

Article

Environmental Challenges for Fragile Economies: Adaptation Opportunities on the Examples of the Arctic and Iraq

Tatyana Semenova * , Ali Al-Dirawi  and Tahseen Al-Saadi

Economics, Organization and Management Department, Saint Petersburg Mining University, 2, 21st Line, 199106 Saint Petersburg, Russia

* Correspondence: tknow@mail.ru

Abstract: The impact of climate change in the Arctic, due to the nature of its ecosystem, the wealth of natural resources and the intensification of activities for their production, is becoming more and more significant and leads to an aggravation of environmental problems in this territory. The situation is even more complicated by the imperfection of legislation and the lack of agreement between neighboring states. Despite the special location of the Arctic zone, similar problems can be found in other states. The purpose of this work is to consider environmental challenges for unstable economies on the example of the Arctic zone and the state of Iraq, to determine the possibilities of adapting similar methods to eliminate existing problems. To achieve this goal, the following tasks were solved in the article: 1. The environmental problems of the Arctic were identified and their similarity with the problems of Iraq was substantiated. 2. It is demonstrated that in order to solve environmental problems related to the impact of climate change, environmental protection and resource management in fragile economy states, it is necessary to create an effective management system at the global, regional and national levels; it is proved that there is a need to improve legal provisions for effective protection of fragile states from risks associated with human activities. The research methods used in this study include a systematic analysis of economic, social, and cultural conditions, including a review of statistical data and various sources. Emerging opportunities for Arctic exploration and exploitation pose a threat to the Arctic environment. Its protection is currently based on too many, often conflicting, international agreements, the domestic legislation of the Arctic states and the recommendations of the Arctic Council. It has been shown that the risk of irreparable damage is particularly high in the case of gas flaring or oil spills from an oil rig or tanker. The problems identified in this article are applicable not only to the Arctic but also to other territories with “fragile” economies such as Iraq, where the oil and gas industry is a strategic factor. Despite the obvious differences, in particular, in climatic conditions, territorial development management has common methodological approaches. The political aspects of such research are the development of unified approaches that enable territories with challenging conditions to adopt the best-integrated practices in the field of management.

Keywords: Arctic; environmental protection; global warming; environmental efficiency; mining; Iraq; oil and gas industry



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1. Introduction

1.1. Investigation of Fragile Territories Development Problems

The Arctic is a region currently undergoing transformation. Instead of being an area of little political or economic importance, it is becoming a subject of great interest to the most influential stakeholders in the international arena. This is due to many factors, including global warming, globalization and modernization, or technological advances that improve living conditions in the region in question. Climate change, which finds its way into the Far North with redoubled force, offers opportunities to exploit new shipping routes and previously inaccessible deposits of natural resources, especially crude oil and natural gas.

Thus, global warming, which is gradually exposing non-strategic values in the region, is a major driver of the debate about the current and future state of the Arctic [1].

The global warming process, clearly noticeable in the Arctic, could have far-reaching benefits on a global scale. A shrinking ice sheet offers potential access to natural resources such as oil, gas, coal and metal ores. New fisheries are being created that allow offshore fishing over large areas. Ice-free northwestern and northeastern passages in the summer months create opportunities for significant reductions in shipping routes from Asia to Europe and from the Pacific to the Atlantic Ocean, bypassing the Suez and Panama Canals. The Arctic region is also attracting a growing number of tourists [2].

However, changes in the Arctic environment and nature do have negative consequences. Increased human activity in the Arctic region and, in particular, its side effects can create all kinds of hazards that negatively affect the fragile Arctic ecosystem. The risk of irreversible damage to the environment is especially high in the case of an oil spill from an oil rig or tanker. In the event of an emergency, in a marine accident, the harsh conditions of the Arctic can make it very difficult or even impossible to conduct rescue activities not only for people and ships but also for the marine environment and its resources [3].

Moreover, the intrinsic specificity of polar ecosystems implies that they have a low capacity for self-recovery. The regulation of environmental protection in the Arctic is currently based on the provisions of international treaties, in particular the United Nations Convention on the Law of the Sea (UNCLOS) and national regulations derived from the legal orders of the coastal states located in the Arctic region, as well as on the recommendations of the Arctic Council. However, due to the effects of climate change, which are creating some potential opportunities for territorial and economic expansion in the Arctic, it may be that environmental protection standards for the Arctic environment remain insufficiently framed in terms of regulation and function [4].

The current legal status of the Arctic, which is based on too many inconsistent and often contradictory legal provisions, must be supported by a holistic and integrated approach that applies to all maritime areas. The rationality premise is that the development of uncontrolled shipping, exploration and exploitation of the marine resources of the Arctic Ocean poses a great danger to this region and efforts should be made to preserve the current Arctic environment, especially valuable for mankind. Development that takes place at the expense of the environment without any restrictions poses a danger to present and future generations.

One of the most important risk factors for the Arctic zone is the intensification of natural resource extraction activities [5–8]. The increase in the volume of hydrocarbons produced leads to negative consequences for the Arctic ecosystem, negatively affects the life of the population of the northern territories and limits the possibilities of the normal functioning of the natural environment [9,10]. Similar problems are found in other countries, where oil and gas production is a strategic industry. For example, the environment of Iraq has suffered a number of converging factors related to population growth, climate change, inefficient management of resource extraction, and destructive impacts on a fragile ecosystem [11,12].

The problem of the development of Arctic territories has long been of concern to the world scientific community. Important studies are devoted to the problems of increasing the economic efficiency of resource extraction in the Arctic [13,14] and in Iraq [15,16]. However, in our opinion, when evaluating projects, it is not enough to take into account only economic efficiency. Ecological and technological aspects are considered in the works devoted to the Arctic region [17,18] and Iraq [19,20]. However, research lacks an integrated approach that takes into account different types of effectiveness in a single way. It should also be noted that, according to various authors, such territories are essential for the global economy, for example, in terms of hydrocarbon resources [21,22] and transport routes [23,24]. The analysis shows that transport issues and problems of resource use should be considered in the aspect of integrated ecological and economic development of these territories. Only

in this case is it possible to ensure their effective development and mutually beneficial cooperation between different countries.

