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Evaluation of Environmental Sustainability Index (ESI) in the Countries around the Caspian Sea

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ABSTRACT

The purpose of the present paper is to study the Environmental Sustainability Index (ESI) of the countries around the Caspian Sea. ESI is an important composite index that tracks a diverse set of socio-economic, environmental, and institutional indicators that characterize and influence environmental sustainability at the national scale. In this paper ESI will be used as the basis for the evaluation and for drawing up policy-making guidelines in order to help achieving better performance levels for the five countries located around The Caspian Sea region during 2005 - 2007. The ESI values onto a zero to 100 scales, where 100 corresponded to the target and zero to the worst observed value. Our findings show the Caspian Sea region has moderate ESI Score, Russia, enjoys high performance comparing to other countries in the region. On the contrary, Turkmenistan has the lowest ESI. Also the results show, Iran has low Environmental Systems score, moderate Stresses and Vulnerability score and very low Capacity and Stewardship score that indicate this country faces many challenges, both natural and manmade, and have poorly managed its policy choices.

KeyWords: Environmental Sustainability Index (ESI), Caspian Sea Region,

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1. INTRODUCTION

Sustainability is a characteristic of dynamic systems that maintain themselves over time; it is not a fixed endpoint that can be defined. Environmental sustainability refers to the long-term maintenance of valued environmental resources in an evolving human context (Rosen, 2017, Zhang et al., 2018).

The best way to define and measure sustainability is contested. Economists often emphasize an accounting approach that focuses on the maintenance of capital stocks. Some in the environmental realm focus on natural resource depletion and whether the current rates of resource use can be sustained into the distant future [Ebert, Udo and Heinz Welsch 2004 and Esty, Daniel C., Mark A. Levy, et al.2003].

The Environmental Sustainability Index (ESI) is a composite index that tracks a diverse set of socio-economic, environmental, and institutional indicators that characterize and influence environmental sustainability at the national scale (Hatami and Shafieardekani, 2014). It was launched in 1999 by Professor Daniel C. Esty, Director of the Yale Center for Environmental Law & Policy, in cooperation with Columbia University's Center for International Earth Science Information Network (CIESIN) and the World Economic Forum's Global Leaders for Tomorrow Environment Task Force [Yale Center for Environmental Law & Policy 2006].

The Environmental Sustainability Index (ESI) provides a gauge of a society's natural resource endowments and environmental history, pollution stocks and flows, and resource extraction rates as well as institutional mechanisms and abilities to change future pollution and resource use trajectories [Esty, Daniel C. 2002 & Esty, Daniel C. 2004].

In seeking to provide a policy-relevant gauge of national environmental conditions and their likely trajectory over the next several decades, the ESI centers on the state of environmental systems, both natural and managed. It also measures stresses on those systems, including natural resource depletion and pollution rates, because the magnitude of such stresses serve as a useful indicator of the pressure on the underlying systems. The ESI further measures impacts and responses and human vulnerability to environmental change. In addition, the ESI tracks a society's capacity to cope with environmental stresses and each country's contribution to global

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stewardship [Esty, Daniel C., Mark A. Levy, et al. 2003 & Levy, Marc A. and Patrick P. Meier 2004].

Environmental sustainability entails issues that are local as well as national and global in scale, all of which should figure in international comparisons (as they do in the ESI) [Parris, Thomas M. and Robert W. Kates 2003].

The ESI and its elements provide a foundation for more data-driven environmental analysis and decision-making. In doing so, it sheds light on a number of critical issues (Foroughi and Esfahani, 2012). The ESI demonstrates, for example, that income contributes to the potential for strong environmental stewardship, but does not guarantee it. Indeed, it is striking how many of the bottom rungs of ESI are occupied by countries that are relatively wealthy [Esty, Daniel C. and Michael E. Porter 2005].

