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The Geo-Economic and Geo-Energy Pillar of Power as a Geopolitical Decision Making Factor within the Dynamics of the Southeastern Europe Geopolitical Complex

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Abstract

The "geopolitical complex" of Southeastern Europe, as a sub-system of the Europe-Asia-Middle East system, highlights its geo-economic dimension since the discovery of hydrocarbons in this geographical area has become a major geopolitical factor, resulting to competitions, conflicts, and strategic alliances among different actors/players. In this context, the particular space and time play an essential role, since the decision-making process has become a vital determinant of the necessary geostrategic synthesis under conditions of uncertainty and risk. This article approaches the subject under consideration by applying quantitative decision-making methods under uncertainty and/or limited uncertainty (risk) conditions by actors/players of the region; it examines the choice of alternative strategies that highlight not only the maximization of the actors' geopolitical benefits but also provides added value to already formed strategic alliances. It also attempts to answer the question of how the construction of an LNG terminal can generate multiple benefits from its location and operation by presenting a theoretical model.

Keywords

geopolitical complex, geoeconomics, hydrocarbons, strategic alliances, geostrategic decision making

1. Introduction

All the phenomena of the current global reality seem to be in a state of rapid change and structural transformation. Everything seems to be in the middle of a transitional phase by seeking a new form of global balance and stability. Some scholars argue that this emerging phase can be called "new globalization" (Bhattacharya, Khanna, Schweizer, & Bijapurkar, 2017; Bremmer, 2014; Vlados, Deniozos, & Chatzinikolaou, 2018).

Overall, this newly emerging evolutionary context, which is in a state of intense and profound structural rebalancing—in a crisis phase—the individual actors, structures, and rules are changing drastically (Figure 1).

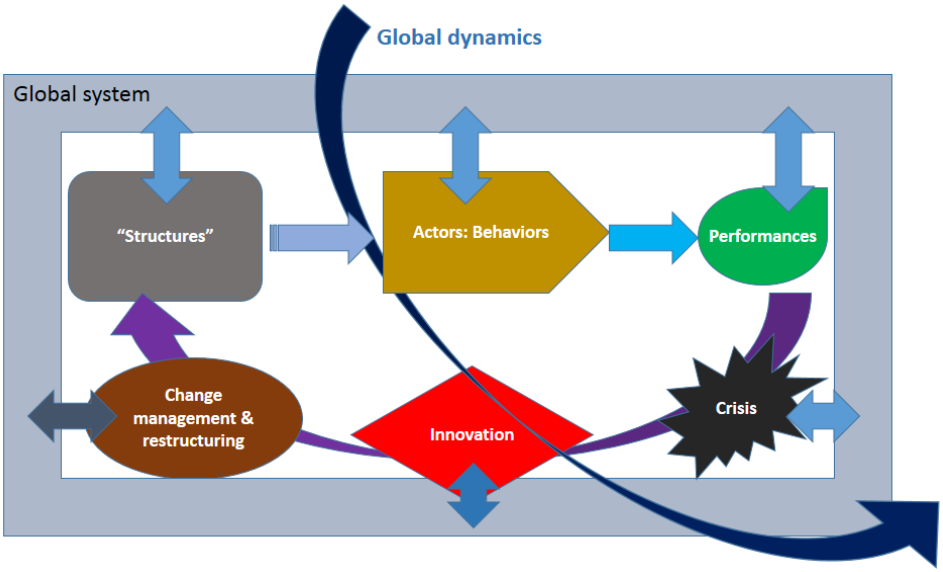


Figure 1. Structures, Behaviors, Performances, and Restructuring in the Global System (Βλάδος, 2017)

Within this global dynamics, specifically:

❖ The structures define the boundaries of the individual actors' behaviors, while these behaviors determine the performance achieved by every actor, hence their survival dynamics and development (Malecki, 2018; Reeves, Levin, & Ueda, 2016).

❖ In case the performances of the actors fall drastically and massively on a systematic base, their survival and individual development are in risk; in this context, the global-scale system enters into the crisis phase (Amable, 2017; Vlados, Deniozos, Chatzinikolaou, & Demertzis, 2018).

❖ The global system then seeks and, under certain conditions, achieves the necessary innovation—innovation perceivable in institutional and geopolitical terms (Kay, 2018; Vlados & Chatzinikolaou, 2019)—as a way out of its crisis; this, in turn, leads to the restructuring of global structures, on the basis of a successful change management. Therefore, a new cycle of global development opens (Gilles,

2004; Grinin, Korotayev, & Tausch, 2016).

❖ In this continuous process, each link of the chain determines and is being determined (at the same time, at any moment) by the dynamic world system (Knox, Agnew, & Mccarthy, 2014; Lenzen, Kanemoto, Moran, & Geschke, 2012).

A particularly interesting recent study (Laudicina & Peterson, 2016) illustrates the fact that the current form of globalization is at a significant crossroads, balancing between divergent forces and leading to a continuous increase of uncertainty: In particular, the authors suggest that globalization is currently facing a temporary halt (a hiatus). The climax of globalization is identified in 2007, while the global financial crisis of 2008-2009 is considered to have marked the transition to a new and prolonged phase of diminished growth—both for the global economy and international economic integration. According to the authors, a critical question that emerges is whether the system will grow again in cross-border movement of goods, services, capital, and people, or whether there will ultimately happen a fundamental change to the existing system's trajectory; a system that existed until the outbreak of the recession (known as the acceleration of globalization).

The writers want us to consider what the future of the global economic state of affairs is going to be. To this end, they distinguish four future socioeconomic situations/scenarios of global development, which they call (a) globalization 3.0, (b) polarization, (c) islandization, and (d) commonization, each one bearing its unique developmental prospects and implications.

At the same time, in one of the earliest in-depth approaches to the current global crisis—and one of the most interesting, to date—the US National Intelligence Council in the report entitled "Global Trends 2025" expressed without hesitations predictions about the gradual emergence of a "transformed world" (National Intelligence Council, 2008). In this study, in particular, the issue of global safety and security seems to be of crucial importance. As the report points out, one of the eight key-uncertainties for the future is whether an energy shift away from oil and gas—supported by improved energy storage, biofuels, and clean coal—will be completed by the year 2025. It also notes that an outcome of probable rising oil and gas prices is that major exporting countries, such as Russia and Iran, will significantly increase their levels of power and influence, projecting that Russia's GDP may reach the respective levels of the United Kingdom and France. On the contrary, a possible prolonged price downturn, which can potentially be supported by a shift toward new energy sources, can trigger a long-term recession for the energy producers as global and regional actors.

