30	0.30	0.20		
P(Consultant predict denial)	0.35	0.35	0.15	0.15		
Real Estate Investment	250	200	-100	-150		
P(Consultant predict approval)	0.40	0.30	0.15	0.15		
P(Consultant predict denial)	0.10	0.20	0.35	0.35		
Investment as deposits with banks	150	100	-250	-120		
P(Consultant predict approval)	0.25	0.40	0.20	0.15		
P(Consultant predict denial)	0.40	0.30	0.17	0.13		

Table 2 (Oredoo) Payoff table analysis, Design by the Researcher

- The values for each state of nature were assumed by the researcher
- The total probability for each state of nature must equal one
- Solution by DPL:

Figure 4 (Oredoo) Solution by DPL



Bank deposits offer a high security ratio because there is no type of risk related to the loss or loss of any part of the money. However, the returns are small due to the returns that can be obtained from other forms of investment. On the more positive side, Ooredoo Palestine can keep bank deposits not only for investment purposes, but also for the purpose of obtaining banking facilities with a low interest margin. Such banking facilities, help in financing working capital, also help to raise the company's capital and finance the purchase of fixed assets.

4.5 Case Tow: Revenues from sales

The decision makers at Jawwal and Ooredoo Palestine, noted that despite the high mobile subscriber numbers for the year ended 2017; this increase was not clearly reflected as an increase in monthly revenue per subscriber.

In order to resolve this problem; Both Jawwal and Ooredoo Palestine want to adjust the prices of local call minutes by 0.5% for individual and business programs: prepaid, postpaid, and MIX. There are three options available to them: increase the price, decrease the price, no change, that's under three states of nature be excluded from each other and must occur one of them.

- The researcher will assume that each company has the freedom of choice whether to make a market study before making the decision or not, also the cost for market study is 4000 \$.
- If the prices were increased adjusted by 0.5%; then the monthly revenue of the subscriber will decrease by 0.5%
- If the prices were decreasingly adjusted by 0.5%; the monthly revenue of subscriber will increase by 0.5%
- The monthly revenue of subscriber at Jawwal 9\$ (jawwal 2017)
- The monthly revenue of subscriber at Ooredoo Palestine 7.5\$ (Ooredoo2017)
- P(favorable market study) = 0.40
- P(unfavorable market study) =0.60

Decision Alternatives	State of nature(profit /lose \$)				
	High demand	Medium demand	Low demand		
Increase the price	14	11	4		
P(favorable market study)	0.20	0.60	0.20		
P(unfavorable market study)	0.40	0.20	0.40		
Decrease the price	14	11	4		
P(favorable market study)	0.50	0.35	0.15		
P(unfavorable market study)	0.15	0.35	0.50		
No change	9	9	9		
P(favorable market study)	0.34	0.33	0.33		
P(unfavorable market study)	0.25	0.50	0.25		

Table 3 Revenues from sales (Jawwal) payoff table analysis , Design by the researcher

Solution by DPL

Figure 5 Revenues from sales :(Jawwal) Design by the researcher



The figure above indicates that; decreasing price by 0.5% will lead to increase the revenue per subscriber by 0.5% to reach 11.4%

Table 4 Revenues from sales Table analysis: (Oredoo) payoff Design by the researcher

Decision Alternatives	State of nature(profit / lose \$)				
	High demand	Medium demand	Low demand		
Increase the price	11.25	9.38	3.75		
P(favorable market study)	0.20	0.60	0.20		
P(unfavorable market study)	0.40	0.20	0.40		
Decrease the price	11.25	9.38	4.25		
P(favorable market study)	0.50	0.35	0.15		
P(unfavorable market study)	0.15	0.35	0.50		
No change	7.5	7.5	7.5		
P(favorable market study)	0.34	0.33	0.33		
P(unfavorable market study)	0.25	0.50	0.25		

• Solution by DPL



Figure 6 Revenues from sales: (Oredoo):Design by the researcher

The figure above indicates that; decreasing price by 0.5% will lead to increase the revenue per subscriber by 0.5% to reach 9.5 $\$

Jawwal and Ooredoo Palestine: two players in non-cooperative telecommunication game:

On 13-7-2011, the Palestinian Ministry of Communications and Information Technology issued a decree regarding the pricing of calls between the subscribers of Jawwal and Ooredoo Palestine. The prices of the Jawwal company towards Ooredoo Palestine are non -competitive and ask Jawwal to reduce the prices of its calls to the Ooredoo Palestine network by at least ten Agora per minute And all its programs.

As of 1/5/2012, Jawwal prices have been considered towards Ooredoo, prices are unreasonably high, and the price of the call is close to the Israeli networks, and therefore considered to be non-competitive prices. (Ministry of communication, 2015)

• Payoff table analysis:

If you know that the call minute from Jawwal towards Ooredoo Palestine network in the billing program is up to 57 Agora, while Ooredoo Palestine has a maximum of 39 Agora, and drops to a minimum of 18 Agora. As for the basic prepaid system, the minute rate of call from Ooredoo Palestine toward Jawwal is only 49 Agora, while rising to 65 Agoras at Jawwal.

- Game: set of rules that discipline the interactions among competitors (J&O)
- Payoff: the surplus per call minutes
- Strategy: decisions on offers that result in maximum payoff
- Move: the payoff achieved as a result of strategy for one player holding the other players' strategies fixed
- Nash Equilibrium: a situation where no player can improve his situation by changing his strategy

Calls minutes by J & O:

To design this matrix, the researcher will use the average of the highest and lowest number of call minutes that the service provider sells to the consumer, as shown in table number 5 bellow:

Table 5 Calls minutes by J & O:, Design by the researcher

Calls minutes	J / high	J/ low
O/ high	O =2000, J = 2000	O = 2000, J =225
O/ low	O = 225, J = 2000	O = 225 , J = 225

Table 6 Prices resulting from the 4 different scenarios: Design by the researcher

The prices of calls listed in the table below are taken from the offers published on the company's website as mentioned before.