The relationship between environmental sustainability and economic development is complex. At every level of income, countries face environmental challenges. Some countries manage their pollution control and natural resource management challenges relatively well while others do not. Development status is therefore not environmental destiny [Chess, C., et al. 2005; Shafieardekani, and Hatami 2013; Kermani et al. 2018].

The ESI suggests that a more quantitative and systematic approach to environmental policymaking – where: [Ebert, Udo and Heinz Welsch 2004, Esty, D.C., M.A. Levy et al. 2005 & Levy, Marc A. and Patrick P. Meier 2004]

(a) Problems are tracked through a carefully constructed set of metrics and indicators.

(b) Policy progress is evaluated empirically.

(c) Governments benchmark their results against a relevant peer group – can help to highlight superior environmental programs, technologies, strategies, and approaches.

ESI-based analysis reveals some of the critical determinants of environmental performance: low population density, economic vitality, and quality of governance. Some of these variables have long been identified as theoretically important. The ESI provides empirical support for these theories [Prescott-Allen, Robert 2001 & Esty, Daniel C. and Michael E. Porter 2005].

The purpose of the present paper is to study the Environmental Sustainability Index of the countries around the Caspian Sea region during 2007 - 2005 period. To do so, we

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used ESI data from the Yale Center for Environmental Law & Policy that reported in 2006. The ESI values onto a zero to 100 scales, where 100 corresponded to the target and zero to the worst observed value. Section II discusses the framework of ESI. Section III compares the ESI and its components for the countries around the Caspian Sea and ranks them accordingly. Finally, section IV summarizes the main findings and conclusions.

2. The ESI FRAMEWORK

The Environmental Sustainability Index (ESI) benchmarks the ability of nations to protect the environment over the next several decades. It does so by integrating 76 data sets – tracking natural resource endowments, past and present pollution levels, environmental management efforts, and the capacity of a society to improve its environmental performance –into 21 indicators of environmental sustainability. These indicators permit comparison across a range of issues that fall into the following five broad categories: [Hatami and Ameri Siahooei 2013; Kermani et al. 2017; Marchettini, et al. 2003]

• Environmental Systems
• Reducing Environmental Stresses
• Reducing Human Vulnerability to Environmental Stresses
• Societal and Institutional Capacity to Respond to Environmental Challenges
• Global Stewardship

These five core components and the logic for their inclusion in the ESI are laid out in Table 1. [Yale Center for Environmental Law & Policy 2006]

Table 1. Environmental Sustainability Index (ESI) Building Blocks–Components

Component	Logic
Environmental Systems	A country is more likely to be environmentally sustainable to the extent that its vital environmental systems are maintained at healthy levels, and to the extent to which levels are improving rather than deteriorating.
	A country is more likely to be environmentally sustainable if the levels of anthropogenic stress are low

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Reducing Environmental Stresses	enough to engender no demonstrable harm to its environmental systems.
Reducing Human Vulnerability	A country is more likely to be environmentally sustainable to the extent that people and social systems are not vulnerable to environmental disturbances that affect basic human wellbeing; becoming less vulnerable is a sign that a society is on a track to greater sustainability.
Social and Institutional Capacity	A country is more likely to be environmentally sustainable to the extent that it has in place institutions and underlying social patterns of skills, attitudes, and networks that foster effective responses to environmental challenges.
Global Stewardship	A country is more likely to be environmentally sustainable if it cooperates with other countries to manage common environmental problems, and if it reduces negative Tran boundary environmental impacts on other countries to levels that cause no serious harm.

Source: Yale Center for Environmental Law & Policy (2006)

This basic model builds on a broad base of theory in the ecological sciences and environmental policy. The core components of the ESI have a great deal of overlap with the widely used Pressure-State-Response (PSR) indicator model, and especially its more recent DPSIR variant that additionally breaks out Driving Forces and Impacts1. The cumulative picture created by these five components does not in any authoritative way define sustainability, but instead represents a comprehensive gauge of a country's present environmental quality and capacity to maintain or enhance conditions in the years ahead [Saltelli, Andrea, Karen Chan, et al. 2000 & Yale Center for Environmental Law & Policy 2006].

