Pol. J. Environ. Stud. Vol. 30, No. 5 (2021), 4597-4608
DOI: *10.15244/pjoes/130908* ONLINE PUBLICATION DATE: 2021-07-13

Original Research

Transboundary Diagnostic Analyses and Prioritization Environmental Protection Strategies in the Caspian Sea

Omid Naderi[1], Parviz Mohammadi[2]*, Nasrin Choobkar[1], Hossein Norouzi[1], Seyed Ahmad Hosseini[1]

[1]Department of Environment, Kermanshah Branch, Islamic Azad University, Kermanshah, Iran
[2]Environmental Health Engineering, School of Health, Kermanshah University of Medical Sciences, Kermanshah, Iran

Received: 29 August 2020
Accepted: 26 November 2020

Abstract

The Caspian Sea has become one of the most important strategic areas of the world in recent years. However, human activities and abnormal exploitation and the large annual inflows of pollutants are serious threats to its ecosystem. In the present study, strengths, weaknesses, opportunities and threats are used for transboundary diagnostic analyses by SWOT strategic planning model. Eight strength points, four points of weakness, five opportunities and five threats were identified and 10 appropriate and practical strategies were presented and internal and external factors values were set at 37.38% and 35.18%, respectively. The result strongly emphasis on the compilation of strategic environmental plans for the control of oil, BOD, phosphate and nitrogen pollutants of neighboring countries, especially. The most important strategies include the formulation of common standards, indicators and guidelines on environmental quality and water quality in the Caspian Sea is required. In conclusion, it should be highlighted that the following legal regime may decrease the environmental problems of the Caspian Sea.

Keywords: environmental management, pollution, SWOT model

Introduction

The Caspian Sea is the largest enclosed water body on Earth [1]. It has a unique ecosystem with 400 endemic species facing a number of threats, including coastal zone degradation, habitat destruction and pollution from oil and gas production [2]. The sufficiency of the presented rules will be judged by their capability to environmental protection of the Caspian Sea [3]. Environmental protection has become a major threat for all countries in recent years and the rise of global temperatures, destruction of forests, and overfishing of aquatic species are among the most prominent examples [4]. Conservation of the marine and coastal environment of the Caspian Sea in the 21 century will be the most important challenge for international environmental cooperation between the Caspian littoral states under the auspices of the Tehran Convention [5]. Accordingly,

*e-mail: parviz8855@gmail.com

the Caspian Sea, is of national, regional and global importance, due to the impact of various industrial and oil pollution in recent has created a worrying environmental trend [6, 7]. However, human activities and abnormal exploitation and the large annual inflows of pollutants are serious threats to its ecosystem [8, 9]. After the collapse of the Soviet Union and the emergence of Turkmenistan, Kazakhstan and Azerbaijan in this vast sea area, economic efficiency from the Caspian Sea peaked as well, and the entry of various pollutions from agricultural, industrial and oil sectors, along with unauthorized fishing [10]. Therefore, pollution of the Caspian Sea can cause significant environmental problems for the surrounding countries [11, 12].

Caspian Sea basin consisting of four geopolitical areas: Azerbaijan from the Caucasus, Turkmenistan and Kazakhstan from the Central Asian basin, Russia as the basin the Soviet Union (Figure 1a). However, the Caspian Sea is a closed ecosystem and only accesses free water through the Volga-Dan and Volga-Baltic channels [13]. The Caspian Sea has a coastline about of 7000 km that 1000 km of which is part of the Iranian coast, about 2320 km off the coast of Kazakhstan, 1200 km off the coast of Turkmenistan, 825 km of the Azerbaijan coast, and 1460 km off the coast of Russia [14].