Price (NIS /Calls minutes)	J / high	J/ low
O/ high	0.39	0.57
O/ low	0.57	0.65

The matrix refers to the revenues in shekels of each of the two companies from each consumer. This is the result of multiplying the call rates by the average number of minutes shown in table 5 above

Price(NIS /Calls minutes)	J / high	J/ low
O/ high	(780,780)	(128, 1140)
O/ low	(128,1140)	(146, 146)

If J "red colored" choose to offer high price of calls minutes with probability 1, and also O "blue colored" with "*imperfect information*" offered high minutes call price, the payoff for each will be (780,780), but the questions here: will the customer be able to continue in the long term to make calls from Ooredoo Palestine toward Jawwal or vice versa despite the high price of the call? Dose the market share of one of the two companies will be affected by the rise at the expense of lower market share of the other, as consumers will tend to subscribe with the company that offers better communication offers among its subscribers?

In order to answer this question, the researcher will solve the "dominant strategy" using Gambit

		Player O	
		Defect	Cooperate
Player J	Defect	(780,780)	(128,1140)
Cooperate	(1140,128)	(146,146)	

Table 7 (O&J) Dominant strategy" using Gambit

	defect		соор	erate
defect	780	780	128	1140
cooperate	1140	128	146	146



This stable outcome (146,146) which players J and O reached by playing the game followed the "*strictly dominant*" strategy of low price; when they "*cooperate*" to gather and reduce the price offered to calls minutes, is what we call Nash equilibrium. Where equilibrium in the general sense means a state in which opposing forces are balanced, thus creating a point of stability ; for players (J& O) in the above "*non zero sum game*" they are both trying to optimize their payoff , and they will both naturally gravitate towards the strategy that gives them the highest payoff. But because their payoff is dependent on what strategy the other chooses and because they cannot depend upon cooperation between

them, they have to choose the best strategy assuming that the other will work to optimize their payoff without cooperating.

4.6 Case Three: Breaking down Advertising Budget

Companies can determine what level to set their advertising budget .Below are several different ways, we have strategies, and the researcher will depend on as options that each of our players Jawwal and Ooredoo Palestine will follow:

- 1. Spend as much as possible: sets aside just enough money to fund operations, are popular with startups that see a positive return on investment on their advertising spend
- 2. A percentage of sales: allocating a specific percentage based on the previous year's total gross sales or average sales. It also assumes that sales are directly linked to advertising.
- 3. Spend what the competition spends: adhering to the industry average for advertising costs.
- **4.** Budget based on goals and tasks: Decide on objectives and then the resources needed to achieve them.
- Select the best strategy that each competitor should follow depend on the other behavior.
- Which strategy achieves Nash equilibrium?





(*J* is red color, *O* is blue color, for each player for alternative strategies available and represented by the branches, twigs from the nods Pair numbers at the end of each node represents the payoff for the players)

Marketing is an administrative process aimed at introducing customers to services and commodities. There are several ways to help the success of marketing: Advertisements, public relations, sales centers. In this case, the focus will be on "advertising" because it is one of the oldest means of marketing; it is considered one of the most important marketing

methods, and a large financial budget is allocated to it in the promotion of goods and services.

Assume that each of Jawwal and Ooredoo Palestine allocated a budget for advertising in which they estimate a promotional expenditure over a certain period of time, each one of them has four options for advertisements: newspaper, website, flyers, and radio.

- Which of the previous advertising methods achieve the highest return of the two companies?
- What is the optimal strategy that both companies will pursue in order to achieve Nash equilibrium?

Figure 8 Solution by Gambit Design by the researcher





Figure 9Breaking down Markiting (J&O) Solution by Gambit

(J is red color, O is blue color, for each player for alternative strategies available and represented by the branches twigs from the nods Pair numbers at the end of each node represents the payoff for the players, the dark color of the branches that indicate the means of advertising / radio are the best the best strategy with the highest payoff)

the mean of advertisement/ radio is the dominant strategy with the highest payoff.

4.7 Case Four: Utility analysis:

One of the Palestinian banks wanted to purchase telecommunications packages for his manager's category. The Director of the Logistics Support Department contacted both Jawwal and Ooredoo Palestine. Each company submitted its offer to the employees as follows:

- Jawwal offers:

Hala programs:

Hala 150:

- You will receive 150 free minutes each month from Jawwal to Jawwal and from Jawwal to Paltel
- You will be able to select two numbers and make calls at very low prices through the best service
- You will be given the opportunity to choose the device you prefer and pay the price on the invoice.
- You will be able to subscribe to the most valuable service to call international at a special price.

All The prices of calls listed in the tables below are taken from the offers published on the company's website.

Price	Call direction
0.60 price per minute. (each minute is 90 seconds)	Jawwal – Jawwal
0.59 Normal time 0.49 Reduced time	Jawwal – PALTEL
0.65	Jawwal – other Palestinian networks
0.79	Jawwal – Israeli networks
0.79	Jawwal- Israeli Cellular

Table 8 Jawwal offers Local call prices: Hala programs

The price of this package is 59 NIS

Hala 350:

- You will receive 350 free minutes each month from Jawwal to Jawwal and from Jawwal to Paltel.
- You will be able to choose two numbers and make calls at very low prices through the best service.
- You will get the chance to choose the device you prefer and pay for it on the invoice.