By giving each variable within an indicator the same weight and weighting each of the 21 indicators equally, we provide an imperfect but clear starting point for analysis.

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Table 2 shows in summary the nesting of indicators within components of ESI [Yale Center for Environmental Law & Policy 2005].

Table 2: ESI Component, Indicators and Indicator Number

Objective	Component	Indicators	Indicator Number
Environmental Sustainability Index	Environmental System	Air Quality	1
		Biodiversity	2
		Land	3
		Water Quality	4
		Water Quantity	5
	Reducing Environmental Stresses	Reducing Air Pollution	6
		Reducing Ecosystem Stress	7
		Reducing Population Pressure	8
		Reducing Waste & Consumption Pressure	9
		Reducing Water Stress	10
		Natural Resource Management	11
	Reducing Human Vulnerability	Environmental Health	12
		Basic Human Sustenance	13
		Reducing Environment-Related Natural Disaster Vulnerability	14
	Social and Institutional Capacity	Environmental Governance	15
		Eco-Efficiency	16
		Private Sector Responsiveness	17
		Science and Technology	18
	Global Stewardship	Participation in International Collaborative Effort	19
		Reducing Gas Emissions	20
		Reducing Transboundary Environmental Pressures	21

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Source: Yale Center for Environmental Law & Policy (2006)

To calculate the ESI scores for each country and to facilitate the aggregation of variables into indicators, the raw data were transformed in a variety of ways. A number of variables require appropriate "denominators" to permit comparisons across countries of different scales, including transformations to improve the imputation model and the symmetry of the data. To avoid having extreme data points skew the results, we "trim the tails" of each data set distribution and construct a "z-score" for each variable that preserves the relative position of each country for each variable while providing a neutral way to aggregate the variable into indicators [Sutton, Paul C. 2003].

3. ESI PERFORMANCE AND COUNTRY RANKINGS

In this section, at first we analysis the 2007 and 2005 environmental Sustainability index in the five countries around the Caspian Sea region, and then compare the index performance of these countries together. Table 3. shows the ESI score in the five countries around the Caspian Sea region. According to the information of this table, average score of ESI in the Caspian Sea region in 2007 is equal 43.8 that shows these countries have moderate score in the ESI, whiles in 2005 the ESI average score in this region is equal 44.6 that indicate the region has a better and 1.7 percentage growth rate respect to last period. Therefore, ESI average score in grouping around Caspian Sea countries in 2007 and 2005 demonstrate that this region has equivalent operation. This fact seems to indicate that Environmental Sustainability challenges come in multiple forms and combination.

Table 3. Environmental Sustainability Index (ESI) Score of the Countries around the Caspian Sea

Country	2007	2005	Growth Rate
Azerbaijan	41.8	45.4	8.6
Iran	44.5	39.8	-10.6
Kazakhstan	46.5	48.6	4.5
Russia	49.1	56.1	14.3
Turkmenistan	27.3	33.1	-11
Average	43.8	44.6	1.7