During the Iran-Soviet cooperation on the environment of the Caspian Sea, in 1988, both countries cooperated under the name of "Iran's Permanent Technical Commission and the Soviet Union" [15]. The collapse of the Soviet Union and the emergence of new coastal states on the margin of the Caspian Sea have led to the expansion of the influence of various pollutants. After the collapse of the Soviet Union, the acceleration of some coastal countries for economic exploitation is such that, based on the evidence available shortly, species of sea and migratory birds will be threatened with extinction, and maybe this sea will die. Stop the cooperation between Iran and the Soviet Union in the field of protecting the Caspian Sea environment, the economic problems and financial weaknesses of the new governments, the inability to allocate the necessary funds for environmental protection, management and administrative problems in these countries and lack of necessary supervision to prevent them, the destructive activities of the environment, in particular, the illegal fishing of aquatic animals and a dramatic increase in oil production in the Caspian Sea that have further damaged. In such a situation, Iran, firstly presented the idea of regional cooperation with the participation of the five coastal waters of the Caspian Sea to protect this environment. The holding of the summit of the coastal states of the Caspian Sea on the eve of the echo summit in Tehran on February 17, 1992, is the first major step in this regard. The establishment of the Caspian Sea Regulatory Committee, the Scientific Committee on Water Fluctuations, the Transportation Committee, the Fisheries Committee (Caspian Sea Committee on Biological Resources) and the Caspian Marine Environment Protection Committee were presented at the meeting [16]. The assignment of three committees from the five committees to environmental issues itself reflects the importance of this. In 1998, the CEP program was established with its aim to halt the deterioration of environmental conditions of the Caspian Sea and to promote sustainable development in the area for the long-term benefit of the Caspian populations [17]. Since its establishment, the CEP has addressed multiple environmental issues by developing an effective coordinated management structure, strategic and national action plans and various transnational measures to fight the imminent dangers towards the Caspian environment. The Protocol Concerning Regional Preparedness, Response, and Co-operation in Combating Oil Pollution Incidents ("Aktau Protocol") was adopted and signed at the third meeting of the conference of the parties in Aktau, Kazakhstan on August 12, 2011. The Protocol on the Protection of the Caspian Sea against Pollution from Land-based Sources and Activities ("Moscow Protocol") was adopted at the Fourth Meeting of the Conference of the Parties in Moscow, Russian Federation on December 12, 2012. The Protocol for the Conservation of Biological Diversity ("Ashgabat Protocol") was adopted at the fifth meeting of the Conference of the Parties in Ashgabat, Turkmenistan on May 30, 2014 [16, 17]. In Meeting of the Environment Ministers of the Caspian Littoral States - 9 June 2020, The Caspian countries further concurred that the Tehran Convention Secretariat should be strengthened by operating from the region [16, 17].

The Tehran Convention serves as an umbrella legal instrument laying down general requirements and the institutional mechanism for environmental protection in the Caspian Sea [18]. The Tehran Convention not only aims to protect the Caspian environment from all sources of pollution but also targets the preservation, restoration, and protection of the marine environment of the Caspian Sea. These objectives are based on several international environmental principles, including the precautionary, polluter pays, and access to information principles. Four ancillary Protocols to the Tehran Convention have been developed, covering the four priority areas of concern, namely: (1) Protocol on the Conservation of Biological Diversity, (2) Protocol on the Protection of the Caspian Sea against Pollution from Land-based Sources and Activities, (3) Protocol concerning Regional Preparedness, Response, and Co-operation in Combating Oil Pollution Incidents, and (4) Protocol on Environmental Impact Assessment in a Trans-Boundary Context. As an organization may have the capabilities and weaknesses in achieving goals for opportunities and eliminating threats, Tehran Convention is no exception to this. Given the fact that strategic analysis is a knowledge-based process and the use of strategic models to clarify the conditions and achieve goals, it is necessary, by reviewing environmental treaties such as the Tehran Convention,

it is possible to identify the existing challenges and improve the effectiveness of its strategies. Therefore, since the optimal use of opportunities and the elimination of threats are determined by the evaluation of the functions of an organization, the evaluation of the performance of an organization undoubtedly requires recognition of the organization's environment.

A strategy analysis tool can be used to understand the organization's environment; the SWOT matrix can be one of these tools [19]. This model in strategic management is an effective analytical tool for identifying the external and internal environment [20]. The SWOT technique is a powerful tool that aims to simultaneously identify and evaluate the internal and external factors affecting the organization's environment so that an appropriate decision can be made [19, 21]. This technique can be used not only in the stage of assessing the situation but also at the strategy development stage [22]. Since in the stages of status analysis and strategy formulation, the topics can easily be influenced by the day's policies, or the taste and character of the individuals involved, the technique of creating order, structuring, objectivity, clarity and purposeful focus on the topics [23]. It is able to play an effective role in promoting the quality of environmental decision-making. This matrix is a conceptual framework for identifying and analyzing threats, opportunities in the external environment and assessing the weaknesses and strengths of a system [24]. Reviewing the checklist provided by Matthew Corona for SWOT analysis helps identify concepts such as threats and opportunities [25]. Friend and Jessop expanded the scope of the SWOT model to use strategic scientific findings such as the principles of operational research in government decision making and policymaking [26]. The formation of the Convention on the Protection of the Marine Environment of the Caspian Sea could be considered as an important step towards the conservation and preservation of the Caspian Sea environment since the development of strategies is periodically considered. To the best of our knowledge, no research has been done about the transboundary diagnostic analyses and prioritization environmental protection strategies in the Caspian Sea. Based on the above, we attempted in this research to examine the capabilities and challenges of the Tehran Convention using the SWOT strategic planning model, using the analytical-descriptive method and data collection in the library to improve the effectiveness of its strategies.

Materials and Methods

The SWOT is a useful tool for understanding and decision-making for every situation in programme planning. SWOT is an acronym for strengths, weaknesses, opportunities and threats. Strengths and weaknesses reflect on the present factors, while opportunities and threats show the influences of the external environment affecting the industry. In this research, for the preparation of the SWOT matrix, internal and external factors affecting the formation and continuation of the Caspian Environmental Protection Convention are first identified and collected using the library method (Table 1).