Table 9 Jawwal offers Local call prices 2: Hala programs:

Call direction	Jawwal	PALTEL	Other network	Palestinian	Israeli Cellular
The price in normal time /minute	0.34	0.39	0.55		0.69
The price at discount time /minute	0.34	0.39	0.55		0.69

The price of this package is 109 NIS

Hala 550:

- You will get 550 free minutes each month from Jawwal to Jawwal and from Jawwal to Paltel.
- You will be able to choose two numbers and make calls at very low prices through the best service.
- > You will get the chance to choose the device you prefer and pay for it on the invoice.

Table 10 Jawwal offers Local call prices 3: Hala programs:

Call direction	Jawwal	PALTEL	Other network	Palestinian	Israeli Cellular
The price in normal time /minute	0.34	0.39	0.55		0.69
The price at discount time /minute	0.34	0.39	0.55		0.69

The price of this package is 159 NIS

- Ooredoo Palestine offers:

Super comprehensive:

- > 700 minutes towards all networks
- Unlimited minutes towards Jordanian networks
- Calls towards 51 countries within the minutes of the program
- Unlimited minutes toward a single custom number
- > 50 minutes towards Ooredoo while roaming on the Cellcom
- ➤ The package price is 95 NIS

Super comprehensive 2:

- ➢ 450 minutes towards all networks
- Unlimited minutes towards Jordanian networks
- > Calls towards 51 countries within the minutes of the program
- ▶ 50 minutes towards Ooredoo Palestine while roaming on the Cellcom.
- ➤ The package price is 75 NIS

Super comprehensive 3:

- ➢ 300 minutes towards all networks
- 300 additional minutes towards Jordanian networks
- ➤ The package price is 55 NIS

The price table below is standard for all programs:

All The prices of calls listed in the tables below are taken from the offers published on the company's website.

Call direction	Price
Ooredoo Palestine –Ooredoo Palestine	0.43
Ooredoo Palestine – other Palestinian networks	0.59
Ooredoo Palestine- Jordanian networks	0.85
Ooredoo palestine- Israeli Cellular	0.59

 Table 11 Ooredoo
 offers Local call prices Design by the researcher

After the Director of the Logistics Department received the previous offers he wanted to take the best offer suitable for the bank to give the lowest expected monthly cost, which estimated the duration of the use of calls by managers' category with the following probabilities:

Table 12estimated probabilities for duration of the use of calls by managers Design by the researcher

Time	Probabilities
150 minutes	0.01
300 minutes	0.05
350 minutes	0.10
450 minutes	0.20
550 minutes	0.30
700 minutes	0.34

• Solution by DPL:

Figure 10 Utility Analysis Design by the researcher



The best decision that the manager of logistic support department should take is to subscribe with Jawwal under the program Hala 550

After the researcher analyzed the previous decisions of the Director of the Department of Logistics support in the bank to get the desired level of utility and also reduce the costs to be paid by the bank, but the question now is what is the relationship between the rest of the offers from Jawwal and Ooredoo Palestine with total and marginal utility of the consumer?

In order to answer that question, we have to base ourselves on a utility theory that helps to explain why the demand curve descends down, as the greater the quantity consumed of a commodity, the marginal utility of that commodity decreases.

The marginal utility can be defined as the amount of additional satisfaction the consumer receives as a result of consumption of an additional unit of the commodity; it is the change in total benefit due to the consumption of one additional unit of the commodity.(Economic dictionary Hassan Najafi, Baghdad. Publishing House, Local Administration Press 1977)

$$\mathbf{MU} = \Delta \mathbf{TU} \div \Delta \mathbf{Q} \ \mathbf{(4)}$$

The table below illustrates the marginal utility for each Jawwal and Ooredoo Palestine customers

:(The quantity here refers to a doubling of calls minutes provided by the service provider 1=100)

Quantity (calls minutes)	Total utility	Marginal utility
1	100	100
2	200	100
3	250	50
4	270	20
5	300	30
6	350	50
7	370	20
8	370	0
9	200	-170
10	150	-50

Table 13Total and Marginal utility Design by the researcher

From the above diagram, we can confirm that the more total benefit from the number of minutes of contact provided by the service providers, the lower the marginal benefit of the consumer. The continuity of both Jawwal and Ooredoo Palestine by offering more minutes for the calls packages does not add a competitive advantage. The consumer will not pay more money for more calls minutes that he will not use, that is, he has reached saturation by exploiting the offer which provides 1000 minutes of calls maximum

4.8 Financial analyses:

The researcher used the financial analysis and forecasting software (Softex) to analyze the financial statements of both Jawwal company and Ooredo Palestine for the purpose of measuring the behavior of the two companies over the course of two consecutive years (2016-2017) and indicators that reflect that the two companies followed some type of strategic games without their full knowledge of it.

These financial statements are:

- Balance sheet.
- income statements.
- Cash flow statement.

The net profit of Jawwal Company for the years 2016 and 2017 was \$ 112,976,022 and \$ 99435825 respectively, while earnings per share for the year 2017 was 0.76\$ compared to 0.86\$ for the year 2016, also the consolidated operating revenues increased by 0.7% to reach 472,073,343 \$ for the year 2017 compared to 468,829,337 \$ for the year 2016.In addition to that all of the net income, gross profit, operating profit and EBITDA were 21.1%, 84.1%, 20.9%, 36.5% respectively.

The decline in the consolidated profits of Paltel group is due to the financial implications that accompanied the renewal of the licenses of Paltel and Jawwal by the end of 2016.

<u>Investment results</u>: The value of cash dividends on the investments of the Paltel Group in other companies increased, in addition to the increase in the Company's share of the profits of the associated companies during 2017 compared to 2016.