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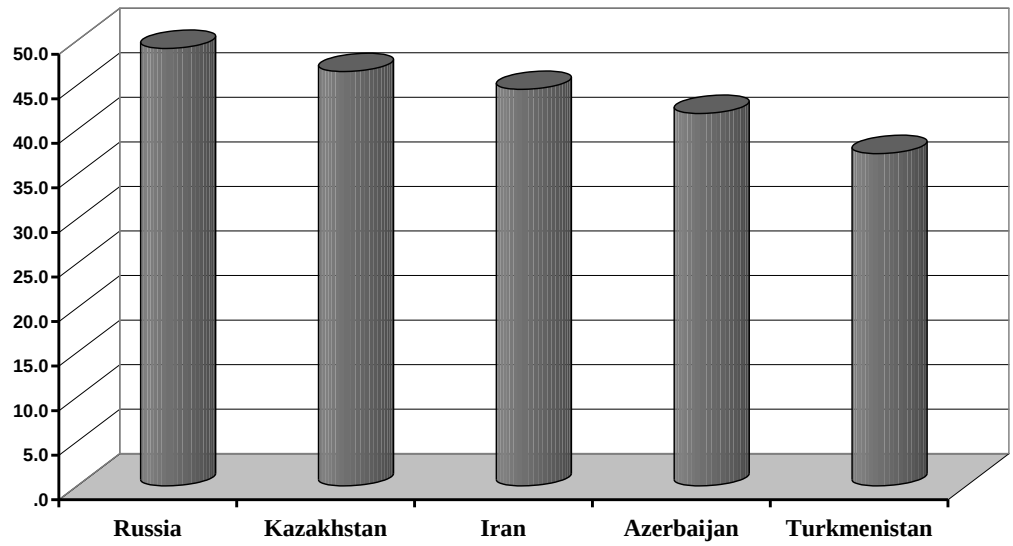
Source: Yale Center for Environmental Law & Policy (2006)

Also table 3. Represents that in 2007, Azerbaijan, Iran, Kazakhstan and Russia have moderate ESI score, while Turkmenistan has low ESI score. Figure 1. Shows the ranking the five countries around the Caspian Sea by ESI score in 2007. Regarding to the figure, the top ranked country in the 2007 ESI is Russia and the lowest ranked country is Turkmenistan. Iran scoring 44.5, ranks 3rd in the ESI among the five countries around the Caspian Sea in 2007.

Figure 1. Ranking the Countries around the Caspian Sea by Environmental Sustainability Index (ESI) in 2003



Source: Table 3

Table 3. As well as expresses that in 2005, Russia has rather moderate, Azerbaijan and Kazakhstan have moderate ESI score, while Iran and Turkmenistan have low ESI score. Figure 2. Shows the ranking the five countries around the Caspian Sea by ESI score in 2005. Regarding to the figure, the top ranked country in the 2005 ESI is Russia and the lowest ranked country is Turkmenistan. Iran scoring 39.8, ranks 4rd in the ESI among the five countries around the Caspian Sea in 2005.

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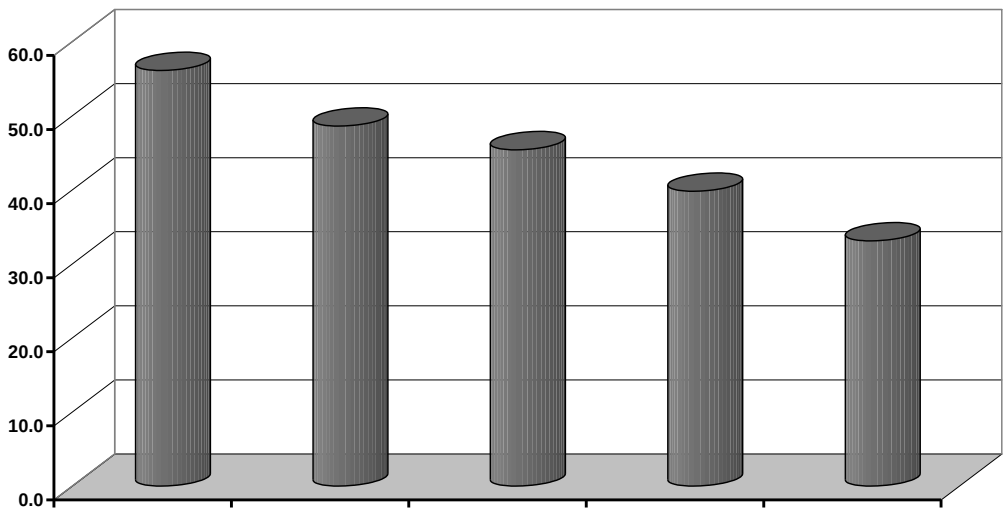
Figure 2. Ranking the Countries around the Caspian Sea by Environmental Sustainability Index (ESI) in 2005