Then, strategic priorities for this study, which include sources of contamination and type of contaminants, are then identified for carrying out the internal factor evaluation (IFE) and external factor evaluation (EFE). The criterion for the selection of strategic options in this study is about internal factors (strengths and weaknesses), common sources of pollution and external factors (opportunities and threats), differences and variations in the share of pollutants. In this study, the contribution of pollutants is considered as the output of a system and is the basis for evaluating internal and external factors. The general rule is that a higher share of pollution is equal to less power, more weakness, less opportunity, and more threat. So, surely fewer shares are equal to more power, less weakness, less threat, and more opportunity to control pollutants. Also, another point is the difference in the share of pollution that must be managed based on the strategic priority of the pollutant source and the type of pollutant.

Accordingly, after identifying the sources of contamination and the type of contaminants, the significance (weighting coefficient) of each is calculated as a percentage by using a comparative method based on the source or contaminant share of the total available share. To determine the weight of internal and external factors for countries, sources and types of pollutants, first, after determining the total amount of each share, the share of each is expressed as a percentage of the total share, each score is then calculated based on predefined states of 1 to 5, and in similar situations, the score will be calculated based on the sum of the countries' total share in all three pollutant sources. Finally, the weighted score of each is determined based on the result of multiplying the percentage share in the score, and each score represents a rank. The score is assigned based on a defined status from low contamination status (1) to the highest contamination condition (5):

1. From the absence of pollutants to the lowest amount (excellent).
2. From the lowest amount of contaminants to the relatively polluted state (good).
3. From moderately contaminated to persistent contamination (moderate).
4. From persistent pollution conditions to situations with the highest pollution levels (weak).
5. Situations with the highest levels of pollution (very weak).

It should be noted that in these situations, each step is considered as a strength and an opportunity compared to the next, and each step is considered a weakness and threat compared to the previous stage. After this step, the weighting of the factors is obtained by multiplying the weighted coefficient by the existing score. Finally,

Table 1. Environmental Challenges of the Caspian Sea (UNEP, 2020; CEIC, 2020; TC, 2019; Majlis Research Center, 2011; Rahmani Fazli, and Sadeghi, 2013).

Internal factors	External factors
Convergence to fight pollution	Pollution as a common threat
Adjustment of convention text and protocols	Legalization of actions
The principle of payment by polluters	Damage caused by pollution
Determining the scope of inclusion	Consider the water level fluctuation
The precautionary principle to postpone cost-Effective measures to prevent damage	Postpone cost-effective measures to prevent damage
Payment by the polluter	Financing
Approval of pollution from land-based sources	Pollution from land-based sources
Approval of pollution from seabed activities	Pollution from seabed activities
Approval of Pollution from Vessels	Pollution from Vessels
Pollution caused by dumping	Pollution caused by dumping
Approval of pollution from other human activities	Pollution from other human activities
Approves the biodiversity protection protocol	Biodiversity protection
Commitment to cooperation	Possibility of developing protocols to the convention
Non-ratification of protocols to the convention on the protection of the environment of the Caspian sea as a criterion for assessing the compliance of coastal states with commitments	Establish a benchmark for assessing coastal states' compliance with commitments
Uncertainty about the legal status of the Caspian sea and consequently uncertainty of disproportionate pollution rate of each country with its share	The necessity to determine the proportion of pollution of each country with its share
The uncertainty of Caspian pollution indices due to it is not collected by coastal countries	Determine indicators of sea pollution
Lack of guidelines and criteria for combating Caspian sea pollution by the coastal states	Provide guidelines and criteria for dealing with pollution
The uncertainty of the Caspian environmental quality standards due to its inability to be formulated by coastal states	Specifying Caspian environmental quality standards
The uncertainty of the Caspian sea water quality standards due to it's not collected by coastal countries	Specifying Caspian water quality standards
Formulation of regulations and bylaws subject to article 29	Possibility of violating the provisions of the convention
The requirement for oil companies and consortia to allocate credits	Insufficient funds
Failure to run continuous programs	Increase public awareness
Preferential benefits of fleeting	The threat of sustainable resources
Inability to create widespread participation across all sectors	Participation of the public and private sector in enforcing the Convention

the SWOT matrix of Caspian contamination status is designed based on information obtained from IFE and EFE matrices.

Results and Discussion

Strategic Prioritization of Countries, Resources, and Types of Pollutants

Strategic priority is attention to the issues that determine the success of actions, and an extended tool for regional development and territorial structuring [17]. This theorem applies to the objectives and functions of the Caspian Convention for the Protection of the Environment, which means that the operation and achievement of the Convention's objectives will only be possible by prioritizing the share of pollutants, sources, and types of pollutants. According to the Version State of the Environment Report by the Caspian states in the third phase of the CEP, the extent and contribution of coastal countries are shown separately (Table 2).

Fig. 1b) illustrates the hazards in and around the Caspian Sea. These hazards in and around the Caspian

Table 2. Pollution loads from different sources in the littoral countries, Transboundary Diagnostic Analyses for the Caspian Sea, (UNEP and UNDP, 2011).