In these increasingly complex global conditions, the region of Southeastern Europe, due to its energy resources, constitutes a vital geographic and economic area for the system of international security (Cherp & Jewell, 2014; Sovacool & Saunders, 2014). The actors in the region, especially those countries that have natural reserves in their maritime zones, have to be forging strategic alliances (such as the Greece-Cyprus-Israel-Egypt alliance) in order to promote their strategic interests and reap the maximum geo-economic and geopolitical benefits. In this context, we understand that economic actors are called upon to make their decisions on the basis of strengthening their geopolitical power (Cohen,

1964; Grieco, 1988; Grygiel, 2006; Karkazis, Vidakis, & Baltos, 2014; Knutsen, 2014; Mackinder, 1904; Marklund, 2015; Neves, 2017; Thirlwell, 2010; Valieva, 2016).

This article attempts to approach this decision-making process through quantitative tools. In conditions of uncertainty and risk (Glancy, 2012; Slovic & Weber, 2002)—the continually changing and unstable international environment justifies these conditions—such tools are the Hurwicz, Savage (min-max regret), and Expected Value criteria. These quantitative tools make use and take into account external environmental conditions as their data, along with the geopolitical constants of the subjects they examine.

2. The Research Question

The geopolitical complex of Southeastern Europe (Daras & Mazis, 2015, 2017; Hamlen, 2013), as a sub-system of the Europe-Asia-Middle East system, highlights its geo-economic dimension, since the discovery of hydrocarbons in this geographical area has become a major geopolitical factor, resulting to competitions, conflicts, strategic alliances, and so forth, between different actors/players (Bajraktarevic, 2012; Kapur & Suri, 2014; Wigell & Vihma, 2016). As a consequence of all these events, the components of the actors' geopolitical power are redistributed within a dynamic process; in this context, the particular space and time play an essential role, since the decision-making process has become now a key determinant of the necessary geostrategic synthesis under conditions of uncertainty and/or risk (Ayoob, 2012; Lee, 2012; Riegl, 2013).

This grid of relations is not neutral and independent. It is directly related also to energy security (European Commission, 2014; Hu & Ge, 2014), which in turn also affects the redistribution of geo-economic and geopolitical power of the subsystem under study. Therefore, this article approaches the subject under consideration by applying quantitative decision-making methods under uncertainty and/or limited uncertainty (risk) conditions by actors/players of the region; it examines the choice of alternative strategies that will ensure not only the maximization of the actors' geopolitical benefits but also will provide added value to already formed strategic alliances. It also attempts to answer the question of how the construction of an LNG terminal can generate multiple benefits from its location and operation by presenting a theoretical model.

3. Methodology

In order to approach the subject and to answer the research question, we follow these particular steps:

- First of all, we review the literature of the article's subject, while trying to conceptually approach the terminology that composes the facets of this issue. Thus, we try to interpret the concepts of geo-economics, geopolitical pillar of power, geopolitical factor, geopolitical complex, and geostrategic synthesis.
- Consequently, we present the geopolitical and geo-economic data of the Southeastern Europe geopolitical complex; these are essentially interpretative variables that, on the one hand, contain

dynamic elements in terms of geographic and economic space and, on the other hand, interpret components of geopolitical power (expressed over geopolitical indicators).

- Next, the approach of using quantitative methods in decision-making takes place. We use the Hurwicz and Savage (min-max regret) criteria under uncertainty conditions and the Expected Value criterion, in order to fulfill the real purpose of maximization as the optimal decision between the actors' strategic alternatives.
- Besides, we calculate the expected values of perfect information; these ultimately highlight the added value of in-depth geopolitical analysis, since they reduce the decision-making costs and can trigger more high-quality decisions.
- The analysis concludes by presenting a theoretical model, which suggests that the location and operation of an LNG infrastructure produce multiplier effects on both regional investment and regional income (on the particular spatial unit is being installed).

4. Literature Review: Conceptual Approaches

The energy dynamics that developed recently in the geographic area of the Southeastern Mediterranean Sea due to the exploration and discovery of hydrocarbons also highlights the geo-economic and "geo-energy" dynamics of this area; this is a geopolitical factor that determines geostrategic options that trigger decision-making by actors-players of the region within the international context of antagonisms and conflicts (Kurecic, 2015; Sidorenko, 2015). The latter characterizes the contemporary chaotic international environment (Kotler & Caslione, 2009; Mayer, 2012). Therefore, it is of crucial importance to define first the concept of geo-economy.

Geo-economics, according to Edward Luttwak (1990), reflects the continuation of the confrontational international scene and the occurrence of competitive relations under the mantle of economic and trade competition. In other words, in geo-economic terms, the confrontational nature of the international system is now reduced to the level of economic means exploitation to achieve strategic goals (the national interest is also materialized under that particular reality). Edward Luttwak further defines geo-economics as a new form of primitive conflict between nations by using solely economic means. Luttwak's parallelism between the conflict of nations with the military (traditional) and geo-economic means is also very interesting. In the age of geo-economics, the invested industrial capital provided or guided by the state is the firepower, while the development of products through state subsidies is equivalent to the innovation of weapons systems, and the penetration of domestic firms in international markets with state support is the equivalent of establishing military bases in foreign territory and having diplomatic influence.

Paraphrasing Carl Von Clausewitz (1832), it can be said that geo-economics is, for the most part, the continuation of primitive competition between nations by new industrial means. Also, geopolitical analyst Savin (2016) points out:

"One of the modern researchers, Klaus Solberg Soilen [(Soilen, 2012)], believes that geo-economics is

the study of spatial, cultural and strategic aspects of resources in order to obtain a sustainable competitive advantage. It is the continuation of the logic of geopolitics, applied to the era of globalization. He also offers a new term that replaces the Heartland and the Rimland—the Nareland (reduction from English 'Natural Resource Lands'). This new logic of dividing geographic locations determines the shift from geopolitics to geo-economics. The author validates this thesis with the example of the US presence in the Middle East, where there are hydrocarbon reserves, as well as China's interests in the agricultural and oil sectors of the African countries".