The contribution to the theory is the shaping of the conceptual and methodological approach to the environmental and economic development of territories with an unstable economy, using the possibilities of strategic and program management with the complex consideration of various types of efficiency and the mandatory environmental component, which involves the adoption of programs in such territories with no harmful effects, in full compliance with environmental regulations.

1.2. A Review of the Literature on the Environmental Problems of the Arctic and Iraq and Management Opportunities

For several decades, the global environment has been strongly influenced by climate change. Its importance for assessing external and internal security in terms of both threats and opportunities was quickly noticed by individual states. There was a need to develop national strategies and prepare tools that would allow, on the one hand, to fight the negative consequences of changes, and on the other hand, to use new opportunities to achieve their own goals. The phenomenon of global warming attracted attention to the Arctic [25]. The aforementioned measurements and areas are of particular interest to fragile countries, especially in this century, for several reasons: due to similar problems, loss of potential benefits, national prestige and the need to prepare to respond to threats arising from new conditions. One can agree with the opinion of researchers who believe that at present there is a competition between the world powers for access to raw materials and their transportation, which is called pipeline geopolitics or geo-economics (Reberski, Rubinić, Terzić, Radišić [26]). As a result, a global conflict is growing concerning strategic raw materials, mainly oil and gas. Possible scenarios, of course, include the Arctic and other states having large reserves of hydrocarbons (for example, Iraq, which plays an important role in the global energy system) [27,28]. The resources of the Arctic, analyzed through the perspective of their possible distribution by sea, undoubtedly constitute the determinant of the geostrategy of states as a geographical direction of foreign policy, characterizing where the state concentrates its efforts through the projection of force and purposeful diplomatic efforts. Currently, the Arctic has also become such a geographical direction [9,29].

One of the main issues for discussing the changes taking place in the Arctic is the potential increase in opportunities for the utilization of the region's natural resources, especially non-renewable minerals, including energy resources such as oil and natural gas. In the Arctic, a smaller and thinner ice sheet paves the way for exploration and the possible production of minerals at the bottom of the Arctic Ocean. According to scientists, the Arctic may contain up to 13% of the world's oil reserves and 30% of the world's natural gas reserves. However, these deposits are unevenly distributed and are not always located in areas allowing for their profitable operation. The demand for these raw materials is growing, while the resources are being exhausted, so each potential new source turns out to be extremely valuable for the mining industry [4].

It is the possibility of discovering new oil and gas fields that drives the actions of the Arctic Five and their desire to occupy as much of the Arctic ice shelf as possible. The Arctic countries are not the only ones who strive to search for and develop oil and gas fields, there are other countries as well. Almost every major concern seeks to place its platforms in the Arctic zone. However, not all of them have a sufficiently developed technology for extracting minerals from deposits in severe weather conditions [30]. Therefore, this activity can become extremely dangerous for the Arctic, because inadequate equipment, machines and inexperienced and poorly trained crews can contribute to a spill that will eventually lead to an environmental disaster.

Currently, several projects are underway related to the exploration and production of both natural gas and crude oil. The current legislation allows the exploitation of the Arctic Ocean floor. If the states beyond the Arctic Circle can prove that the ocean floor is a geological extension of the land territory, they will be able to expand their continental shelf

to 350 nautical miles or even to the pole. They can seek control over the area associated with their continental shelf and thereby expand their rights to explore the ocean floor. Thus, the price of Arctic exploration may be much higher than the potential billions of barrels of crude oil or natural gas. An irresponsible approach to mining in the Arctic may create immediate problems rather than global benefits [31–33].

The study by Sadiq M., Wen F. and Dagestani A.A., which analyzes the impact of nuclear energy consumption on the environment in the presence of environmental technologies and globalization of the ten largest ecological footprint countries from 1990 to 2017 [34], is also of great interest. Considering a set of methods that can help solve the problem of cross-dependence, the authors used the Lagrange multiplier bootstrap cointegration method, Driscoll-Kraay standard errors for long-run estimation and feasible generalized least squares (FGLS) and panel-corrected standard errors (PCSE) for robustness. The results of the study showed a significant negative impact of nuclear energy consumption, environmental technologies, population density, and a significant positive impact of globalization and economic growth on the ecological footprint [34].

Iraqi scientists conducted similar studies of climate change and the impact of extractive industries on these processes. According to some of them, the main problems for the ecology of Iraq include [12,35]:

Oil spills. Numerous spills resulted from damage to Iraq's oil infrastructure, and the lack of water treatment facilities at Iraqi refineries led to contamination of these facilities. This causes a lot of concern among the population of Iraq. It is necessary to apply modern methods for cleaning soil and water from oil pollution [36].

Non-compliance with sanitary standards. Due to the damage to the infrastructure, a significant part of the population does not have proper water supply and sewerage systems.

Land degradation. In agriculture in Iraq on the alluvial plain, soil quality has deteriorated due to deposits of large amounts of salts carried by irrigation overflows and wind, as well as due to poor soil drainage. Desertification and erosion have also reduced arable land.

Many researchers note that, despite the attempts and measures taken by interested states to eliminate environmental problems, the current management system in the Arctic makes it difficult to delegate decisions and responsibilities "top-down". Decisions are made at the political level, and resources are also distributed "top-down", which prevents individual industries from performing their assigned functions and also limits the possibilities of effective implementation of strategic development priorities [37,38].

At the political level, there is a growing interest in strengthening the right of people to live in a healthy environment. The resolutions of the United Nations Environment Assembly (UNEA) on conflict and the environment and the French-led Global Environment Pact [27] initiative provide the basis for further progress in the field of environmental security. In this regard, the article by Eesley C. et al. should be considered, where it is proved that the co-temporal development should be carried out jointly with the broader institutional environment. An important consequence of this is that institutional changes can change beliefs and behavior, and they must correspond to a more active institutional environment in order to improve the activities of States in the current conditions of threat to the environment [38]. Such a comprehensive and progressive approach to ensuring environmental safety can help us invest the right funds and methods to address environmental vulnerability, human health risks and social problems arising from conflicts.

In order to increase the efficiency of the development of territories with fragile economies, it is necessary to use the most modern approaches to managing the development of the industry.

The analysis shows that when managing territories with complex conditions, there is no agreed initial prerequisite associated with the formation and use of a range of development goals in management. In addition, there is no unambiguous understanding of the place and role of programs in the strategic management system, and there is also no common understanding of common criteria for evaluating the public benefit of the final results [39–41]. The issue of performance evaluation is very important [42].