Country	Pollution source	BOD (t/y)	Nitrogen (t/y)	Phosphate (t/y)	Oil (t/y)
Azerbaijan	River	36000	19000	1000	600
	Municipalities	38000	13000	3300	9400
	Industry	7100	1100	300	14000
Iran	River	49500	12000	1200	400
	Municipalities	68000	16000	4400	7800
	Industry	28200	600	210	12500
Kazakhstan	River	13200	6000	600	400
	Municipalities	800	500	100	200
	Industry	2900	7100	100	1800
Russia	River	807900	805000	87500	73100
	Municipalities	16000	5000	1400	3800
	Industry	4900	300	100	8900
Turkmenistan	River	0	0	0	0
	Municipalities	1600	400	100	100
	Industry	1500	100	3970	5400
Total		1075600	886100	104280	138400

Sea are including oil and gas drilling, projected off-shore pipelines, oil wells flooded and leaking, an area under exploration for oil and gas (high potential), polluted sea (oil, pesticides, chemicals, heavy metals or bacteriological pollution), polluted soils and land degradation, soil salinization, polluted rivers (industry and municipal sewage water, land-based source of river pollution (mainly heavy industries), identified poorly stored hazardous industrial waste site or polluting industrial activities, former nuclear testing site, the main direction of sandstorm causing salt transfers toward arable lands of the Volga region.

Internal (IFE) and External (EFE) Factors Evaluation Matrix

The formation of internal and external factors evaluation matrix depends on the source of the pollutant, the type of pollutant, and the contribution of the pollutant. Existing statistics will largely illustrate how countries operate and the contribution of pollution as the output of a system can be the basis for evaluation. The statistics presented here by the Caspian countries were cited in 2002 and 2011 and, more importantly, no more accurate information is currently available.

The Internal Factors Evaluation Matrix (IFE) considers the total share of pollutant resources as a basis for assessing the strength and weaknesses of Caspian countries in how to manage pollutant resources. For evaluating, the allocation of pollutant resources is extracted separately from existing reports, Then the contribution coefficient of each will be expressed as the sum of the total points and expressed as a percentage, the ranking of each country is then calculated on the basis of matching scores that have already been specified as a percentage, and then the weighting of the pollutant sources is also obtained by multiplying the share and ranking.

In Table 3, the total share of countries' pollutants is estimated based on their sources of pollution. In this assessment, Russia has the most shares of river sources and Iran has the most shares of industrial and municipal pollutions. In Table 4, an initial assessment is made based on the overall share of the countries, which shows the pollution status of each country, the Russian Federation has the highest share of pollution in this assessment. In Table 5, the share of BOD and phosphate pollutants of each country is determined by resource allocation. In this assessment, Russia has the most share of river phosphate, Turkmenistan has the most industrial phosphate, and Iran has the most share of BOD and phosphate pollution. In Table 6, the share of nitrogen and oil pollutants of each country is determined by resource allocation. In this assessment, Iran has the most shares of Industrial and municipality's pollution and Azerbaijan has the most shares of oil pollutants. Based on the material above, Table 7 summarizes the internal and external factors.

Table 8 lists the strength, weakness, opportunity, and threat resources scores. In this table, each country's

Fig.1. a) Location of the Caspian Sea, and b) hazards in and around of the Caspian Sea (UNEP, 2010).

share of strength resources (7), weakness resources (8), opportunity resources (36), and threat resources (24) are specified.

The IF and EF are calculated according to equations (1) and (2). The IF and EF values were set at 37.38% and 35.18%, respectively.

$$\%IF = \frac{S+W}{40(s+w)} \times 100 \qquad \%IF = \frac{29.88+30}{40(5+5)} \times 100 = \%37.4 \tag{1}$$

$$\%EF = \frac{O+T}{40(o+t)} \times 100 \qquad \%EF = \frac{26.355+35.33}{40(5+5)} \times 100 = 35.18 \tag{2}$$

Determining the Macro Strategy

The grand strategy is determined by the sum of the available strengths, weaknesses, threats, and opportunities, so that for each of the options, the number of available strengths, weaknesses, opportunities, and threats is extracted from the assessments made. Then, the contribution coefficient of each is determined by the proportionality of the component to the total and expressed as a percentage [27]. For example, since there are three sources of pollution, rivers, cities, and industry, a country with a lower percentage of pollution in one source has a strength and two weaknesses. After summing all the sources of the capability of the countries, the coefficient of the contribution of each country is determined, that is, if the total capacity of the countries is eight and the capacity of one country is equal to two, the share coefficient of that country will be 25%. Then, by ranking each country according to the estimates we have previously obtained from the lowest (1) to the highest (5) pollutant share, we will multiply the power factor by the weighted number obtained. To determine the macro strategy, we follow the rules outlined in the assessment of the internal and external factors.