At the same time, Repasova and Ciderova (2013) analyze the concept of geo-economics and introduce the term "geo-heterogeneity" to define geographic categories such as geo-culture, geo-history, geopolitics, and geo-economics. Also, according to Sanjaya Baru (2012), geo-economics can be defined in two different ways: first, as the relationship between economic policy and shifts in national power and geopolitics (in other words, the geopolitical consequences of economic phenomena) and, second, how the economic consequences affect geopolitics and national power. The author asserts that both the notion that "trade follows the flag" (the projection that national power has economic consequences) and that "the flag follows trade" (the geopolitical consequences of economic phenomena) point to the discipline of geo-economics.

Scekic et al. (2016, pp. 66-67) on the issue of geo-economy point out:

"The end of last and the beginning of the current millennium was marked by the escalation of mutual relations of the great powers. Struggle for resources on the global level increased. Economic rivalries have become the dominant phenomenon. In this context neoliberal ideology ceded its place to geoeconomics. The latter explains geographical, economic, historical, political and institutional characteristics of a certain region … for explanation of the current process of adjustment to new (global) economic and political demands it is necessary to be aware of recent geoeconomic phenomena and categories, because the current geopolitical rivalry of the great powers is happening on the field of economics and it is mostly the struggle for resources."

In their recent book, Blackwill and Harris (2016, p. 20) define geo-economics as "*The use of economic instruments to promote and defend national interests, and to produce beneficial geopolitical results; and the effects of other nations' economic actions on a country's geopolitical goals*."

Regarding "geo-energy", this term was adopted and introduced in the literature by Vidakis and Baltos (2015, p. 3), according to which:

"*Geoenergeia is a new analytical method referring to political decision-making in both national and international affairs. The method's first step examines decision-making processes in political, economic, and even social fields in relation to geographic areas defined by energy resource information. The next step interprets the interaction between political decisions and actions and the existence of energy resources as well as the utilization of potential for energy resources. The study of energy interrelationships at the international, global or regional level.*"

Regarding the concepts "pillar of power" and "geopolitical factor", according to I. Mazis (Μάζης, 2002,

2012), we have to notice the following. Since the subject of geopolitics is to study the influence of power of international or national actors via defense, political, economic and cultural means, therefore the pillars of power are the four categories of defense/security, economy, politics and culture/information, which determine the power and distribution of power in the spatial complex. The geopolitical factor, especially, triggers the redistribution of power in the geopolitical complex. In turn, the geopolitical complex is the broader geographic unit of the system, which is the exact aggregate of the territorial units that constitute the geopolitical subsystems (Figure 2).

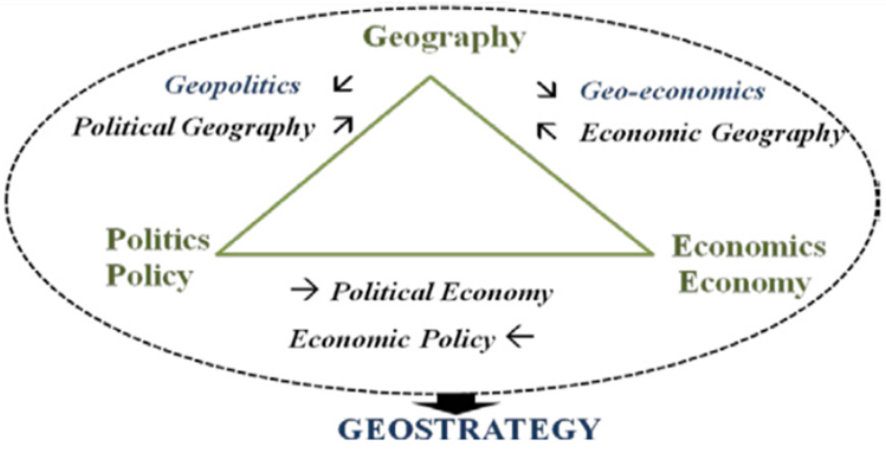


Figure 2. A Geostrategic Conception. Reproduced from Savin (2016)

Finally, in order to link the concept of decision-making to the subject matter, it must be pointed out that the concept of geopolitics does not coincide with the concept of geo-strategy: geopolitics constitutes the question of "is", while geo-strategy questions "what has to be done" by undertaking the practical description of the outcomes of geopolitical analysis. Thus, decision-making methodology is a practical way to achieve the real purpose of geo-strategic synthesis.

5. The Geopolitical and Geo-Economic Data of the Southeastern Europe Geopolitical Complex

An essential element to be highlighted initially is a constant variable: given the confrontational and competitive international scene, the whole game takes place in situations of uncertainty or limited uncertainty since the deterministic element is absent. This aspect leads us to use quantitative methods in decision-making on the part of actors in order to try to approach the subject through a methodology that geopolitical analysis has so far presented. The actors (decision-makers) in our case, are the allied partnership between Greece-Cyprus-Israel in the Southeastern Europe geopolitical complex. Thus, we can formulate the problem in the form of a "pay-off matrix" and, consequently, highlight with this structure the need for making decisions that affect the "geopolitical power redistribution components" of the Southeastern Mediterranean Sea (Mazis, 2018).

Also, other vital constants/data of the subject under study are:

a) Turkey's ongoing revisionist stance. Turkey is a regional power of the region that seeks continuously to gain a leading role in the Muslim population internationally. As M. Troulis (Τρούλης, 2018) points out, regardless the ideological approach of the new elites to Islam or choosing religion as an ideal tool of strategic penetration to the Middle East (and, more broadly, to Muslim world), the Islamization of Turkish strategic behavior is an observable event. Furthermore, we must not ignore the fact that Turkey has declared its will to become an energy storage hub instead of an energy transit country (Austvik & Rzayeva, 2017). Thus, by maximizing revenue and reducing its energy dependency, Turkey aspires to make energy a strategic tool for its international relations (Barysch, 2007; Biresselioglu, 2007).

b) We must not ignore existing technical and economic data, such as the offshore fields of the Republic of Cyprus. "Glaucus" and "Aphrodite" alone are not enough to construct a liquefaction terminal in Cyprus, since, according to experts, such an installation presupposes the existence of quantities exceeding 10 trillion cubic meters and cost exceeding ten billion dollars. However, Aphrodite contains four trillion cubic feet, while Glaucus, according to the first estimates, contains three to eight trillion cubic feet. Thus, according to the law of probabilities, there is 75% chance to find five trillion cubic feet and 25% chance to find eight trillion cubic feet, as the experts speculate (Konofagos, 2019a).