Source: Table 3

Figure 3. Shows the ranking the five countries around the Caspian Sea by ESI growth rate in 2003- 2005. Regarding to the figure, the top ranked country in the ESI growth rate is Russia and the lowest ranked country is Turkmenistan. Iran ranks 4th in the ESI growth rate among the five countries around the Caspian Sea. Also according to figure 3, Russia, Azerbaijan and Kazakhstan have a positive ESI growth rate. On the contrary, Iran and Turkmenistan have a negative ESI growth rate during 2003-2005.

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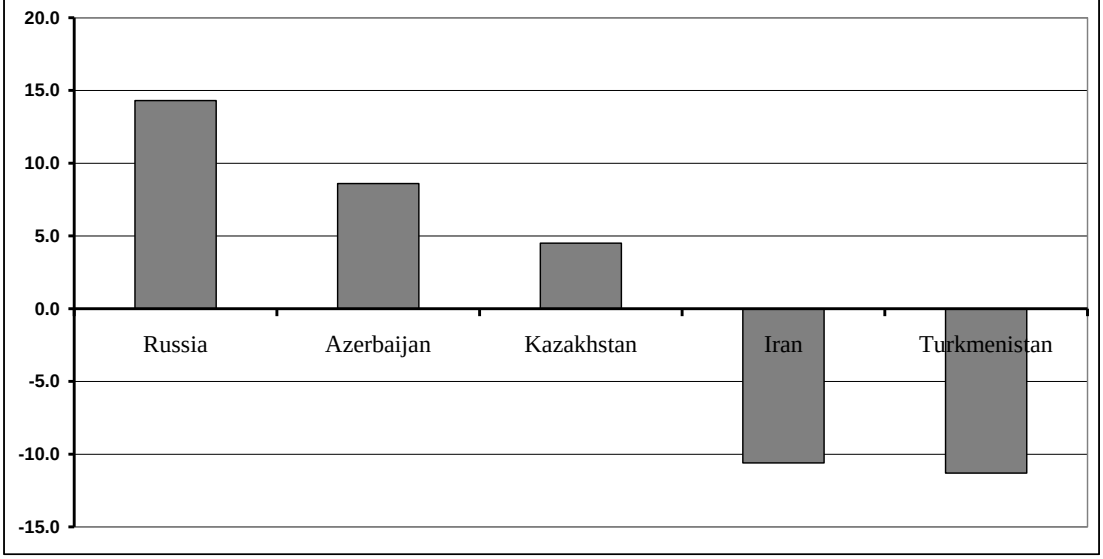
Figure 3. Ranking the Countries around the Caspian Sea by Environmental Sustainability Index (ESI) Growth Rate



Source: Table 3

Table 4. shows the Environmental Systems Index score in the five countries around the Caspian Sea. According to the information of this table, average score of Environmental Systems Index in the Caspian Sea region in 2003 is equal 49.2 that shows these countries have moderate score in the Environmental Systems Index, whiles in 2005 the Environmental Systems Index average score in this region is equal 53.6 that indicate the region has a better and 9 percentage growth rate respect to last period. Therefore, Environmental Systems Index average score in grouping around Caspian Sea countries in 2003 and 2005 demonstrate that this region has equivalent operation. This fact seems to indicate that Environmental Sustainability challenges come in multiple forms and combination.