When adopting programs, there is no comprehensive approach to evaluating effectiveness [43–46]. The authors investigated the possibilities of program-targeted management [47–49] and management based on a balanced scorecard [50,51].

2. Materials and Methods

2.1. Methodology for Studying Arctic Problems and Developing Common Approaches

The research methods used in this study were a systematic analysis of economic, social and cultural conditions, taking into account the history of the Arctic, including a review of statistical data and various sources. An inductive approach was employed in conducting a comprehensive review of previous studies related to the subject of the study in order to elucidate the development of concepts related to environmental issues and climate change. A deductive approach was used to analyze research variables to clarify the role of government regulation in achieving sustainable development.

The information base of the study consisted of statistics and regulatory and legislative acts in the field of environmental protection and resource base regulation [52] and theoretical and methodological studies of scientists on the issues under study.

The study analyzed the period between 2010 and 2021. It should be noted that the proposed method was tested only on the example of Iraq since an accurate reproduction of the study of the Arctic by this method is impossible due to the lack of statistical data for calculation. However, successful testing on the statistical data of Iraq suggests that, if the necessary information is available, calculations can be carried out for any state (territory).

2.2. Research Methodology for the Iraqi Economy and Ecology

To assess changes in the possible implementation of the environmental policy of Iraq by the method of expert assessments and calculation on this basis by comparing ranks. As described earlier, strategies for reorienting factors influencing policy formation have a significant impact on the final result. The use of a ranking assessment will reveal a significant component of the reorientation of factors—these are the dominant factors influencing the formation and implementation of the chosen strategy, as well as coordinating factors determining possible policy changes at the stages of its implementation. The authors believe that the use of information from the above sources should be considered reliable. The purpose of processing is to obtain generalized data and new information contained in a hidden form in expert assessments. Based on the results of processing, a solution to the problem is formed. By processing the results of the expert assessment, it is possible to establish dependencies between the ranking of various groups of assessed factors and thereby establish the unity and difference of expert opinions. It is important to establish the relationship between the ranking according to various indicators of the comparison of objects. The identification of such dependencies makes it possible to identify related comparison indicators and possibly, group them according to the degree of connection. The importance of the task of determining dependencies for practice is obvious. For example, if different goals are used as comparison indicators, and objects are a means of achieving goals, then establishing a link between the ranking that organizes means in terms of achieving goals allows you to reasonably answer the question to what extent the achievement of goals is achieved; one goal will be this means to contribute to the achievement of other goals. The ranking results are presented in Table 1. Expert assessment from 1 to 3 is tracked: 1—has reliable data that can be evaluated by the international community and scientists, 2—has data for practical application and further research, 3—has information data published and used as a basis for analytics and forecasts (Table 1). Moreover, we deliberately indicated the names of problems in the ecology of Iraq instead of experts, since this information on each of the problems is collected from the above sources, which we accept as the opinion of experts. We will describe a detailed analysis in our study later.

The method of average ranks assumes a certain base of statistical knowledge, especially when using programs such as STATISTICA, SPSS, and MS Excel. Collection of information, its systematization and formation into groups of factors influencing the formation of

environmental safety policy (X1-X7: X1—Oil spills, X2—Non-compliance with sanitary standards, X3—The impact of military technology, X4—Pollution, X5—Land degradation, X6—Transboundary pollution, X7—Lack of management river basin). The system of ranks from 1 to 3 is assigned taking into account the influence of polluting conditions in accordance with the data: 1—absolute impact, 2—impact on most industries and total consumption, 3—impact on oil and gas and strategic industries. Table 1 presents the results of evaluating the information using the rating system.

Table 1. Evaluation of information according to the ranking system.

Sources of Information	Environmental Factors	Political, Legal, Economic and Social Factors	Factors of Managerial and Marketing Behavior for the Formation of Environmental Policy	Rank of Experts	Weight of Expert Opinion
1	2	3	4	5	6
1. Open reports of the Basra Oil Company—(BOC), «Southern Gas Company»	1	2	1	8.525	0.293
2. Data from research agencies	2	3	1	5.344	0.184
3. Data from administrative sources	2	1	2	5.328	0.183
4. Data from international organizations	1	3	1	5.213	0.179
5. Data of exporting companies	2	1	2	4.656	0.160

Group 1 includes the following criteria: the level of infrastructure at enterprises; the level of so-called and terrorist threats; the activities of state-owned enterprises in the production sectors; the involvement of foreign companies in the environmental problem of the country; the activities of the Government in the development and implementation of laws on environmental safety; the activities of knowledge-intensive industries; the activities of subsidizing industrial enterprises; the activities of enterprises with foreign investments; the impact of the financial crisis on the economy; the activities of the oil industry; activities of the agro-industrial sector; activities of the machine-building industry; activities of strategically important industries.

Group 2 includes the following criteria: flexibility of environmental legislation; openness of the state to environmental problems of the country; the level of state regulation of environmental problems; the level of anti-crisis regulation; the influence of bureaucracy on environmental processes; loyalty to foreign investment and profits; the level of political stability; adoption of legislative acts that worsen the possibilities of environmental policy; tax reform activities; financial and social reform; crime rate; income level of the population; the level of medical care.

Group 3 includes the following criteria: the situation in the industry; changes in effective demand; product quality control; the share of import-substituting products; the development of dealer networks; the share of import-substituting products; the development of dealer networks; the uniqueness of the supply chain; the importance of the buyer; the share of individual oil and gas suppliers.

After analyzing the information, we systematized them in accordance with the factors influencing the process of forming an environmental safety policy. These calculations show three groups of factors: group 1—environmental factors, group 2—political, legal,

economic and social factors; group 3—factors of managerial and marketing behavior for the formation of environmental policy in Iraq. To objectively reflect the information, we have divided the collection into 126 factors of influence, the essence of which is divided into three, to an unequal degree. This is explained by the fact that everything in management is interconnected. A high value of the consistency coefficient indicates that the opinions of experts are consistent, so the quality of expertise can be assessed as high. Table 2 presents the rating system information by the example of Iraq.

Table 2. The evaluation of information according to the ranking system using the case of Iraq.