c) The trilateral Greece-Israel-Cyprus summit to sign the intergovernmental agreement on the EastMed pipeline. It was held on March 20, 2019, in Tel Aviv with the presence of the US Foreign Minister Mike Pompeo. This agreement has put together many expectations for the region. The EastMed pipeline might transform the region into a significant gas exporter and a vital source of supply for Europe while strengthening the hopes of those who see in the construction of the ambitious EastMed project the enhanced role of Greece as an energy transit center, which initiated after the launch of the TAP pipeline. This meeting is a continuation of the trilateral strategic alliance, which takes the form of strategic alignment, incorporating the co-understanding of threats primarily.

d) Egypt, according to announcements from the country's responsible Ministry of Petroleum, has 72 trillion cubic feet of proven gas reserves, while unconfirmed deposits can reach up to 120 trillion cubic feet (Τρούλης, 2018). To Israel, the proven natural gas reserves amount to 176 billion cubic meters, given that a high potential within the declared EEZ is present. Moreover, according to the US Geological Survey, there are additional gas reserves in the Levantine basin, which amount to 3.45 trillion cubic meters of gas, 1.8 billion barrels of crude oil and 4 billion barrels of liquid hydrocarbon gases (Τρούλης, 2018). It should be noted, however, that Egypt is not interested in participating in the EastMed project, given the fact that Cairo aspires to become the new energy hub of this geopolitical complex.

e) However, East Med's design may not only linked to geo-economic but also national-supranational and geopolitical balances. In this regard, Italy (Marseglia, Rivieccio, & Medaglia, 2018) has expressed concerns about the pipeline's route crossing its territory. Although Rome is officially

invoking environmental concerns and arguments, the more profound interpretation of Italian maneuver (not a decision) highlights complex balances of Rome-Berlin, Paris, and Brussels relationships, as well as the ideological and political affinity of Salvini-Putin. National-populism, however, is also an area that Donald Trump exploits, who exerts influence in Rome, but the lack of coherent structures and immediate realizable benefits for Italy allows a closer Italy-Russia relationship.

f) The issue of energy security, that is, to be ensuring a stable and unimpeded energy supply by multiple and diversified producers towards the European Single Market, and reducing the dependency on Russian energy sources, also acquires primary importance (European Commission, 2006; Mañé-Estrada, 2006).

6. Decision-Making under Uncertainty and Limited Uncertainty or Risk

6.1 Defining the Problem

As we have already mentioned, we can formulate this problem in a pay-off matrix and, therefore, highlight with this structure the need for making decisions that affect the "geopolitical power redistribution components" of the Southeastern Mediterranean Sea, where:

- The external states take the symbol S, and more accurately defined S_1, S_2, S_3, as follows:

a) Subsea Natural gas pipeline towards Turkey (S_1).

b) The construction of EastMed pipeline 2000km long, with a construction cost of 6-7 billion euros, while the quantity of natural gas it could potentially transfer to Italy annually amounts to 20 billion cubic meters (S_2).

c) S_3 is the state where a gas pipeline starts from Cyprus heading to LNG facilities in Egypt (Idku and Damietta) and therefore by ships in Europe.

- Let us then assume that there are three groups of alternative strategies to be adopted by actors-players of the geopolitical Complex of the Southeastern Mediterranean combined with the external environment. They base their strategies on:

a) The outcome according to a pessimistic scenario (d_1), which refers to the route of the energy resource through Turkey;

b) The outcome according to a moderate degree of optimism scenario (d_2), which refers to the transit of natural gas through Egypt's terminals; and

c) The outcome according to a very optimistic scenario, for the benefit of actors-players (d_3), which refers to the construction of the EastMed pipeline.

- The matrix is fulfilled by the pay-offs, which indicate the benefits (positive values) and losses (negative values), in monetary units, depending on the external states (S) mentioned above. In this case, the real purpose is the maximization as an optimal decision. The values of the pay-off matrix can derive from the previous in-depth geopolitical analysis taking into account the constants as well as the prevailing environmental conditions.

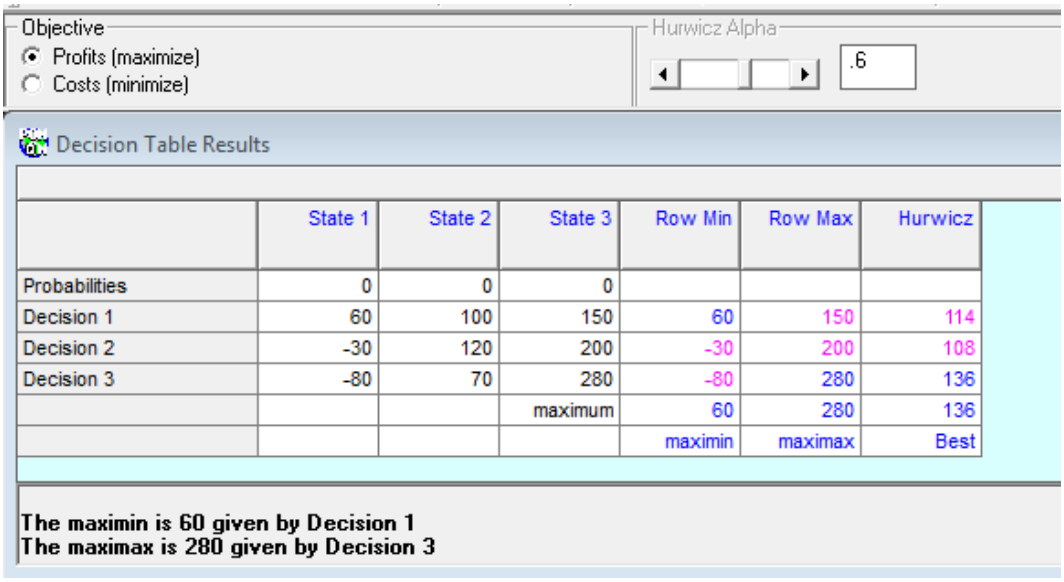
So the illustration of the issue is as follows (Table 1):

Table 1. Pay-off Matrix

	EXTERNAL STATES		
STRATEGY			
	The subsea gas pipeline towards Turkey (S_1)	Construction of EastMed pipeline (S_2)	Gas pipeline from Cyprus to LNG facilities in Egypt (Idku & Damietta) and from there by ships in Europe (S_3)
Outcome according to pessimistic scenario (d_1)	60	100	150
Outcome according to a moderate degree of optimism scenario (d_2)	-30	120	200
Outcome according to the most optimistic scenario, for the benefit of actors-players (d_3)	-80	70	280