<u>Change in subscriber numbers:</u> The number of prepaid subscribers increased from 2584 thousand subscribers in 2016 to 2609 thousand subscribers in 2017. While the number of postpaid subscribers increased from 351 thousand subscribers in 2016 to 375 thousand subscribers in 2017. However, the average monthly revenue per subscriber fell to 2017.

The financial statements analyses indicated that there was no change in the capital of the company where it remained as it is 131652000 JD as follows:

Number of shares offered for subscription = 1,165,000,000 shares

Nominal value per share = JD 1

The Ordinary General Assembly approved in its meeting held on 05/04/2017 the distribution of cash dividends to shareholders by 40% of the value of one share for the year 2016, where the total cash dividends was 52,620,000 JD.

Ooredo Palestine Subscribers increased to more than one million subscribers at the end of 2017, compared with 773 thousand subscribers at the end of 2016 by a rise of 31%, for that the company's market share increased to 25% by the end of 2017, and the total revenues of the company rose to reach \$ 86 million at the end of 2017, compared with \$ 84 million at the end of 2016, and EBITDA reached 19 million dollars.

The company's capital has been raised from \$258 million, to \$293 million, through the launch of 35 million shares for the general secondary subscription of the shareholders of the company, for the purpose of achieving the strategic objective of expanding investment activities in Palestine coinciding with the company's entry into the Gaza Strip and the development of services of the third generation well in the West Bank.

The number of exhibitions of the company Ooredo Palestine 10 exhibitions, distributed on the main cities in the West Bank, and opened 6 exhibitions in the cities of the Gaza Strip, the company has 135 agents deployed in the cities of the West Bank, and 153 in the Gaza Strip.

The company achieved net income of (\$ 6.6) million at 2017 compared to net income of (\$ 1.5) million for the same period at 2016; this is due to the company's bearing of expenses significant preparations for the start-up in the Gaza Strip and preparations for the launch of 3G services during 2017, this is expected as result of these investments.

Chapter Five

Summary and Recommendations

5.1. Conclusion

Despite the right of cellular operators to adapt prices inside the network different from prices outside the network, but the difference between the two prices should be reasonable or would be a barrier to fair competition as it leads to the reluctance of Jawwal subscribers to contact Ooredoo Palestine subscribers and thus promotes the principle of oligopoly, and deprivation of the people, thus hampering the growth of the Palestinian economy. The rising price of mobile calls towards Ooredoo Palestine is hampering the continuity of subscribers between two Palestinian companies, which were originally found to facilitate and improve telecommunications services and upgrade the Palestinian telecommunications sector.

A game with imperfect information is a good framework in the Palestine telecommunications sector, because the users of a network seldom know the exact actions of the other users. However, it is often more convenient to assume perfect information.

PALTEL achieves the majority of its revenues and profits through its mobile phone. This is due to a number of reasons, as the appropriateness of mobile technology for the modern lifestyle, as well as the neglect of the company to invest in fixed lines.

The entry of Ooredo Palestine (which was known as al –Wataniya mobile) to the Palestinian cellular market constituted a quantum leap for the telecommunications sector. However, this step was not complete due to the inability of the Palestinian National Authority to grant cellular operators sufficient frequencies controlled by the Israeli side, especially 3G frequencies, which allow subscribers to access the Internet.

The legal environment governing the Palestinian telecommunications sector is unclear and incomplete, which could negatively affect the entry of new investments into the telecommunications sector. It also leads to waste of public money because the Palestinian Ministry of Communications and Information Technology is not able to monitor and regulate the telecommunications sector at an adequate level and in the manner expected by the investor.

From the previous analyses in chapter 4, the researcher conclude to classify the game played by Jawwal and Ooredoo Palestine as a *Two - person game* in terms of the number of players each of Jawwal and Ooredoo Palestine are rational players and they are also the only competitors in the oligopoly market for the Palestinian telecommunications sector, in terms of strategy it is mixed strategy game; because there are randomly determined choices for each player, for example in the case of pricing decision, each company have many strategies (choices) to follow : raise prices, reduce prices, or keep prices unchanged, and in terms of the result , where that is a cooperation between the two companies to reduce the price, the profit is equal for both parties, so that the game is non - zero game and the players payoff is equal, but when any company decides .to detect and raise the price , the game will be zero sum game , in addition to that the game between the players are Dynamic Games in its extensive form, the game also is a Sequential-Move in terms of play type, in which the movements or selection of strategies by one player the opponent knows and then works on it.

Jawwal Company represents the Stackelberg model, it plays the role of leader who chooses a strategy first, and then the follower "Ooredo Palestine" observes this decision and makes their own strategy choice. Jawwal intuitively choosed the best possible point of the best Ooredo Palestine response function; there for the Jawwal choosed Nash Equilibrium, and got the advantage to be at least as well off as they would be in Nash Equilibrium.

It is difficult to say that both Jawwal and Ooredoo Palestine have been able to achieve their mission, and their vision completely, that the lack of available alternatives for the Palestinian consumer are what prompted him to submit to the high prices offered by the two companies to the prices of domestic and international calls, or some other offers that involve misleading him.

Ooredo Palestine offers many programs through which it has access to the Palestinian citizen throughout West Bank, and has formed a subscriber base that has reached more than one million subscribers.

Ooredo Palestine is working to promote its research and development investments to offer the best products and services. This is represented by many interactive campaigns and distinctive programs launched by the company recently, relying on specialized marketing research that are carried out continuously throughout the year, and opinions of
subscribers to evaluate their services and products, and opinion polls to understand more the needs of the target group .