Groups of Factors	Oil Spills	Non-Compliance with Sanitary Standards	Influence of the Production of Military Equipment	Pollution	Land Degradation	Transboundary Pollution	Lack of River Basin Management	Sum of Ranks	Auxiliary Calculation	Criterion Weight
	X1	X2	X3	X4	X5	X6	X7			
1	2	3	4	5	6	7	8	9	10	11
1. The economic factors, factors of influence of globalism and coronavirus epidemic	95	102	110	111	102	106	106	732	7705	2858
2. Political, law and social factors	56	61	51	48	73	56	52	397	7089	3107
3. Management and marketing behavior factors	87	88	100	93	78	89	94	629	7230	3046
F1	−0.17	−0.43	0.38	0.25	0.25	0.4	−0.08			
F2	0.1	0.09	0.17	0.43	−0.35	−0.07	−0.02			

The results obtained show that the influence of the group of factors 1–3 prevails in Iraq. Based on the application of this calculation method, we can draw the following conclusions. The main factors cannot be considered as a single group of factors. In fact, as practice shows, interrelated factors prevail in different groups of countries. The dominant determining factors were environmental and political group factors. Management and marketing behavior for the formation of environmental policy in a number of oil and gas enterprises can significantly offset the risks from environmental pollution. The political aspect of oil spills is determined not only within the Middle East but also by countries outside its environment, for example, the United States and Canada. Therefore, political and general market factors should be leveled by the adoption of legislation in the field of ecology on the safety of handling oil and petroleum products. Nuclear and renewable energies can process these difficulties that are increasing at an exceptional velocity recently due to enhanced energy mix efficiency, technological breakthroughs, and structural reforms. Against these backdrops, this research focuses on the ecological consequences of expanding nuclear energy consumption, environmental technology and globalization in nuclear-consuming nations with the highest ecological footprint [34,53].

3. Results

3.1. Development of Northern Regions with a Fragile Economy

One of the consequences of global warming, which has led to the disappearance of the shelf and drifting ice, is the expected opening of new sea routes for international shipping. The opening of the Northern Sea Route (NSR) or the Northeast Passage along the coast of Russia and the Northwest Passage in Canadian waters may lead to a shift in shipping between the markets of the North Atlantic and Asia. New shipping routes can reduce ship travel by as much as 40%. This is of great importance, especially for countries such as China and Japan, whose exports and imports depend on maritime transport. The rather high, actual difference in travel time encourages more and more shipowners to use new sea routes [54].

Shipping on the NSR connecting North America with Europe and Asia saves 6500 miles on the Panama Canal and is 9000 miles shorter than the Cape Horn route. In contrast, ship-

ping through the Northwest Passage, which connects Northern Europe and Asia, shortens the journey from Hamburg to Yokohama by 5000 miles compared to the Suez Canal along the pole from the Bering Strait through the Arctic Ocean past Greenland to Iceland. These routes can be the shortest and easiest, as they do not have other navigational obstacles except ice and, most importantly, the route would pass through the open sea taking into account the current division of the waters of the Arctic region [5,55].

Recently, the number of vessels using the NSR has been gradually increasing. Low temperatures, severe winters, short summers, storms, winds and darkness—all complicate navigation in the Arctic Ocean, and so far, few shipowners in the world have the highest ice class vessels in their fleet. Inadequate shipbuilding and the lack of a sufficiently qualified crew can cause accidents, which, in turn, can lead to environmental disasters.

Fishing is one of the main branches of the Arctic economy. Fisheries management in the Arctic is extremely difficult. It has several measurements, from regional to international. It includes both individual fisheries and entire marine ecosystems. The main legal documents regulating fishing in the Arctic region include the aforementioned UNCLOS, the 1995 United Nations Fish Stocks Agreement, the 1993 United Nations Food and Agriculture Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, the FAO Code of Conduct for Responsible Fisheries and some United Nations General Assembly resolutions [6].

All activities in the Arctic should be based on expanding knowledge about its biodiversity, marine ecosystems and their interactions, climate change and the side effects of human activities. At the moment, the available knowledge is insufficient and subject to a high degree of uncertainty due to the lack of adequate data, too short observation periods and the consequences of progressive climate change [7].

The most important international treaty establishing the rights and obligations of all states in relation to the Arctic is the United Nations Convention on the Law of the Sea. This comprehensive convention, also known as the Law of the Sea Treaty, defines, among other things, issues related to the protection of the marine environment and the delimitation of marine areas. It regulates the rights and obligations of states, including freedom of the seas or the principles of marine scientific research with respect to all marine areas under the jurisdiction of coastal states or none states. It imposes obligations on states to protect and preserve the marine environment from pollution from various sources. Environmental issues are specified in Part XII of UNCLOS. However, only article 234 discusses the specifics of ice-covered areas. The second legally binding agreement, the Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic, was signed in 2013 in Kiruna, Sweden. The provisions of the agreement relate to the development of rapid response methods in the event of oil pollution of the sea. After the disaster in the Gulf of Mexico, the Arctic states agree that every effort should be made to prevent such an incident in the Arctic region [56].

This provision grants coastal states the right to issue non-discriminatory legal regulations within exclusive economic zones to prevent pollution of the marine environment by ships. The right to issue such standards legitimizes the risks associated with navigation in ice areas. One of the fundamental principles of UNCLOS is the peaceful use of the seas and oceans, the fair and efficient use of their resources, the conservation of living resources, as well as the study, protection and preservation of the marine environment. The Convention defines the rights and obligations of states in relation to the seas and oceans establishing the principles of their use, international navigation, environmental protection and management of natural resources. UNCLOS contains provisions applicable to all countries, as well as establishes requirements for environmental protection and pollution reduction. First of all, UNCLOS establishes the fundamental obligation of all states to protect and preserve the marine environment. In addition, it calls on all states to cooperate at the global and regional levels in the development of principles and standards and to take measures to achieve this goal [28]. The goal is to eliminate intentional pollution of the marine environment by oil

and other harmful substances and to reduce the accidental discharge of these substances into the sea [8].

International atmospheric standards are also important for protecting the Arctic environment. Anthropogenic climate change and the further prevention of these changes have been the focus of discussions for the past decade or so. They have led to numerous agreements to reduce activities that destroy the atmosphere and pollute the air. In international law, there are three contractual systems that define three types of atmospheric hazards: related to the protection of the ozone layer, trans-border air pollution and climate change [10,29].