6.2 Decision-Making Under Uncertainty

For this case, we choose the Hurwicz criterion or the criterion of optimism index. We can define a coefficient of "optimism" which, according to the literature (Anderson, 2008; Collier, Lambert, & Linkov, 2016; Tsangaratos et al., 2017; Veen, 2013), takes values between 0 and 1 (including the limits where a value equal to 0 means that the decision-maker faces the situation with full pessimism, while a value equal to 1 means that the decision-maker faces the situation with full optimism). At this point, we must notice that the optimism index incorporates all the components of the previous geopolitical analysis. In our analysis, we set the optimism index at $\alpha = 0.6$ (moderate degree of optimism), and by using the QM for Windows software, we get the following results (Figure 3):



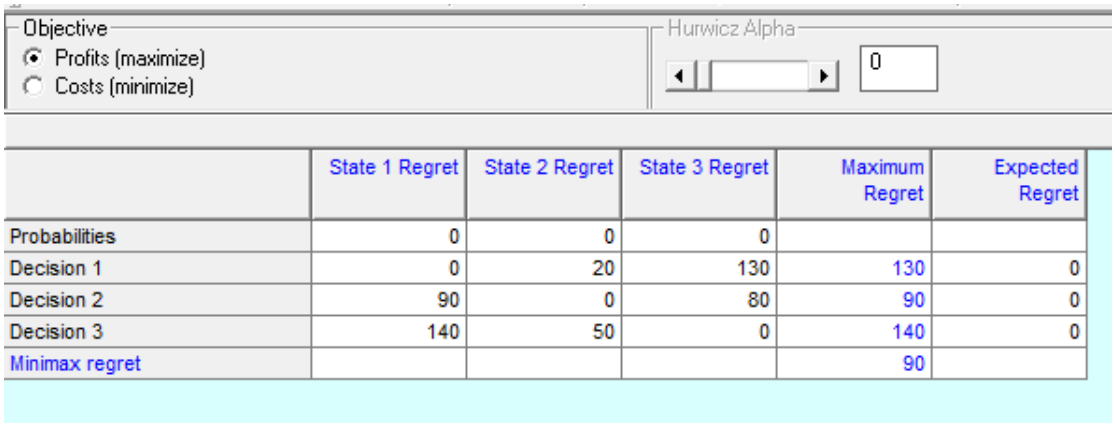
	State 1	State 2	State 3	Row Min	Row Max	Hurwicz
Probabilities	0	0	0			
Decision 1	60	100	150	60	150	114
Decision 2	-30	120	200	-30	200	108
Decision 3	-80	70	280	-80	280	136
			maximum	60	280	136
				maximin	maximax	Best

The maximin is 60 given by Decision 1
The maximax is 280 given by Decision 3

Figure 3. Decision Table Results (Hurwitz Criterion). Authors' Calculation

According to this criterion and with the optimism index set at 0.6, d_3 is the preferred strategy. This strategy refers to the outcome with the most optimistic scenario.

If we choose the Savage or "min-max regret" criterion, where the actors-players seek to minimize the degree of regret from not implementing the best possible conditions for the chosen strategy, then as shown below the chosen alternative is d_2 (Figure 4).



	State 1 Regret	State 2 Regret	State 3 Regret	Maximum Regret	Expected Regret
Probabilities	0	0	0		
Decision 1	0	20	130	130	0
Decision 2	90	0	80	90	0
Decision 3	140	50	0	140	0
Minimax regret				90	

Figure 4. Decision Table Results (Savage Criterion). Authors' Calculation

6.3 Decision-Making under Conditions of Limited Uncertainty or Risk

In this case, we apply the Expected Value methodology, where for each condition of the external environment, the actors-players can determine the probabilities tied to them. As can be seen from the table below (Figure 5), we have determined the probabilities for the external environmental conditions based on existing data, as follows:

a) The route of a natural gas pipeline to Turkey (S_1) with a probability of 10%, since such a

situation faces severe political problems, mostly because the EU does not desire such a development as its energy dependence from Turkey would be enhanced, and thus Turkey would be transformed into an important transit hub. Moreover, of course, neither the Republic of Cyprus considers such a possibility for obvious geopolitical reasons. This option is the most financially advantageous, but there are two significant obstacles. The first obstacle is Israel's reluctance to trust the "Islamized" Turkey; today, much of Turkey's public administration staff are Islamists and, also in the future, because Islamization has been introduced to education, new generations of radicals Islamists will be created to oppose Israeli interests. The second major obstacle is that the pipeline to Turkey will have to pass through the EEZ of Cyprus and, therefore, before any such decision, the Cyprus conflict must be resolved.

b) The construction of East Med pipeline with 2000km and 6-7 billion Euros cost of construction. The quantity of natural gas it could potentially transfer to Italy (passing through Crete, Peloponnese and final destination Italy) per annum amounts to 20 billion cubic meters (S_2) with a probability of 30%, since this pipeline is not feasible at the moment, and a final feasibility study has not yet started (Τσακίρης, 2016, 2018). Moreover, as we have mentioned earlier, Italy has expressed second thoughts on this route. Also, we must notice that Italy was absent from the "trilateral summit plus one" that took place in Israel. However, such a project will need support from the European Union, which should incorporate it into its critical energy infrastructure. Spain opposes this option, proposing the transfer of gas to one of the existing re-gasification facilities on its territory. Spain has 40% of such facilities on the EU territory, and despite recent gas imports from the US, these continue to under-operate. In this case, the gas would be liquefied in two existing facilities in Egypt and possibly in a third, perhaps built in Cyprus, and then transported by special tankers to one of the three re-infiltration facilities Spain has in the Mediterranean.

c) Transfer of gas through a pipeline from Cyprus to LNG facilities in Egypt (Idku & Damietta) and from there to Europe (S_3) with a probability of 60%. Such an alternative from a technical and economic point of view is the most competitive option.