By tracking the behavior of the two companies, the researcher realized that each of the two companies is playing a zero-sum game; since any increase in the market share of one of the two competitive companies represents a decrease in the market share of the other company, and part of the operating costs paid by one of the two companies caused by the temptation of one company to catch up the other. For example the cost of launching 3G services lead to significant losses increased from \$ 1.5 million in 2016 to \$ 6.6 million in 2017 for Ooredo Palestine . The researcher notes here that the behavior of Ooredo Palestine is to follow a Sequential dynamic game; because Jawwal has been the only company in the wireless communications sector in Palestine for over two decades and it is naturally that Ooredo Palestine pursues its marketing and strategic approach to control what remain from the Palestinian market.

The ambition of the two companies to introduce the fourth generation service to the Palestinian telecommunications sector following their vision to keep pace with developments and provide the best services to the Palestinian consumer will also be reflected in the future financial statements, especially on the items of operating costs, capital, net income, gross profit and EBITDA.

In terms of the two companies' competitive behavior associated with the social responsibility, the two companies follow a series of dynamic games; both companies sponsor the Palestinian football team, support the Hebron Rehabilitation Committee and sponsor cultural and community activities, which will increase the operating cost and this will be reflected In cash flow statements.

Game theory remains the best in giving the true meaning of the decision making process in the Palestinian oligopolistic market, specifically the telecommunications sector, where the information supported by numbers and probability for these numbers, which makes the decision measurable, and thus more accurate and objective than other decision-making methods.

5.2 .Recommendations

- The cooperative games lead to a better outcome, than the non-cooperative games for the consumer. If both Jawwal and Ooredoo Palestine cooperate in a legal framework imposed by the Palestinian Ministry of Communications and Technology, this will reflect positively on the pricing situation and services provided to the customer.
- For the purpose of minimizing the risk of investment, Jawwal and Ooredoo Palestine are required to diversify their investment portfolio, so that they do not resort to the same type of investment every time they wish to maximize their profits.
- When creating the advertising budget, each of Jawwal and Ooredoo Palestine must weigh the trade-offs between spending one additional advertising dollar by the amount of revenue that the dollar will bring in as revenue.
- The improvement on the telecommunication offers with high demand from the Palestinian consumer is the optimal way to achieve profits for Jawwal and Ooredoo Palestine, rather than offering unsolicited offers, as the consumer has reached satisfaction at an earlier stage.
- The construction of the strategic plan by Jawwal or Ooredoo Palestine does not have to be considered in any case to the behavior of the other party, because of the differences in the financial position of both companies, and Jawwal's position in the market and its acquisition of the largest share of the market share.
- More research and studies on the application of game theory should be conducted by Palestinian researchers about the different aspects of the Palestinian economy.
- Developing the skills and abilities of decision makers in each Jawwal and Ooredo Palestine in the field of game theory and its economic applications.
- Drafting legislation that meets the requirements of the privilege and its definition, in addition to identifying oligopoly companies in the Palestinian market in a clear legal manner, in order to enable the Palestinian business environment, which is an important part of the market regulation process.

- Prices must be reduced both inside and outside the network and interconnection tariff between Jawwal and Ooredo Palestine, as well as the price of (Termination calls) per minute for mobile phone.
- The transfer of numbers between Jawwal and Orado Palestine should be allowed, and the price of interconnection should be standardized and controlled, and the large differences between the price of the call should not be allowed, in order to reduce the dominance and control of competitors in the Palestinian telecommunications market and to allow the Ministry of Communications and Information Technology to do that.

5.3. Future studies

The researcher believes that the science of game theory is a new science in the Palestinian society, despite its great importance in achieving optimal results in maximizing profits, reducing losses and avoiding risks. The term gains and losses does not only concern aspects of business and economy but extends beyond political science, social science, environmental and biology science.

Accordingly, the researcher proposes the following future studies:

Finance and economy:

• Palestinian Stock market:

Investors and business leaders in the markets are always looking for good trading tools and methods to develop their business and increase their profits. It is therefore important to study historical market data to find the correct and logical trends that investors can exploit correctly

• Palestinian Banks sector:

There are many banks operating in the financial sector in the West Bank and Gaza Strip, which compete continuously and seek to develop their banking products to consumers. In the face of this ongoing competition, there is a need for an effective strategic planning tool used in this sector for organizing competition, maximizing the competitors profits, and provide the best financial products to the Palestinian consumer.

Therefore, the researcher believes that it is very important to highlight the competitive aspects of the banking sector, which relate to interest rates and commissions in particular through conducting intensive research and studies that seek, through their results, to reduce the dominance of some banks in Palestine, which play in reality a zero-sum game.

• Investments trends:

Game theory could be a perfect framework for investment projects in which both the government and the private sector are the players. For example, building a new airport or constructing a seaport, a new residential suburb, a hospital, a school, railway construction or infrastructure development.

• Palestinian Social Security Law:

The Palestinian Social Security Law has recently raised a conflict between those opposed to this law who are working in the private sector on the one hand and the Palestinian government on the other and the continuation of this conflict may have negative consequences on the Palestinian economy and community welfare programs. In this context, the researcher believes that studies should be conducted on the use of game theory in solving this conflict in order to reach the stage of equilibrium in which the mutual profit of the parties.

Political science:

The game theory is widely used in the field of political science, since it based primarily on the choice of options in decision-making. This theory can help decision makers to make decisions at the level of bilateral relations with countries; relations with the United States of America and the European countries, especially those countries that play a key role in resolving the Palestinian-Israeli conflict.