SWOT Matrix Design

The internal and external factors assessment of this study showed in Fig. 2. Accordingly, the green color

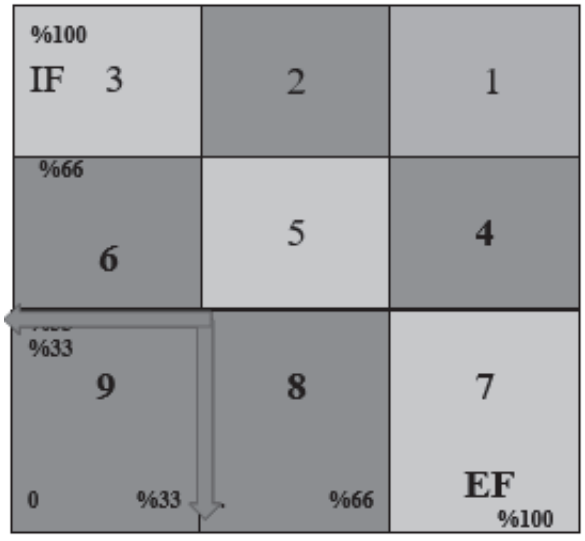

Fig. 2. Internal and External Factors Assessment.

Table 3. The total share of Caspian Sea countries' pollutants.

Country	Pollution source	Total (t/y)	Pollution share factor (%)	Rating	Weighted score
Azerbaijan	River	56600	2.95	3	8.85
Iran		63100	3.29	4	13.16
Kazakhstan		20200	1.05	2	2.1
Russia		1773500	92.68	5	463.4
Turkmenistan		0	0	1	0
Total		1913400	100	-	-
Azerbaijan	Municipalities	63700	33.54	4	134.16
Iran		96200	50.65	5	253.25
Kazakhstan		1600	0.84	1	0.84
Russia		26200	13.79	3	41.37
Turkmenistan		2200	1.15	2	2.30
Total		189900	100	-	-
Azerbaijan	Industry	22500	22.25	4	89
Iran		41510	41.06	5	205.3
Kazakhstan		11900	11.77	2	23.54
Russia		14200	14.04	3	42.12
Turkmenistan		10970	10.85	1	10.85
Total		101080	100	-	-

(no. 1) is strategy SO. In this strategy, the organization draws on external opportunities to the greatest extent. The blue color (no. 2 and 4) is strategy WO. The purpose of this strategy is to take advantage of the opportunities available to offset weaknesses. The yellow color (no. 3, 5, and 7) is strategy ST. In this situation, the goal of the organization is to use methods that utilize internal strengths to prevent the negative impact of external threats and even try to eliminate them. The red color (no. 6, 8, and 9) is strategy WT (defensive strategies) [28]. The purpose of this strategy is to reduce internal weaknesses and avoid threats from the external environment. The results of this research emphasize strategy (WT; Table 9).

The findings of this study showed that despite all the benefits of the Tehran Convention, strategic priorities must be identified in the selection of pollutants and sources of pollution in the Caspian Sea. Because any natural or artificial activity that causes alterations or material entry into the marine environment has adverse effects on the marine, aquatic and even human environment and per Maritime Law in 1982 is considered to be marine pollution. SWOT technique is an efficient and desirable method and many researchers have used it under similar conditions. For example, a paper on recognizing and assessing the vulnerability of Anzali beaches using the SWOT model, concludes that the most important weakness in coastal management is polluted rivers. In this research, after the analysis of the matrix and the analysis of its elements, the most important internal and external factors influencing the coastal zone and its vulnerability to environmental

Table 4. Assessment based on the total of pollutants.

Country	Total (t/y)	Pollution share factor (%)	Points	Weighted points
Azerbaijan	142800	6.47	3	19.41
Iran	200810	9.10	4	36.4
Kazakhstan	33700	1.52	2	3.04
Russia	1813900	82.28	5	411.4
Turkmenistan	13170	0.59	1	0.59
Total	2204380	100	-	-

Table 5. The share of BOD and phosphate pollutants of Caspian Sea countries.

Country	Pollution source	BOD				Phosphate			
		Amount (t/y)	Pollution share factor (%)	Rating	Weighted score	Amount (t/y)	Pollution share factor (%)	Rating	Weighted score
Azerbaijan	River	36000	3.97	3	11.9	1000	1.10	3	3.3
	Municipalities	38000	30.54	4	122.2	3300	35.48	4	141.9
	Industry	7100	15.91	4	63.6	300	6.41	4	25.6
Iran	River	49500	5.45	4	21.8	1200	1.32	4	5.3
	Municipalities	68000	54.66	5	273.3	4400	47.31	5	236.6
	Industry	28200	63.22	5	316.1	210	4.48	3	13.4
Kazakhstan	River	13200	1.45	2	2.9	600	0.66	2	1.32
	Municipalities	800	0.64	1	0.6	100	1.07	1	1.1
	Industry	2900	6.50	2	13	100	2.13	1	2.1
Russia	River	807900	89.11	5	445.6	87500	96.89	5	484.5
	Municipalities	16000	12.86	3	38.6	1400	15.05	3	45.2
	Industry	4900	10.98	3	32.9	100	2.13	2	4.3
Turkmenistan	River	0	0.00	1	0.0	0	0.00	1	0.0
	Municipalities	1600	1.28	2	2. 6	100	1.07	2	2.1
	Industry	1500	3.36	1	3.4	3970	84.82	5	424.1
Total (t/y)	River	906600	1075600			90300	104280		
	Municipalities	124400				9300			
	Industry	44600				4680			

Table 6. The share of nitrogen and oil pollutants of Caspian Sea countries.