	State 1	State 2	State 3	EMV
Probabilities	,1	,3	,6	
Decision 1	60	100	150	126
Decision 2	-30	120	200	153
Decision 3	-80	70	280	181
			maximum	181
				Best EV

The maximum expected monetary value is 181 given by Decision 3

Figure 5. Decision Table Results (Expected Monetary Value). Authors' Calculation

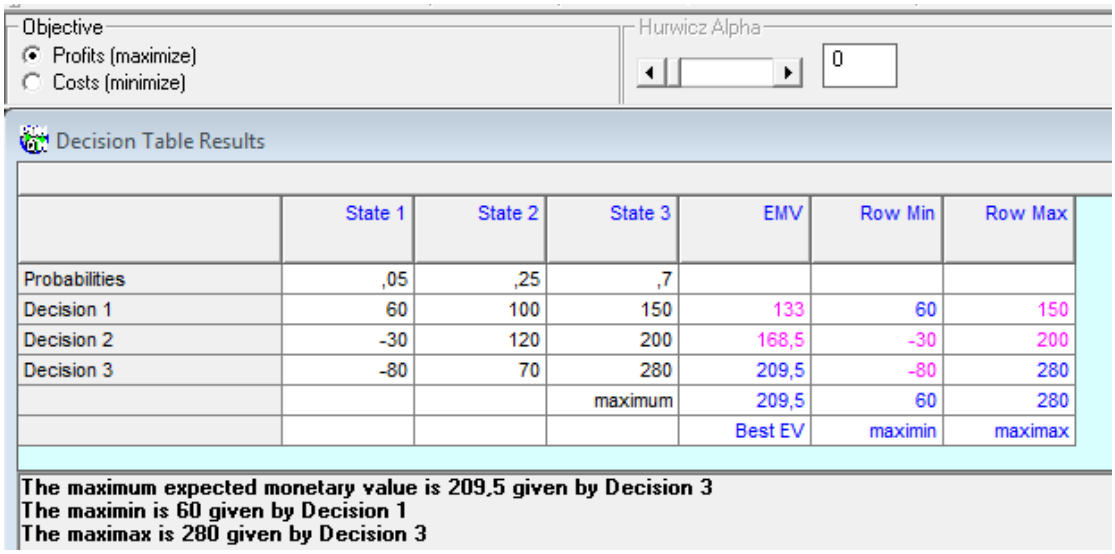
From all the above, we get that the adoption of the d_3 strategy achieves the best decision.

Another interesting point in the analysis mentioned above is the value of perfect information, which is the cost of uncertainty, as it becomes known to actors-players an additional expected value that could be for their benefit if they had perfect information about external states. The optimal strategy that is adapted based on the existence of perfect information is expressed as follows: If S_1 is valid then d_1 is adopted, if S_2 is valid then d_2 is adopted, and if S_3 is valid then d_3 is adopted. This condition gives the expected value with perfect information, which we calculate as follows:

$$(0.1)(60)+(0.3)(120)+(0.6)(280)=210$$

The expected value without perfect information, as we have previously shown, is 181. So the value of perfect information is 210-181=29. However, what does this price mean? It means that if actors-players, acting through alliances, can acquire and obtain additional information on external states through appropriate procedures, then they will consider imposing a cost of less than 29 monetary units in order to achieve this goal.

However, we have to notice that it is necessary to examine the impact of changes in a priori probabilities in the proposed decisions and how they affect them. In other words, sensitivity analysis is a process that we must not omit. So if we revise/change the probabilities to S_1:5%, S_2:25%, and S_3:70%, then the results are as follows (Figure 6):



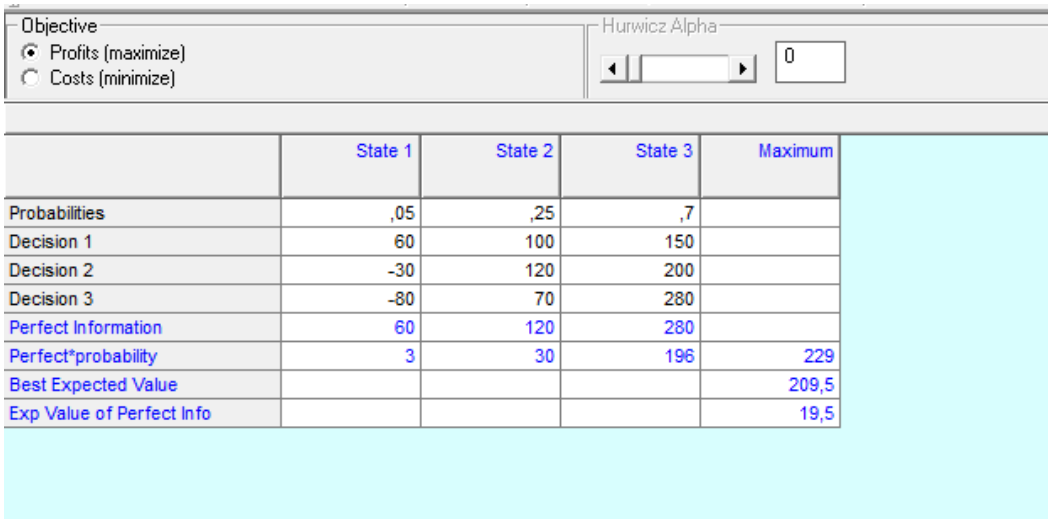
	State 1	State 2	State 3	EMV	Row Min	Row Max
Probabilities	,05	,25	,7			
Decision 1	60	100	150	133	60	150
Decision 2	-30	120	200	168,5	-30	200
Decision 3	-80	70	280	209,5	-80	280
			maximum	209,5	60	280
				Best EV	maximin	maximax

The maximum expected monetary value is 209,5 given by Decision 3
The maximin is 60 given by Decision 1
The maximax is 280 given by Decision 3

Figure 6. Decision Table Results (Review of a Priori Probabilities). Authors' Calculation

In this case, also, the d_3 strategy seems to be the best option available.

Furthermore, the calculation of perfect information, as well as the expected value of perfect information calculated above (with the previous probability values), is of interest. The following table shows the figures mentioned above, with the expected value of perfect information to be 19.5 (Figure 7).



	State 1	State 2	State 3	Maximum
Probabilities	,05	,25	,7	
Decision 1	60	100	150	
Decision 2	-30	120	200	
Decision 3	-80	70	280	
Perfect Information	60	120	280	
Perfect*probability	3	30	196	229
Best Expected Value				209,5
Exp Value of Perfect Info				19,5

Figure 7. Decision Table Results (Expected Value of Perfect Information). Authors' Calculation

A strengthening factor, regarding the spatial dynamics of this area, is the potential construction and operation of an LNG terminal in the Republic of Cyprus territory. Developing the energy sector around an LNG plant and the multiple effects of implementing the required infrastructure are indeed critical elements for the country's economic future for many reasons. A dynamic energy sector can lead to job

creation across the value chain of the industry and contribute to the development of technical expertise, applied research and innovation (Brutschin & Fleig, 2016; Szulecki, Fischer, Gullberg, & Sartor, 2016). It can create cross-sectoral synergies and economies of scale (Harrison et al., 2015; Weber & Schaper-Rinkel, 2017). The fastest possible introduction of gas into the transformation of the electricity sector is an important priority that results in significant microeconomic and macroeconomic impacts. The reduced cost of generating electricity will have obvious benefits for both households and industrial users. This kind of change will exert downward pressure on inflation and make businesses and the economy more competitive (Alexandros & Metaxas, 2016; Berger, 2008). Besides, the substitution of oil with gas exports and LNG will correct prolonged macroeconomic imbalances, such as trade and current account deficits.