At the local level, the theory of the game can also contribute to the expansion of options for the Palestinian leadership in resolving the internal conflict (Palestinian division). The researcher therefore advises to conduct in-depth studies on the application of game theory in the conflict between the Palestinian National Authority and Hamas in order to understand the dimensions of Options or steps to end this division

Criminal and judicial issues:

The prisoner's dilemma is one of the most common examples of game theory, depending on that the researcher believes that it is possible to build a model based on the this theory by prison administrations, criminal investigators and security men, because this method leads to more accurate and safer results and does not affect the dignity or integrity of the accused in a crime or a security issue.

In terms of the internal security of the country in general, studies can be conducted on the subject of hostage-taking and confronting terrorist groups that threaten the occupants. For example, when a gang or terrorist group seizes a certain geographical area of the state and holds part of the population hostage, This insurgency is either a mass attack or aerial bombardment of the site, and based on these two options the corresponding returns can be determined for strategies.

Sports games:

Game theory has been linked to will known games as checkers, XO, and poker, and the researcher believes that it is possible to link this theory to sports games on a wider scale, such as those games, which results in a country to get the World Cup such as football matches, and The Olympic games. As these sports consist of several teams or several players compete each other to win the final payment (gold medal or silver or bronze or even the World Cup).

Anyone who want to conduct studies in this field can track the behavior of the opposing team over a period of time in order to build strategies (to defend or attack) based on that behavior, which avoid this team to fall in the same previous mistakes or choose the same strategies in the previous play and thus maximize the payoff. The researcher thought that sport games are kind of non-cooperative zero-sum games.

References

- Abreud, (1986) <u>Extremal Equilibria of Oligopolistic Supergames</u>. Journal of Economic Theory, Vol. 39.
- Anthony Kelly, (2003) <u>Decision Making Using Game Theory: An Introduction</u> <u>for Managers</u>, Cambridge university press
- Ap Krzysztof , (2011) <u>Strategic games</u> , University of Warsaw in Poland viewed on 05th November , 2018 from <u>https://homepages.cwi.nl/~apt/stra/stra10.pdf</u>
- Avenhaus Rudolf , CantyMorton (1996), <u>Compliance Quantified</u>, Cambridge University Press, UK
- Aumann, J , (1971) ,<u>Advances in Game Theory 627</u>, second printing , Princeton university press ,USA
- Barri , Adnan (2015) <u>Introduction to Decision Analysis The theory of matches</u> <u>:by using Treeplan and Excel Solver SageMath, Gambit, and Silver Decisions</u>, al king suaid university ,Riyadh, Saudi Arabia.
- Bayar, Guzin (2003) <u>Corruption-a game theoretical analysis</u>, athesis submitted to the graduate school of social sciences of Middle East technical university, Turkey
- Bertrand Munier (2008) experimenting in economics or management, Journal of Political Economy Vol (111)
- Binmore Ken, (2007), <u>Game Theory a very Short Introduction</u>, University of OxfordNew York ,USA.
- Cellinia Roberto, Lambertini Luca (2005) <u>A differential game approach to</u> <u>investment in product differentiation</u>, Dipartimento di Scienze Economiche, Università degli Studi di Bologna, Strada Maggiore 45, 40125 Bologna, Italy
- Chah Kenneth , Elizabeth Tabetando , Kibuh Primus (2012) <u>a study on entry modes in an</u> <u>oligopolistic market situation</u> , Linnaeus University , Sweden
- 12. Consortium for Mathematics and Its Applications.(1996). For all practical purposes: Introduction to contemporary mathematics, 4th ed. New York: W.H. Freeman and Company/
- Colman, A.M. (1982) Game Theory and Experimental Games: The Study of Strategic Interaction ,Oxford, PergamonPress,UK..
- Chatterjee, Kalyan, Samuelson, William F (Eds.) (2001) game theory and business applications, Kluwer Academic Publishers, Dordrecht.
- Christiansen, Bryan, Basligan Muslm (2014) <u>Economic Behavior, Game Theory,</u> and Technology in Emerging Markets. business science reference IGI global ,USA

- Coccorese Paolo (2010) <u>Oligopoly and game theory</u>, Vittorio Cafagna's studies Università degli Studi di Salerno Fisciano, Campania, Italy
- 17. Connor , john, (2001) <u>Global Price Fixing: Our Customers Are the Enemy</u> <u>Springer Science & Business Media</u>, USA.
- Dammey Eric van, Hurkens Sjaak (1998) <u>Endogenous Stackelberg Leadership</u>, published thesis, reviewed in October 2018, department of economic university Pombeu ,Spain
- 15 Datamax-O'Neil, 2013 ,DPL manual, reviewed in August 2018 see the pdf manual link https://www.honeywellaidc.com/en/-/media/en/files.../DPL_88-2360-01_B.pdf.
- 20. Dockner, Eds.(,2000), <u>Differential Games in Economics and Management</u> <u>Science</u>, Cambridge University Press, UK.
- Dragasevic Zdenka, Rakocevic Svetlana, Glisevic Nevenka (2001) <u>The application</u> of the game theory to the oligopolistic, market Faculty of Economics Jovana Tomasevica, Podgorica Montenegro
- 22. Eatwel, John, Milgate Murray, Peter Newman, (Eds.) (1989) Game theory, New York
- 23. Erich Prisner (2014) <u>Game Theory Through Examples Franklin University Switzerland</u>, Council on Publications and Communications, MAA Service Center Washington, DC
- 24. Friedman, J. (1977) <u>Oligopoly and the Theory of Games</u>, Amsterdam : North Holland.
- 25. Fetchenhauer. & others (2006) <u>Solidarity and Prosocial Behavior</u>: An Integration of Sociological and Psychological Perspectives , university of Groningen, Netherlands
- 26. Gibbons Robert (1997) <u>An Introduction to Applicable Game Theory</u>: Vol. 11, No. 1 American Economic Association, USA
- 27. Guillermo Valencia Arana, Currency Wars (2014)<u>" The Lack of a Global Monetary</u> <u>System</u>", A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master in Management, Technology, and Economics, master thesis, Zürich.
- Ibrahim. Nabeel, BaqayyatAnam, 1999Operations Research: <u>Computer Algorithms</u> and <u>Software</u>, Dar Wael Publishing, Jordan,
- 29. Jamil misef , hejazia hmaad 2017 , <u>Promote franchise policies as a tool to regulate</u> <u>the market</u> , MAS , Palestine .
- 30. Juha Leino (2003) Master's thesis <u>"Applications of Game Theory in Ad Hoc</u> <u>Networks "Helsinki university of technology</u>, Finland