The Arctic is home to many animals, the most famous of which are polar bears, seals, whales, reindeer and caribou. Unfortunately, all these species are threatened with extinction due to human activity. Centuries of hunting whales, seals and other marine mammals have almost led to the extinction of some species. Individual animals are protected by the 1972 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The provisions of the Convention relate to the need to preserve wild forms of flora and fauna that are part of terrestrial natural systems and should be preserved for present and future generations. The Convention declares the obligation of states to protect animals and plants in their territories. There are many other agreements, both international and regional, on the protection of individual animals [35]. Among them, the following can be considered significant for the Arctic: the 1992 Agreement on the Establishment of the North Atlantic Marine Mammal Commission (NAMMCO), the 1973 Agreement on the Conservation of Polar Bears, the 1979 Bonn Convention on the Conservation of Migratory Species of Wild Animals, the 1951 International The 1951 Plant Protection Convention (Food and Agriculture Organization of the United Nations (FAO) or the Ramsar Convention on Wetlands.

Currently, the Arctic is one of the few untouched places on Earth that has not yet been affected by the side effects of human activity. The changes occurring due to global warming negatively influence the region, and it can have serious consequences for the entire planet. The safety of the Arctic environment is regulated by international agreements, in particular the standards contained in UNCLOS, as well as quasi-legal acts called “soft law”.

It is characteristic that there is no single comprehensive agreement that would sufficiently protect the Arctic environment in the face of impending changes.

Similarly, biodiversity in Iraq has suffered a lot due to a number of factors, including unregulated hunting and extraction of endangered species, trade with endangered species, high salinity and environmental pollution, uncontrolled development and lack of protection in a lot of the most important locations. International efforts have been made to restore wetlands, but restoration is uneven due to the high salinity of the soil and water, and the marshes have become fragmented, which has affected the survival of many species and the health of the marshes [35]. Iraq’s infrastructure has been extensively destroyed as a result of systematic and large-scale military conflicts [12]. The strength of evidence regarding environmental risks in Iraq is ambiguous since there are no reliable data; we have calculated the structure of the environmental component when evaluating the effectiveness of projects for fragile states (Table 3).

As we can see from the results of calculations, environmental degradation can be both a cause and a consequence of conflict.

When assessing the environmental effectiveness of programs and projects, it is necessary to take the following into account:

1. Reducing the negative impact of products during their creation and sale
2. Compliance with environmental regulations with respect to:
 - maximum permissible content of harmful substances polluting the air, soil and water;
 - maximum permissible emissions and discharges;
 - maximum permissible radiation intensity;
 - maximum permissible noise pollution level;

- solid and bulky waste;
 - maximum permissible residual chemical substances.
3. Completeness of the recovery of natural resources.
 4. Costs associated with ensuring environmental friendliness and improving the safety of work.

Table 3. The structure of the environmental component in assessing the effectiveness of projects for fragile economy states.

Types of Efficiency	Criteria for Evaluating Effectiveness in Points	Criteria Weight	The Name of Indicators	Weight of Indicators	Points	Characteristics of Indicators	Recommended Values of Indicators in Points	
1	2	3	4	5	6	7	8	
Ecological	$y \geq 8.5$	0.30	Reducing the negative impact of processes	0.40	10	No harmful effects	$y_1 = 10$	
					5	Minor harmful effects		
					0	Significant negative impact		
			Environmental Compliance	0.30	10	Full compliance with environmental regulations		$y_2 = 10$
					5	Minor deviation		
					0	Significant deviation		
		Costs for ensuring environmental friendliness and improving work safety	0.30	10	Sufficient costs for ensuring environmental friendliness and improving work safety	$y_3 \geq 5$		
				5	Slight lack of funds			
				0	Extremely under-invested			

3.2. The Influence of Various Factors on the Development of Regions with Fragile Economies on the Example of Iraq

As a result of studying the influence of factors, the groups were divided into two directions—environmental costs as a result of changes in regulatory documents due to the fault of the first direction (F1), and the second direction (F2)—the influence of political, legal, economic and social factors. Table 2 shows that factor 1 is determined by a combination of groups of factors 2 and 3, namely political and changes in the form of lawmaking, from the point of view of environmental safety policy. Factor 2 is determined by the relationship of the values of groups 1 and 2 with the predominant importance of political or social factors.

The consequences of land degradation and desertification, such as dust storms, drying up of lakes, water scarcity, poverty and migration, and ultimately, the destruction of ecosystems in Iraq with more than 75% of the drylands, requires a thorough understanding of the desertification process and recognition of the driving forces. This study examines the effectiveness of the statistical method to identify the most important criteria affecting the desertification process and risk. The studied region showed areas subject to desertification with a 63% level of high risk of desertification. The results of this study showed that erosion factors, including water and wind erosion, are the most important factors of desertification in the study area. Overgrazing and vegetation degradation in the region, especially in the last decade, have led to soil degradation and reduced fertility, so the level of erosion in the study area is increasing [57].

Nevertheless, there is still no law in Iraq defining the basics of subsurface use, due to the fact that the country’s political groups cannot agree on the legal boundaries of foreign companies in Iraq and the distribution of income from oil and gas production.

3.3. Consideration of the Environmental Component in the Development of Countries with Fragile Economies

Emphasis should be placed on the Management by Objectives approach to the development and selection of programs for funding when managing such territories.

Figure 1 shows the proposed structure of the types of effectiveness of investment programs. This structure of efficiency and the importance of the environmental component is of great importance for fragile countries.