Table 4. Environmental Systems Index Score of the Countries around the Caspian Sea

Country	2003	2005	Growth Rate
Azerbaijan	44.2	51	15
Iran	41	32.7	-20
Kazakhstan	50.6	61.3	21
Russia	72.2	72.7	0.7

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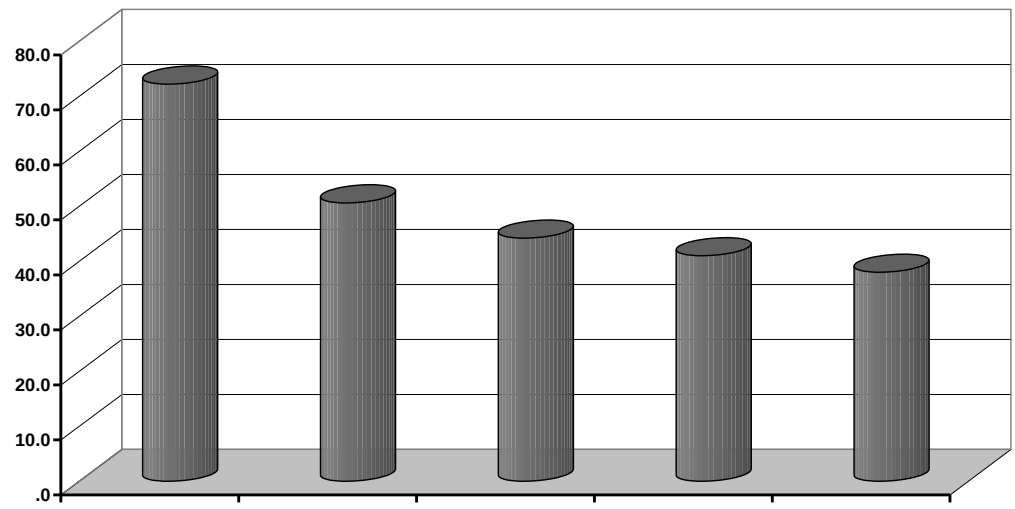
Turkmenistan	38	50.4	32
Average	49.2	53.6	9

Source: Yale Center for Environmental Law & Policy (2006)

Also table 4. Represents that in 2003, Azerbaijan, Iran and Kazakhstan have moderate Environmental Systems Index score, Russia has high Environmental Systems Index and Turkmenistan has low Environmental Systems Index. Figure 4. Shows the ranking the five countries around the Caspian Sea by Environmental Systems Index score in 2003. Regarding to the figure, the top ranked country in the 2003 Environmental Systems Index is Russia and the lowest ranked country is Turkmenistan. Iran scoring 41, ranks 4rd in the Environmental Systems Index among the five countries around the Caspian Sea in 2003.

Figure 4. Ranking the Countries around the Caspian Sea by Environmental Systems Index in 2003



Source: Table 4

Table 4. As well as expresses that in 2005, Russia and Kazakhstan have high, Azerbaijan and Turkmenistan have moderate, and Iran has low Environmental Systems score. Figure 5. Shows the ranking the five countries around the Caspian Sea by Environmental Systems score in 2005. Regarding to the figure, the top ranked country in the 2005 Environmental Systems is Russia and the lowest ranked country is Iran.

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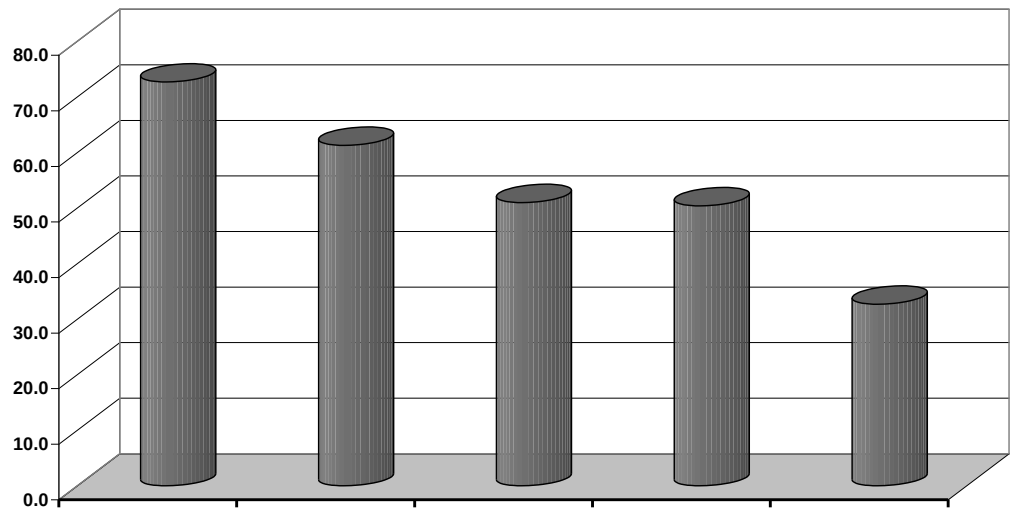
Figure 5. Ranking the Countries around the Caspian Sea by Environmental Systems Index in 2005