The following theoretical model can interpret the above:

We assume that a production function can express the "regional product", where Y_R is the regional product, K stands for capital, L stands for labor and qI_s is the investment in the LNG terminal. I_s is the volume of investment and q the quality of this infrastructure. So we have the function of the regional product expressed as follows:

$$Y_R = f(K, L, qI_s)$$

A productive function with downward marginal productivity of infrastructure investment means that new investments in developed regional economies or central regions are less efficient than the same level of investment in less-favored areas (Blažek & Csank, 2016; Pylak, 2015). Therefore, if the above regional productive function is valid, with

$$\partial Y / \partial I_s < 0 \text{ and } \partial Y^2 / \partial^2 I_s < 0$$

Then, we have downward marginal productivity of investments in the specific infrastructure. This case is understood using the following diagram (Figure 8).

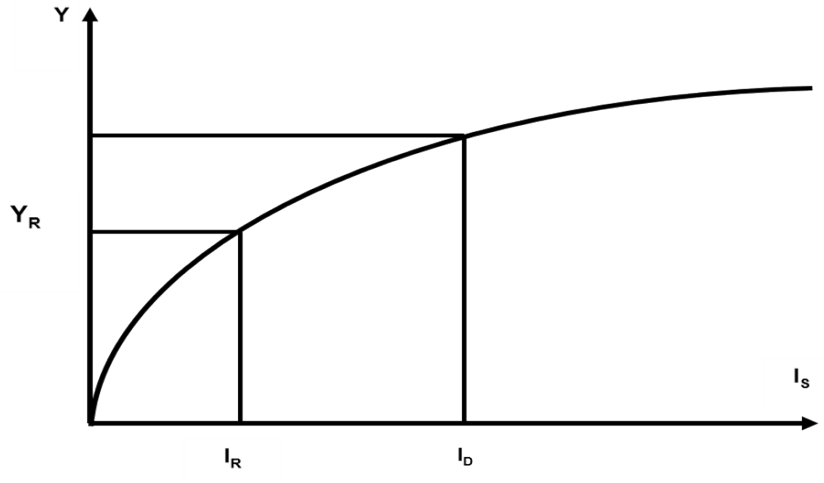


Figure 8. Marginal Productivity-Less-Developed and Developed Regional Economies

I_R = the volume of investment in the less-developed area

I_D = the volume of investment in developed regional economies or central areas.

It is evident from the above figure that a new investment unit in the problematic area is more efficient than a similar one in a more developed area if:

$$(\partial Y / \partial I_R) > (\partial Y / \partial I_D)$$

Furthermore, this specific LNG infrastructure has a dual effect on regional employment. The following Figure 4 shows this effect. First, total employment increases from L_1 to L_2, concerning Y_1 production, which is equivalent to increasing the regional product from Y_A to Y_B. Second, if we combine the increase in employment with training and educational programs, the workforce acquires new skills and becomes more productive. This increase in employment results to a shift from the Y_1 productive function to Y_2, with a more efficient labor factor per unit of employment, because in this case, new technology embedded in this LNG facility comes into play. Therefore, the following equation gives the benefit to the regional product from shifting to a new production function:

$$Y_C - Y_A = (Y_B - Y_A) + (Y_C - Y_A)$$

The developmental spatial dynamics that this process entails from the installation of the LNG terminal is considered to have the potential to cause spatial restructuring in this area; it can even cause the restructuring of the residential networks by creating concentration economies which can take the form of:

- Economies of scale within the LNG terminal enterprise resulting from the growth of production scale at that specific area;
- Economies of location for all the energy sector's enterprises resulting from the growth of the sector's total outputs; and
- Economies of urbanization for all the enterprises located in the same area (from all sectors) resulting from the expansion of the overall economic size of the area.

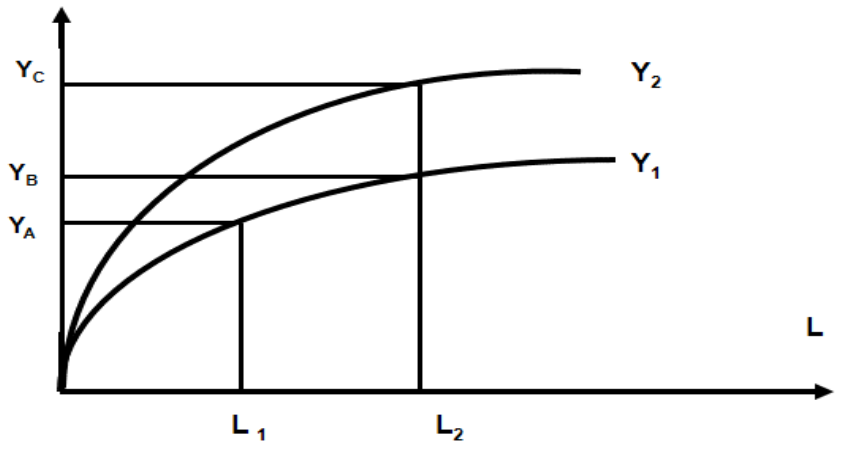


Figure 9. The LNG's Dual Effect on Regional Employment

7. Concluding Remarks and Limitations

According to the analysis and findings of our research, we come to the following conclusions:

I. The scientific purpose of this article was to propose a decision-making methodology using quantitative methods in uncertainty and limited certainty of actors in the geopolitical complex of Southeastern Mediterranean. It took into account the geo-economic/geo-energy pillar of power as a geopolitical factor, by contributing further to the geostrategic synthesis always based on a previous geopolitical systemic analysis (Mazis, 2008).