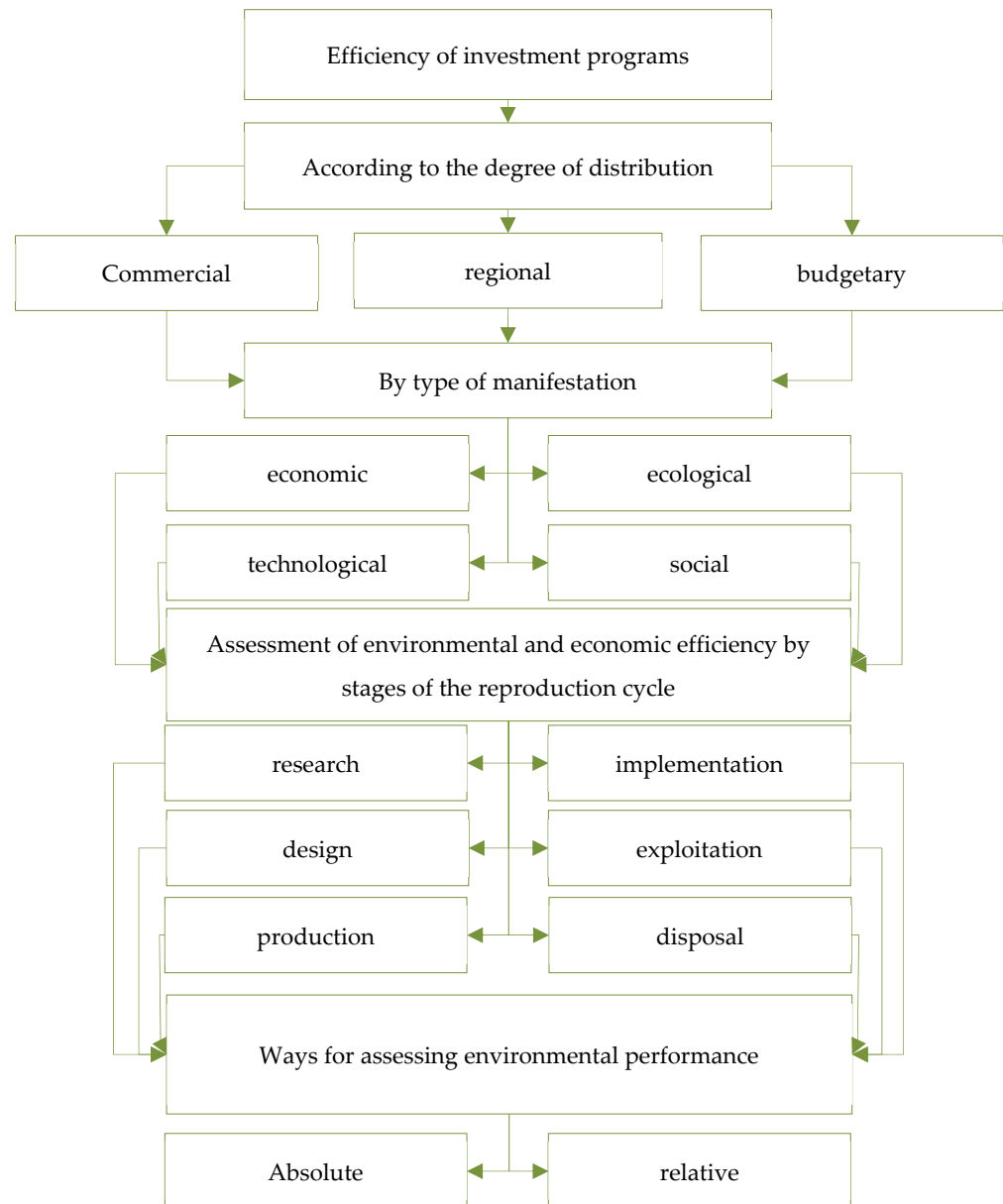


Figure 1. The structure of types of efficiency and the place of environmental efficiency in the evaluation of investment projects.

Environmental efficiency should be determined by performance at all stages of the production cycle—research, design, production, sale, operation and disposal. The effectiveness of investment programs is systemic in nature; it implies the links between the types of efficiency. Environmental efficiency is accompanied by social results, consequences in the development of science and technology and changes in an economic situation.

Absolute efficiency involves comparing the results obtained in the analyzed period with the costs of achieving them. Comparative effectiveness is related to the comparison of the results obtained in the reporting and base periods, either during the implementation of alternative program options or obtained by various entities, etc. Comparative efficiency is also used to select the best possible planned and design options for solving program tasks.

A comprehensive accounting of efficiency in the selection of programs implemented in the territory is a key mechanism for improving the management mechanism of territories with unstable economies. Limited resources in this case will be used as efficiently as possible. Environmental problems in the 21st century is of paramount importance. Therefore, environmental efficiency must necessarily be taken into account in relation to economic development. At the same time, the development of the territory should be carried out using modern technical and technological solutions, which are taken into account within the framework of this approach when evaluating the technological component of efficiency. This implies an assessment of the competitiveness and novelty of the proposed solutions. The social aspects of the implemented programs are related to the environment, as it is necessary to assess the impact of the implemented projects, including on the health of the population. The assessment of social efficiency also includes the number of jobs created and an increase in the level of education of the population. All this needs to be translated into a quantitative form of assessment similar to the environmental efficiency discussed in this article.

4. Discussion

4.1. Influence of the Oil and Gas Industry

The oil and gas sector remains the worst polluter, contaminating the environment at all stages of production—both during extraction (the main source of pollution is gas flares in the field) and during transportation (pipeline accidents), as well as during extraction, refining and use of fuel by consumers (gas emissions into the air). This situation has not been changed even by the rather significant investments made by the sector over the last 10 years, the main purpose of which was to reduce the financial losses incurred by the industry due to gas flaring (chimneys are used to get rid of excess gas from the production area). Similar problems can be seen in Iraq. According to the World Bank, Iraq burned 632 billion cubic feet of natural gas in 2019 [58,59], ranking second in the world for natural gas flaring. Figure 2 shows data on natural gas production and combustion in Iraq.