Source: Table 4

Figure 6. Shows the ranking the five countries around the Caspian Sea by Environmental Systems growth rate in 2003- 2005. Regarding to the figure, the top ranked country in the Environmental Systems growth rate is Turkmenistan and the lowest ranked country is Iran. Also according to figure 6, Turkmenistan, Russia, Azerbaijan and Kazakhstan have a positive Environmental Systems growth rate. On the contrary, Iran has a negative Environmental Systems growth rate during 2003-2005.

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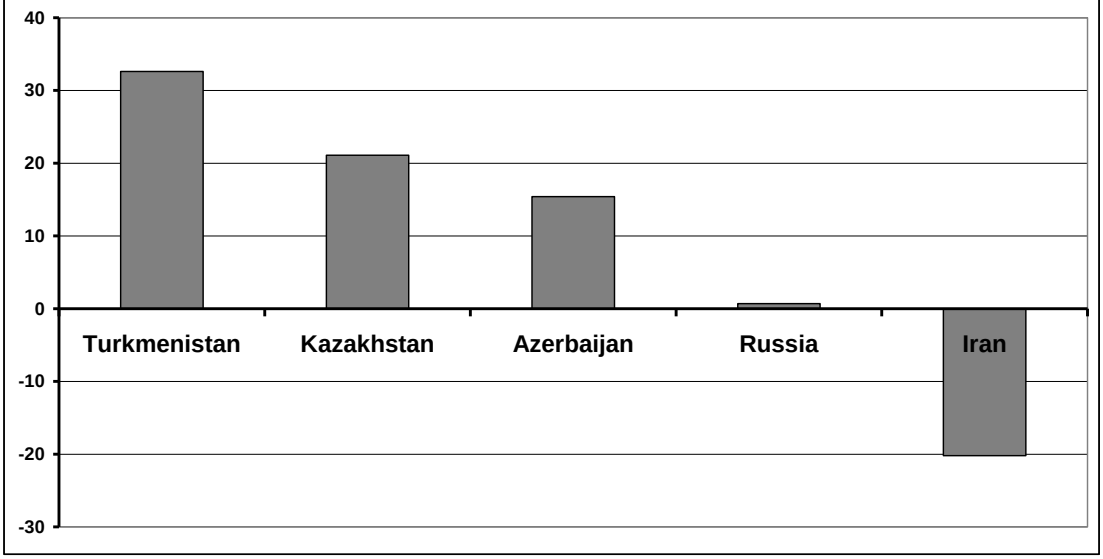
Figure 6. Ranking the Countries around the Caspian Sea by Environmental Systems Index Growth Rate



Source: Table 4

Table 5. Shows the Reducing Environmental Stresses score in the five countries around the Caspian Sea. According to the information of this table, average score of Reducing Environmental Stresses in the Caspian Sea region in 2003 is equal 59.1 that shows these countries have rather high score in the Reducing Environmental Stresses Index, whiles in 2005 the Reducing Environmental Stresses Index average score in this region is equal 57.9 that indicate the region has a worse and 2 percentages negative growth rate respect to last period. Therefore, Environmental Systems Index average score in grouping around Caspian Sea countries in 2003 and 2005 demonstrate that this region has moderate operation. This fact seems to indicate that Environmental Sustainability challenges come in multiple forms and combination.