Country	Pollution source	Nitrogen				Oil			
		Amount (t/y)	Pollution share factor (%)	Rating	Weighted score	Amount (t/y)	Pollution share factor (%)	Rating	Weighted score
Azerbaijan	River	19000	2.25	4	9	600	0.80	4	3.22
	Municipalities	13000	37.24	4	148.96	9400	44.13	5	220.65
	Industry	1100	11.95	4	47.8	14000	32.86	5	164.3
Iran	River	12000	1.42	3	4.26	400	0.53	3	1.59
	Municipalities	16,000	45.84	5	229.2	7800	36.61	4	146.44
	Industry	600	6.52	3	19.56	12500	29.34	4	117.36
Kazakhstan	River	6000	0.71	2	1.42	400	0.53	2	1.06
	Municipalities	500	1.43	2	2.86	200	0.93	2	1.86
	Industry	7100	77.17	5	385.85	1800	4.22	1	4.22
Russia	River	805000	95.6	5	478	73100	98.12	5	490.6
	Municipalities	5000	14.32	3	42.96	3800	17.84	3	53.52
	Industry	300	3.26	2	6.52	8900	20.89	3	62.67
Turkmenistan	River	0	0	1	0	0	0	1	0
	Municipalities	400	1.14	1	1.14	100	0.46	1	0.46
	Industry	100	1.08	1	1.08	5,400	12.67	2	25.34
Total (t/y)	River	842000	886100			74500	138400		
	Municipalities	34900				21300			
	Industry	9200				42600			

Table 7. All internal and external factors.

	Azerbaijan		Iran		Kazakhstan		Russia		Turkmenistan	
Strength	River:3		River:4		Municipalities:1		Municipalities:3 Industry:3		River:1 Industry:1	
Weakness	Municipalities:4 Industry:4		Municipalities:5 Industry:5		River:2 Industry:2		River:5		Municipalities:2	
Opportunity	BOD	River:3	Oil	River:3	BOD	River:2 Municipalities:1 Industry:2	BOD	Municipalities:3 Industry:3	BOD	River:1 Municipalities:2 Industry:2
			N	River:3 Industry:3	N	River: 2 Municipalities:2	N	Municipalities:3 Industry:2	N	River:1 Municipalities:1 Industry:1
	P	River:3	P	Industry:3	Oil	River:2 Municipalities:2 Industry:1	Oil	Municipalities:3 Industry:3	Oil	River:1 Municipalities:1 Industry:2
					P	River:2 Municipalities:1 Industry:1	P	Municipalities:3 Industry:2	P	River:1 Municipalities:2
Threat	BOD	Municipalities:4 Industry:4	BOD	River:4 Municipalities:5 Industry:5	N	Industry:5	BOD	River:2 Municipalities:1 Industry:2	P	Industry:5
	N	River:4 Municipalities:4 Industry:4	N	Municipalities:5			N	River: 2 Municipalities:2		
	Oil	River:4 Municipalities:5 Industry:5	Oil	Municipalities:4 Industry:5			Oil	River:2 Municipalities:2 Industry:1		
	P	Municipalities:4 Industry:4	P	River:4 Municipalities:5			P	River:2 Municipalities:1 Industry:1		

Table 8. Strength resources scores.

Country	Number of resources	Contribution rate (%)	Rating	Weighted score
	Strength			
Azerbaijan	1	1.42	3	4.26
Iran	1	1.42	4	5.68
Kazakhstan	1	1.42	2	2.84
Russia	2	2.85	5	14.25
Turkmenistan	2	2.85	1	2.85
Total	7	10=100	-	29.88
Weakness				
Azerbaijan	2	2.5	3	7.5
Iran	2	2.5	4	10
Kazakhstan	2	2.5	2	5
Russia	1	1.25	5	6.25
Turkmenistan	1	1.25	1	1.25
Total	8	10=100		30
Opportunity				
Azerbaijan	2	0.55	3	1.65
Iran	4	1.11	4	4.44
Kazakhstan	11	3.055	2	6.11
Russia	8	2.22	5	11.1
Turkmenistan	11	3.055	1	3.055
Total	36	10=100		26.355
Threat				
Azerbaijan	10	4.16	3	12.48
Iran	8	3.33	4	13.32
Kazakhstan	1	0.41	2	0.82
Russia	4	1.66	5	8.3
Turkmenistan	1	0.41	1	0.41
Total	24	10=100		35.33

vulnerability are identified and presented [29]. Also, in another research entitled The Development and Prioritization of Appropriate Strategies for Managing the Geopolitical Area of the Caspian Sea, the issue of optimal management of the Caspian Sea is being developed to extend resources with the aim of sustaining and productive peaceful and participatory efforts, In this research, by the SWOT method, eight strength points, four points of weakness, five opportunities and five threats were identified and 10 appropriate and practical strategies were presented.