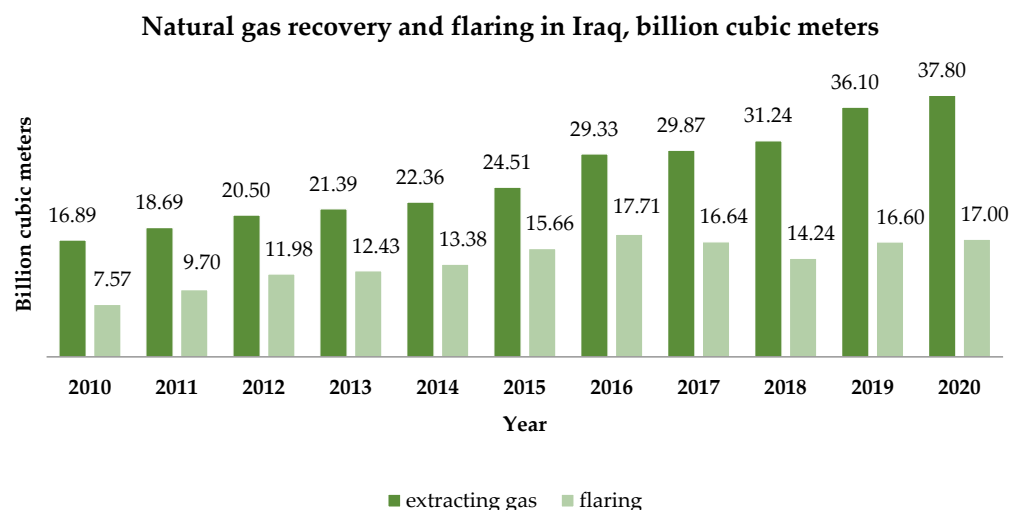


Figure 2. Production and flaring of natural gas in Iraq, billion cubic meters [54,59].

Natural gas is flared due to insufficient pipeline capacity and other midstream infrastructure to transport natural gas from production areas. Until recently, conflicts, sanctions and insufficient investment have hindered the full development of gas reserves. Major environmental polluters, which may include oil and gas companies, receive preferential treatment from the government owing to their importance to the state budget.

Environmental degradation can be both a cause and an effect of conflict. Sometimes it can also exacerbate a conflict that originally arose for other reasons. However, even nonmilitary activities can have negative effects on the environment, from routine pollu-

tion to more serious threats, including nuclear weapons testing, nuclear waste storage, etc. In order to avoid any possible problems, it is important to protect, improve and restore the environment while ensuring the sustainable use of natural resources, including their use by local and indigenous populations and to acknowledge the traditional and cultural needs, values and customs. In addition, it is important to regularly assess the state of the Arctic environment. The ultimate goal is to detect, reduce, and then eliminate environmental problems.

These objectives rely on the following principles: management, planning, and development of measures that will ensure the sustainable use and protection of the Arctic ecosystem and its natural resources for the benefit and enjoyment of the present and future generations.

The use and management of natural resources should be based on an approach that embraces the value and interconnected nature of the ecosystem. Information and knowledge about the natural ecosystem will be developed and disseminated with a view to supporting development activities that should consider the social, economic, cultural and health needs of indigenous peoples. Development activities are based on sound assessments of their potential impact on the environment. It must ensure the preservation of the ecosystem and biodiversity, respect the importance and impact on the global climate, and incorporate the results of scientific research and the traditional knowledge of indigenous peoples.

4.2. Mathematical Interpretation of the Impact of Ecology on Economic Development

We propose a mathematical interpretation of the results reflecting the importance of the environmental factor and the assessment of environmental efficiency for countries with fragile economies. Let us express the consistency of the system taking into account its non-determination and the influence of the environmental factor. To do this, let us first consider the deterministic option.

Based on the inter-sectoral balance model, let us consider a system consisting of n industries and represented by a vector of gross products $X = \{X_1, \dots, X_n\}$, where X_j is the volume of industry j output. $A = \{a_{ij}\}_{i,j=1}^n$ is the inter-sectoral balance matrix (a_{ij} —the amount of industry i output required to produce a unit of industry j output); matrix $B = I - A$, where I is the unit matrix. $Y = \{Y_1, \dots, Y_n\}$ —vector of final products; $Y = BX$.

Suppose that for all $j = 1, \dots, n$ X_j cannot exceed the values of Z_j for the economy:

$$X_j \leq Z_j (j = 1, \dots, n) \quad (1)$$

Let us call $Z = \{Z_1, \dots, Z_n\}$ the vector of ultimate capacities.

We will maximize the final output in the specified proportions β_1, \dots, β_n :

$$\bar{K} = \bar{K}(Z) = \max_{X \leq Z, Y \geq 0} \min_{j \leq n} \{Y_j / \beta_j\} \quad (2)$$

under constraints (1) and natural constraints

$$j = 1, \dots, n \quad (3)$$

\bar{K} —the maximum final output in the specified proportions under the existing economic constraints.

The environmental factor affects the non-determination of the economic system and requires consideration of the probabilistic situation. In this case, the management of the territory should provide for the fact that the ecology of fragile countries may turn out to be a “bottleneck”.

Let us introduce the values

$$V_j = Z_j - \gamma_j, \quad (4)$$

where $\gamma = \{\gamma_1, \dots, \gamma_n\}$ is the cost vector for the implementation of investment projects with environmental efficiency of less than 8.5 (in accordance with Table 3).

The values Z_j and, consequently, V_j (reflecting the possible level of ecological and economic development) are assumed to be independent random variables. The validity of the assumption that these variables are random is based on the fact that an unstable economy is characterized by a non-deterministic environmental impact. In the course of analyzing a probabilistic situation, planning or forecasting tasks are being solved, since in one way or another the events that are just about to happen are considered.

Let $F_j(x)$ be the distribution function of a random variable V_j , i.e., $F_j(x) = P(V_j < x)$ is the probability that the economy of the j industry will not exceed the level of x .

The analysis shows that the probabilistic distribution of a random variable \bar{K} at a large n should be determined by the behavior of $F_j(x)$ only at a small x , i.e., by the probabilities of a sharp aggravation of the environmental situation and significant deviations from the targeted indicators.

Let us assume that V_j can be represented as

$$V_j = \theta_j \xi_j \quad (5)$$

where the deterministic variables θ_j are scale coefficients (which depend on γ), ξ_j are random variables having, at large n , a distribution close to the standard, namely

$$P(\xi_j < x) \rightarrow G_\alpha(x) \quad (6)$$

where

$$G_\alpha(x) = 1 - \exp\{-x^\alpha\} \quad (7)$$

The control parameter α characterizes the consistency of the system in relation to the influence of the environmental factor—the higher the α , the “less random” the \bar{K} : with $\alpha \rightarrow \infty$ V_j , K tending to be deterministic variables (in probability). The coefficient α can be interpreted as an assessment of the environmental reliability of the development of economic sectors in terms of the fulfillment of tasks and as a measure of the confidence of management bodies in achieving targets.