- 31. Horn Henrik , Persson Lars (1999) <u>The Equilibrium Ownership of an</u> <u>International Oligopoly</u>,center of economic policy research , EU
- 32. Kargman Paul , Wells Robin , (2006) Eco<u>nomics Worth</u>, Published Palgrave Macmillan , New York .
- Kreps, David, (1990) <u>Game Theory and Economic Modelling</u>, Oxford University Press, UK.
- Kamienmorton, Schwartz, Nancy (1981), <u>Dynamic Optimization</u>: The Calculus of Variations and Optimal Control in Economics and Management. North Holland Publishing Amsterdam.
- 35. Leino, Juha (2003) <u>Applications of Game Theory</u>, Master's thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Technology Helsinki University of Technology, Finland
- 36. Majalat alwaqayie alfilastinia (2015), <u>Decree Law No. (5) for the year 2015 on the</u> <u>amendment of the Income Tax Law No. (8) for the year 2011</u>, Magazine number 112, Palestine.
- 37. Mandy David Producers, (2016) <u>Consumers, and Partial Equilibrium</u>, University of Missouri, Columbia, MO, USA .
- 38. Marc Feeley, (2016) Manual of Gambit ,Reviewed in October 2018, see the pdf manual link : <u>http://www.iro.umontreal.ca/~gambit/doc/gambit.pdf</u>
- Motty Perry and Philip J. Reny4 (Jul., 1994) <u>A Noncooperative View of Coalition</u>, Formation and the Core Vol. 62 ,Econometrica, JOURNAL ARTICLE, Published by: The Econometric Society.
- 40. Marshall v Ecklund,(1992) ,<u>Using Game Theory to Model Strategic Decision</u> <u>Making in the Contemporary Operating Environment</u>, United States Military Academy USA New York.
- Najjar, Farid Ragheb (2009) <u>Operations Research in Management</u>, University House for Publishing and Distribution, Alexandria.
- 42. Nash johan, (1950) Equilibrium points in n-person games. Proc Nat AcadSci USA
- Neumann John, Morgenstern Oskar (1947) <u>Theory of games and economic</u> <u>behavior</u>. 2nd ed, Princeton, NJ, Princeton University Press.
- 44. Nilsson, Eric. (2004) <u>Capitalism: Power, Profits, and Human Flourishing</u>, California State University, San Bernardino San Bernardino, CA.

- 45. Nayyar Shivani (2009) **Essays on repeated games**, A dissertation presented to the faculty of Princeton university in candidacy for the degree of doctor of philosophy
- Okuguchi Pundalik Prakash (1977) <u>game theory and coalition formation</u>, Cornell University New York .
- 47. Osborne j Martin, (2002) An introduction to game theory, Oxford University Press
- 48. Prakash P Shenoy,(1980) <u>Committee Decision Making: A Game Theoretical</u>
 <u>Approach</u>, The Institute of Management Sciences, Vol. 26, No. 4
- 49. Porter, Robert (2005) **Detecting Collusion Department of Economics**, Northwestern University, Evanston, Illinois, U.S.A
- 50. Puu tonu (2011) Oligopoly: Old Ends New Means . Springer, new York
- Quiggin John , Menezes Flavio (2007) <u>Games without Rules</u> , Volume 63, Issue 4, School of EconomicsUniversity of Queensland Brisbane Australia
- 52. Raffaelli Enrico 1995 : <u>Oligopolies and Antitrust Law Volume 19</u>, Issue 3 Article
 6, Fordham International Law Journal ,USA.
- 53. Shi, Hong (2011) <u>"A Game Theoretic Approach in Green Supply Chain</u> <u>Management "</u> master Thesis Submitted to the Faculty of Graduate Studies, university of Windsor, Ontario, Canada.
- Simaan J. B., Jr Cruz, (1973), <u>the Stackelberg strategy in nonzero-sum games</u>, Optimization Theory and Applications, N .11
- 55. Sloman John · Norris Keith· Garrett Dean (2014) : <u>principle of economic 4</u> <u>edition</u>, P.Ed Australia;
- 56. Song Ruoyu 2015 <u>Game theoretic optimization for product line</u> <u>evolution</u>. A Master Thesis Presented to The Academic Faculty Georgia Institute of Technology
- 57. Stolwijk A. 2010 <u>Solution Concepts in Cooperative Game Theory Master's</u> <u>Thesis</u>, Mathematisch Instituut, Universiteit Leiden Netherlands
- 58. Steven J. Brams and Philip D. Straffin Jr (1979)., <u>Prisoner's Dilemma and</u> professional sports drafts, American Mathematical Monthly N.88
- 59. Straffin, Phillip. (1996). <u>Game theory and strategy. Washington</u>, D.C.: The Mathematical Association of America.USA.
- 60. Tamer Basar, Geert Jan Olsder (1998) <u>Dynamic Noncooperative Game Theory:</u>
 <u>Second Edition</u>, academic press, New York