II. This methodology attempted to use the decision-making quantitative tools Hurwitz, Savage's under uncertainty conditions and Expected Value under limited uncertainty conditions or risk in the geostrategic planning of actors-players in the geopolitical context of Southeastern Mediterranean, by taking into account the geo-energy geopolitical factor so that it incorporates the utility of these tools. To this end, Kouskouvelis (Κουσκούβελης, 2015) in his book "Decision Theory at Thucydides", in the section on the usefulness of decision theories, states among others that the advantage of decision theories in interpreting the facts is that no emphasis is placed on why, but mainly on how the decision was made and, therefore, the fact. In other words, the reason why a particular decision was taken is linked to the theories of decision, mainly by how the decision was taken.

III. With the methodology mentioned above, apart from the selection of the optimal alternative strategy according to the algorithm of each criterion, we had the opportunity to calculate the value of perfect information or even the expected value of perfect information. These assessments give policymakers and, by extension, the actors the opportunity to make the best possible and more economical use of their means to achieve their real purpose. This aspect of our analysis is also an added value to the whole project.

IV. Concerning possible limitations, we can summarize the following thoughts:

- When using the Hurwitz criterion with optimism index, its value should be set according to the objective data available and in particular by a thorough geopolitical analysis. To have a holistic approach, one must use alternative values of the optimism index.
- If a utility function has evaluated the results, then we cannot use the Savage criterion. This particular limitation emerges because the value or utility grade for a pay-off price is not absolute, but rather a pseudo-absolute price.

V. Therefore, with all the above mentioned, we attempted to approach the subject with a "quantitative" perception, which by no means covered this very up-to-date geo-economic with geopolitical dimensions aspect and which is in line with Viktor Hugo's saying: "*An invasion of armies can be resisted, but not an idea whose time has come*".

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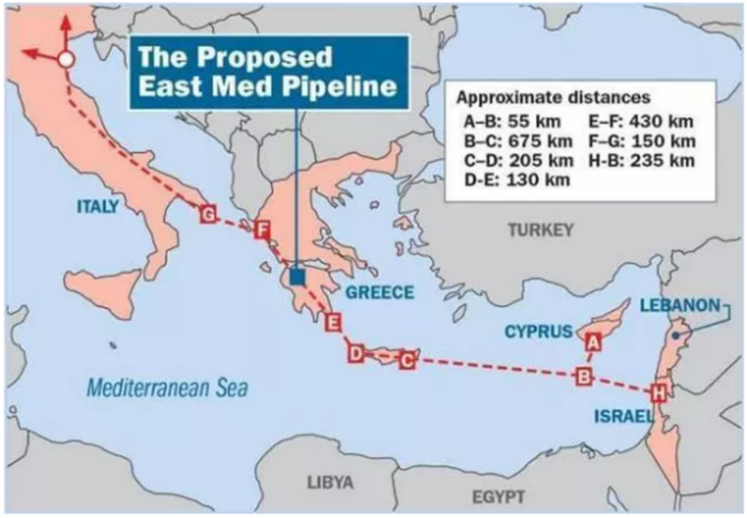
Appendix 1

East Med Proposed Gas Pipeline

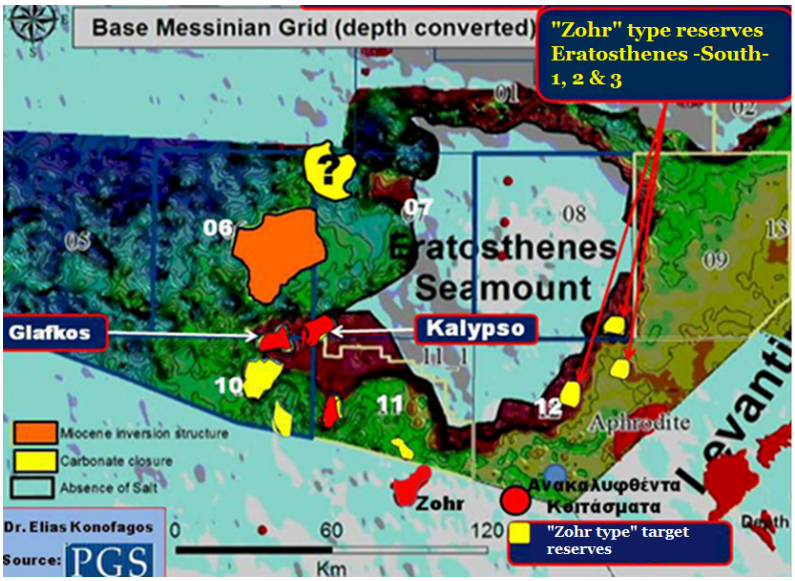


Appendix 2

Alternative Gas Routes

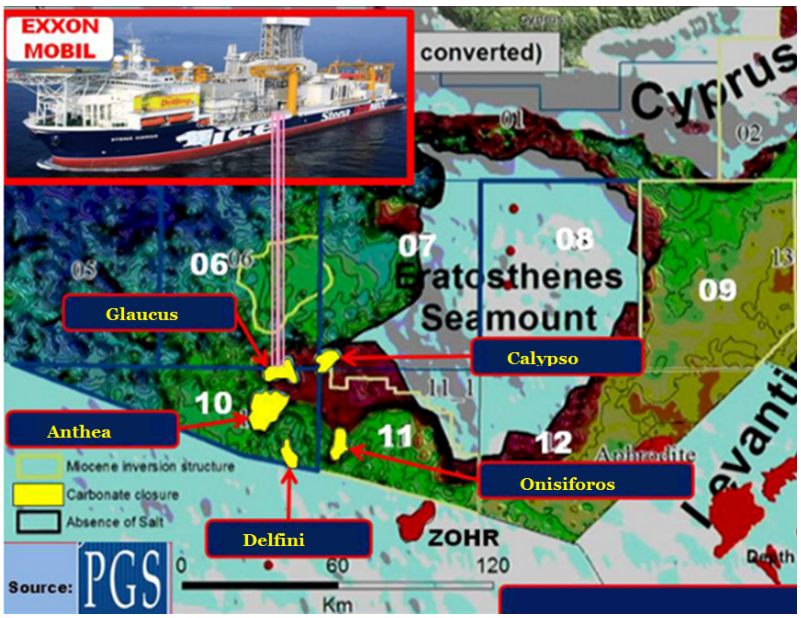
Appendix 3

Targets and Natural Gas Reserves in the Cypriot EEZ. Adapted from Konofagos (2019b)



Appendix 4

Natural Gas Reserves of "Zohr type" in the Cypriot Offshore Block 10. Adapted from Konofagos (2019a)



Appendix 5

Natural Gas Reserves of "Zohr Type" in the Cypriot Offshore Block 10. Adapted from Κονοφάγος (2019a)