It should be noted that the environmental factor is interrelated with the technological one, for example. Investments in the creation of new technologies can be considered not only as the cost of achieving economic indicators but also as the cost of improving environmental efficiency. Investments aimed at improving the environmental sustainability of the system can include the costs of such changes in technological processes that reduce fluctuations in the quantity and quality of products.

5. Conclusions

5.1. Improving the Efficiency of the Development of the Northern Regions, Taking into Account the Environmental Factor

Thus, it has been shown that many international laws apply directly to the Arctic and to other countries with natural resource extraction and “fragile economies” for which any crisis could lead to disaster. Security of the Arctic environment is enhanced by the participation of the Arctic states in international organizations and discussion forums, as well as by their adherence to multilateral agreements. Documents issued by international institutions, in particular by the Arctic Council, as well as numerous regional and global agreements serve as the basis for environmental protection in this area.

Despite the fact that the various forms of cooperation are not consistent, they nevertheless contribute to many useful initiatives that have a positive impact on environmental protection. Yet, often the provisions contained in treaties overlap, duplicate, or even contradict each other. Overlapping regulations also mean that it is difficult to find the right rule to fit the current situation. Too many sources of law render it impossible to examine the applicable law. This entails a number of negative consequences in terms of compliance, application, interpretation, and lawmaking. As a result of the different legal systems

operating in the countries bordering the Arctic Ocean, it is not always possible for all of them to adhere to a particular international agreement. Most international agreements have different standards for state parties and third countries. Harmonization of these laws will require international meetings and agreements.

In the 21st century, when the market pursues profits and is only driven by self-interest, which it places above environmental protection, nations must compel entrepreneurs to behave appropriately in order to protect the natural environment we live in. Unfortunately, in the case of the Arctic, the major threat is posed by the actors who indeed are responsible for caring for the environment. The Arctic states cannot only take care of their own interests. Their goal cannot only be benefits from the extraction of oil and natural gas, the underdeveloped deposits of which are potentially located in the Arctic region.

Without comprehensive legal regulation of environmental protection, there is a heightened sense of threat. Environmental law must be structured to combine the fundamental principle of international law of state sovereignty with the need to benefit from the common environment and socio-economic development. In order to protect a fragile ecosystem, action is needed on two fronts, both regionally and globally. The first should be the adoption of uniform standards that take into account minimizing the effects of carbon dioxide pollution, supporting the development of regional adaptation strategies to accommodate increased shipping traffic, marine resource exploitation and exploration issues and issues related to fisheries. The second area covers global measures, such as the adoption of international agreements to reduce greenhouse gas emissions and international agreements imposing new, strict rules for the operation of equipment related to accidents and environmental disasters.

5.2. Ecological and Economic Development in Modern Conditions on the Example of Iraq

Ensuring the sustainable functioning and development of the Iraqi economy requires the involvement of foreign investments, technologies and specialists in the oil and gas industry. An important task at the same time is the adoption of a single coordinated law that would consolidate the foundations of subsurface use. This law should reflect the legal relations and economic mechanisms for the distribution of oil production revenues between foreign companies and territorial departments of the country.

Natural gas plays an increasingly important role in the global energy balance. Its biggest advantage is environmental friendliness, since, in comparison with other energy carriers, less harmful emissions are released when burning natural gas. In addition, it has economic and technological advantages.

The Institute of preventive environmental responsibility plays a special role in the realization and protection of citizens' rights to environmental safety.

The regulatory basis for its application is the provision of Article 32 of the Law of the Republic of Iraq No. 27 of 2009 «On the Protection and Improvement of the Environment», according to which activities that hinder the exercise of citizens' right to a safe environment and their other environmental rights are subject to termination in accordance with the procedure established by this law of Iraq.

It should be noted that for some time the use of such means of influence as restriction, suspension and termination was considered in the special legal literature mainly from the standpoint of measures of administrative response to illegal actions or measures to suppress offenses as a kind of administrative responsibility, which can hardly be agreed on the basis of the following considerations.

The application of the above measures of state influence is possible only for environmental offenses, in particular offenses in the field of environmental safety:

1. Violation of environmental safety requirements:

- (a) violation of environmental requirements in the production, storage, transportation, disposal, disposal of toxic and other substances dangerous to the environment, human health and life;

- (b) the absence or non-adoption of measures aimed at preventing salvo emissions and discharges that create high and extremely high levels of pollution of air and water basins and soils that pose a danger to human health and life, wildlife and flora;
- (c) the introduction of enterprises that do not fully comply with environmental requirements, in particular environmental safety requirements;
- (d) violations of environmental requirements, in particular environmental safety requirements in the production of military equipment [27].
- (e) It requires the application of international experience in the application of modern technologies that reduce the burden on nature in related industries [60–62].

5.3. General Conclusions to Improve the Efficiency of Development of Regions with Fragile Economies

The proposed conceptual and methodological approach includes, among other things, the need for an integrated account of various types of efficiency with a mandatory environmental component, which implies the adoption of programs to be implemented in such territories with no harmful effects, in full compliance with environmental regulations. In addition, it is necessary to incur the necessary costs to ensure environmental friendliness and improve occupational safety.

When managing the development of territories, it is very important to evaluate the effectiveness of ongoing projects. In order to increase the efficiency of the development of regions with a fragile economy, an integrated approach is needed to assess the effectiveness of projects under development with the obligatory consideration of environmental and other types of efficiency—technological and social. The significance of environmental efficiency in an integrated approach should be at least 0.3 in fractions of a unit.

To indicate strategic goals and objectives, it is necessary to apply key performance indicators that quantify the level of expected achievement of these goals. Therefore, to improve the efficiency of managing the development of regions with a fragile economy, it is proposed to use a system of strategic development indicators. This scorecard is based on the concept of a balanced scorecard, which is used to manage the development of enterprises and territories in various countries (USA, Sweden, Belgium and others).

The system of indicators of strategic development as an obligatory element should have prospects—the main projections of activity in which the decomposition of the strategy is carried out in order to implement it. For countries with fragile economies, the ecological subsystem should act as a target projection. Within the framework of a balanced scorecard, one can distinguish between indicators that measure the results achieved (lagging indicators of the quality of past performance) and leading indicators that reflect the factors of activity that lead to the emergence of lagging indicators. As the study showed, for countries with fragile economies, at least 30% should be environmental indicators. When evaluating the effectiveness of projects implementing the development strategy, much attention should be paid to the environmental component.

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