- Theodore L. Turocy, Bernhard von Stengel, (2001) <u>Game Theory</u>, CDAM Research Report LSE-CDAM, online available , reviewed in October 2018 http://www.cdam.lse.ac.uk/Reports/Files/cdam-2001-09.pdf.
- Varian , Hal R (1980) <u>model of sales</u>. American Economic Association Pennsylvania USA
- 63. Zagare ,Frank, (2014) <u>A Game-Theoretic History of the Cuban Missile Crisis</u>, viewed on 07th November , 2018 from
- 64. <u>https://www.google.com/search?q=1+Zagare+%2CFrank%2C+2014+A+Game-</u> Theoretic+History+of+the+Cuban+Missile+Crisis&rlz=1C1CHWL_enPS765PS765& oq=1+Zagare+%2CFrank%2C+2014+A+Game-Theoretic+History+of+the+Cuban+Missile+Crisis&aqs=chrome..69i57.507j0j4&sour ceid=chrome&ie=UTF-8

Websites

- 1- www.dspace.univ-tlemcen.dz/bitstream/112/380/6/Chapitre3.pdf
- 2- www.jawwal.ps
- 3- www. https://www.ooredoo.ps/ar
- 4- www,wafa.ps
- 5- <u>www.mas.ps</u>
- 6- https://www.nobelprize.org/prizes/economic-sciences/1994/press-release/
- 7- https://www.comap.com/cgi-bin/search.cgi
- 8- https://www.oecd.org/daf/competition/1920526.pdf
- 9- https://www.pmi.org/

ANNEX

List of shapes and symbols

symbol	definition
Ø	The empty sequence
Н	History
Z	The set of terminal histories
P(h)	The player function being the player who takes an action
	after the history
UI	utility function
<u> </u>	less than or equal to
a ^k	exponent
∞	infinity symbol
f (x)	function of x
Δ	change / difference
Σ	summation - sum of all values in range of series
(NMTC)	National Mobile Telecommunications Company
(PNA)	Palestinian National Authority
(PIF)	The Palestine Investment Fund
P(A)	probability function
P(A B)	probability of event A given event B occurred
a ∈A	element of, belongs to
N	natural numbers / whole numbers set
Ζ	integer numbers set
=	equality
>	greater than
<	less than
±	both plus and minus operations
<i>≠</i>	inequality
$A \cap B$	intersection
$A \cup B$	union
$A \subset B A$	is a subset of B, but A is not equal to B
EBITDA	earnings before interests, taxes, depreciation, and amortization

ملخص

هدفت هذه الدراسة إلى تسليط الضوءعلى أهمية استخدام نظرية المباريات كأداة رياضية في اتخاذ القرار في سوق احتكار القلة الفلسطيني – قطاع الإتصالات، وذلك كونها تعطي نتائج أكثر دقة من آليات اتخاذ القرارات الأخرى المستخدمة ، وهذا بالضرورة ينعكس بشكل ايجابي على الأرباح والإيرادات وسعر سهم الشركة ، إضافة إلى التقليل من المخاطر التي قد تتعرض لها الشركة نتيجة لاتخاذ قرار خاطئ أو غير مبني على أسس سليمة.

وقد أوضحت هذه الدراسة بموجب معطيات رقمية مأخوذة من القوائم المالية الموحدة والتقارير السنوية المنشورة لكل من شركتي جوال وشركة اوريدو فلسطين مدى قدرة نظرية المباريات على استخدام هذه البيانات ووضعها في إطار من حالات الطبيعة واحتمال وقوع هذه الحالات ، في بلورة قرار استراتيجي صائب يعظم الربح ويقلل المخاطر.

وأجابت هذه الدراسة على مجموعة من الأسئلة التي تدور حول سوق احتكار القلة في قطاع الاتصالات الفلسطيني، إضافة إلى الأسئلة المتعلقة بنظرية المباريات كتعريفها ونشأتها وتطورها وأقسامها ، وماهو توازن ناش الذي يعتبر المحور الأساسي لنظرية المباريات.

واستخدمت الدراسة كل من برنامج Gambit و DPL، كاداتين دقيقتين في تحليل نظرية المباريات وشجرة القرار حيث تم الحصول على البيانات المطلوب ادخالها على هذين البرنامجين من خلال البيانات المالية المنشورة لفترة عامين متتاليين لكل من شركة جوال واوريدو فلسطين ، بحيث تم التعرض لأربع حالات دراسية مشتركة بين الشركتين وهي : آليات تسعير المكالمات ،توجهات الإستثمار ، زيادة نسبة العائد على المبيعات ، وقضية تتعلق بالمستهلك الفلسطيني في تحديد أي العروض المقدمة من قبل الشركتين تحقق له القدر المطلوب من المنفعة ، وفي هذه الأخيرة تم الحديث عن حساب المنفعة الكلية والمنفعة الحدية وارتباطهما بمستقبل العروض المقدمة من كلا الشركتين .

وفي النهاية تم تقديم التوصيات لصناع القرار في كل من الشركتين المتنافستين لأغراض استخدام هذه الأداة الدقيقة وتطبيقها في كافة المجالات التي تحتاج الى اتخاذ قرار استراتيجي يهدف إلى تحقيق التقدم والتطور الدائم لقطاع الإتصالات الفلسطيني وتحقيق المنافسة العادلة مع الحفاظ على حقوق المستهلك الفلسطينى وتقديم خدمات الإتصال له على أتم وجه .

الكلمات الإفتتاحية: نظرية المباريات، سوق احتكار القلة في قطاع الاتصالات الفلسطيني، قطاع الاتصالات، جوال، واوريدو فلسطين