The results of this study also summarize and recommend these findings:

– The superiority of sustainable resources over fleeting revenues.
– Formulation of common standards, indicators, and guidelines on environmental quality and water quality in the Caspian Sea.
– Mapping the contamination.
– Special attention to river flows as the main contamination factor of the Caspian Sea.
– The implementation of urban and domestic sewage collection and treatment systems.
– Conduct joint environmental audits.
– Establishing a conservation and exploitation plan jointly by coastal countries.
– Find incentives to raise countries' adherence.
– Environmental opportunities are one of the main factors in the crystallization of the capacities of the Caspian states to achieve greater convergence.

Table 9. The summarized SWOT matrix.

SWOT	Opportunities	Threats
Strengths	SO	ST
	-Possibility of reducing BOD and phosphate contamination in river resources by Azerbaijan -Possibility of reduction of nitrogen and oil in river resources by Iran -Possibility of reducing BOD and phosphate in urban resources by Kazakhstan -Russia's ability to reduce phosphate and nitrogen in industrial sources -Possibility for Turkmenistan to reduce pollution of the river and industrial resources	-The necessity of preventing the spread of BOD, phosphate and nitrogen pollutants in urban and industrial sources by Azerbaijan -The need to prevent the spread of oil pollutants in urban and industrial resources by Iran -The necessity to prevent Kazakhstan from spreading phosphate contaminants in rivers and oil in industrial sources -The need to prevent Russia from spreading river pollutants -The need to prevent the spread of urban pollution by Turkmenistan
Weaknesses	WO	WT
	- Management of oil and nitrogen river resources by Azerbaijan - Management of BOD and river phosphate resources by Iran -Management of urban oil and nitrogen resources by Kazakhstan -Management of urban phosphate and nitrogen, BOD and municipal and industrial oil by Russia -Phosphate management and urban BOD by Turkmenistan	- Management of oil pollutants in urban and industrial resources by Azerbaijan - Management of BOD pollutants in urban and industrial sources, urban phosphate and nitrogen by Iran - Industrial nitrogen management by Kazakhstan -Russia's management of BOD, nitrogen, phosphate, and oil in river resources -Management of industrial phosphate by Turkmenistan

- The ability of the Caspian states to converge, to the threats, required the adoption of legal frameworks.
- Attract NGOs to monitor compliance with environmental regulations by coastal governments.
- Management of oil pollutants in urban and industrial resources by Azerbaijan.
- Management of BOD pollutants in urban and industrial sources, urban phosphate and nitrogen by Iran.
- Industrial nitrogen management by Kazakhstan.
- Russia's management of BOD, nitrogen, phosphate, and oil in river resources.
- Management of industrial phosphate by Turkmenistan.
- The weakness of the Caspian states is the most important deterrent in regulating and safeguarding control mechanisms.
- The management of existing threats and weaknesses will only be achieved through shared and differentiated accountability.

Conclusion

Due to the importance of the Caspian Sea for coastal countries, proper management of this sea has always been one of the important issues to consider. Among the contracts that have been concluded between the Caspian countries so far, the Tehran Convention is of particular importance, but it has capabilities and weaknesses as well as other organizational conventions in the world in achieving opportunities and threats. Based on the SWOT technique and based on strategic priorities based on the share of countries, sources and types of pollutants, a new matrix was designed to determine the contribution of each country to this important and influential issue. The main findings of this study are that while environmental opportunities and threats have created convergence and, consequently, the adoption of a legal framework among the Caspian states, but only by establishing and safeguarding preventive mechanisms and acceptance of joint and different responsibilities, the aims of the Convention come true. Our results recommend an application of SWOT technique on strategic priorities. It is, therefore, suggested that future work seek to use SWOT analysis for prioritizing strategies in Persian Gulf and other lakes around the world.

Conflict of Interest

The authors declare no conflict of interest.

References

1. JAHANGIR M.H., MAZINANI M. Evaluation of the convertible offshore wave energy capacity of the southern strip of the Caspian Sea. Renewable Energy, **152**, 331, **2020**.
2. UNEP (UNITED NATIONS ENVIRONMENT PROGRAMME), UNEP Regional Seas, Caspian Sea, **2020**.

3. HAWKINS C.V., KWON S.W., BAE J. Balance between local economic development and environmental sustainability: A multi-level governance perspective. International Journal of Public Administration, **39**, 803, **2016**.
4. CAZZOLLA GATTI R. Trends in human development and environmental protection. International Journal of Environmental Studies, **73**, 268, **2016**.
5. TEHRAN CONVENTION (TC). Caspian Sea State of the Environemnt, Interim Secretariat of the Framework Convention for the Protection of the Marine Environment of the Caspian Sea, **2019**.
6. VAN BAKK C.G., GROTHE A., RICHARDS K., STOCIA M., ALIYEVA E., DAVIES G.R., KRIJGSMAN W. Flooding of the Caspian Sea at the intensification of Northern Hemisphere Glaciations. Global and Planetary Change, **174**, 153, **2019**.
7. MEDVEDEV I.P., RABINOVICH A.B., KULIKOV E.A. Tides in three enclosed basins: The Baltic, Black, and Caspian seas. Frontiers in Marine Science, **3**, 46, **2016**.
8. LATTUADA M., ALBRECHT C., WILKE T. Differential impact of anthropogenic pressures on Caspian Sea ecoregions. Marine Pollution Bulletin, **142**, 274, **2019**.
9. JAFARI N. Review of pollution sources and controls in Caspian Sea region. Journal of Ecology and the Natural Environment. **2**, 25, **2010**.
10. ORAZGALIYEV S., ARARAL E. Conflict and cooperation in global commons: Theory and evidence from the Caspian Sea. International Journal of the Commons, **13**, 2, **2019**.
11. BANIEMAM M., MORADI A.M., BAKHTIARI A.R., FATEMI M.R., KHANGHAH K.E. Seasonal variation of polycyclic aromatic hydrocarbons in the surface sediments of the southern Caspian Sea. Marine Pollution Bulletin, **117**, 478, **2017**.
12. SOBHANARDAKANI S., TAYEBI L., HHOSSEINI S.V. Health risk assessment of arsenic and heavy metals (Cd, Cu, Co, Pb, and Sn) through consumption of caviar of *Acipenser persicus* from Southern Caspian Sea. Environmental Science and Pollution Research, **25**, 2664, **2018**.
13. KOOLAEE E., GOUDARZI M. Ecological Threats in the Caspian Sea and the Role of the Tehran Convention. Environmental Sciences, **7**, 69, **2009**.
14. ZEINOLABEDIN Y., YAHYAPOUR M.S., SHIRZAD Z. Geopolitics and environmental issues in the Caspian Sea. Caspian Journal of Environmental Sciences, **7**, 113, **2009**.
15. MALEKI A. Caspian Sea and environmental necessities: coordination to deal with problems, source: Central Asia and Caucasus Studies, Tehran, **2002**.
16. DAMIRCHILU M. Developments of the Legal Regime of the Caspian Sea: An Iranian Outlook. Journal of Central Eurasian Studies, **1**, 29, **2008**.
17. DE MORA S.J., TURNER T. The Caspian Sea: a microcosm for environmental science and international cooperation. Marine Pollution Bulletin, **48**, 26, **2004**.
18. PISHGAHIFARD Z., NUSRATI S., BAZDAR S. Formulate and prioritize proper strategies for managing the geopolitical field of the Caspian Sea. Central Eurasia Studies, **9**, 193, **2016**.
19. PHADERMROD B., CROWDER R.M., WILLS G.B. Importance-performance analysis based SWOT analysis. International Journal of Information Management, **44**, 194, **2019**.
20. QUEZADA L.E., REINAO E.A., PALOMINOS P.I., ODDERSHEDE A.M. Measuring Performance Using SWOT Analysis and Balanced Scorecard. Procedia Manufacturing, **39**, 786, **2019**.
21. KANGAS J., KURTTILA M., KAJANUS M., KANGAS M. Evaluating the management strategies of a forestland estate - the S-O-S approach. Journal of Environmental Management, **69**, 349, **2003**.
22. CUI J., ALLAN A., LIN D. SWOT analysis and development strategies for underground pedestrian systems. Tunnelling and Underground Space Technology, **87**, 127, **2019**.
23. NOVAC V., RUSU E., SCURTU I.C. Opportunities and risks related to offshore activities in the western Black Sea. Journal of Environmental Protection and Ecology, **20**, 1698, **2019**.
24. GUREL E., TAT M. SWOT analysis: a theoretical review. Journal of International Social Research, **10**, 994, **2017**.
25. CARMONA M. Housing Design Quality: through policy, guidance and review. Taylor & Francis. **2002**.
26. FREIND J., JESSOP W N. Local government and strategic choice. 2nd Edition, Oxford. Pergamon Press, **1976**.
27. SETAK M. Evaluation of internal and external factors.: https://wp.kntu.ac.ir/setak/files/11-Chapter, **2017**.
28. WEIHRICH H. The TOWS matrix, in R.G. Dyson (ed) Strategic Planning: Models and analytical techniques, Chichester: John Wiley & Sons, **1990**.
29. RAMEZANI G.B., RAJABI R. Environmental vulnerability assessment of Tourism in Anzali Coastal with Using of SWOT model. Journal of Environmental Science and Technology, **16**, 275, **2014**.