Table 5. Reducing Environmental Stresses Index Score of the Countries around The Caspian Sea

Country	2003	2005	Growth Rate
Azerbaijan	61.2	59	-3.6
Iran	58.2	58.7	0.9
Kazakhstan	64.3	62	-3.6
Russia	60	60.6	1

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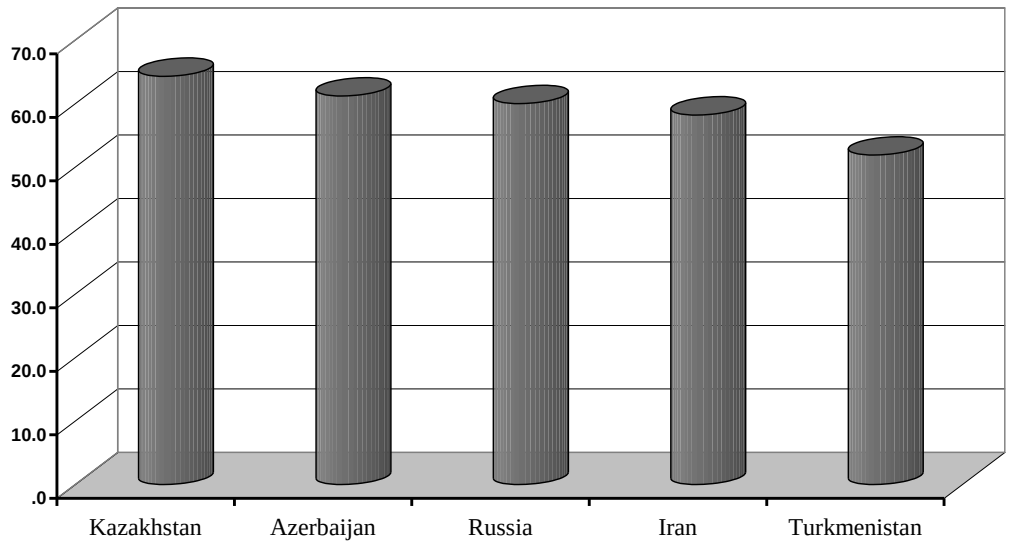
Turkmenistan	51.9	49.4	-4.8
Average	59.1	57.9	-2

Source: Yale Center for Environmental Law & Policy (2006)

Also table 5. Represents that in 2003, Azerbaijan, Iran, Russia and Kazakhstan have rather high Reducing Environmental Stresses Index score, and Turkmenistan has moderate Reducing Environmental Stresses. Figure 7. Shows the ranking the five countries around the Caspian Sea by Reducing Environmental Stresses score in 2003. Regarding to the figure, the top ranked country in the 2003 Reducing Environmental Stresses Index is Kazakhstan and the lowest ranked country is Turkmenistan. Iran scoring 58.2, ranks 4th in the Reducing Environmental Stresses Index among the five countries around the Caspian Sea in 2003.

Figure 7. Ranking the Countries around the Caspian Sea by Reducing Environmental Stresses Index in 2003



Source: Table 5

Table 5. As well as expresses that in 2005, Russia, Iran, Azerbaijan and Kazakhstan have moderate Reducing Environmental Stresses score, while Turkmenistan has low Reducing Environmental Stresses score. Figure 8. Shows the ranking the five countries around the Caspian Sea by Reducing Environmental Stresses score in 2005. Regarding to the figure, the top ranked country in the 2005 Reducing Environmental Stresses is Kazakhstan and the lowest ranked country is Turkmenistan. Iran scoring

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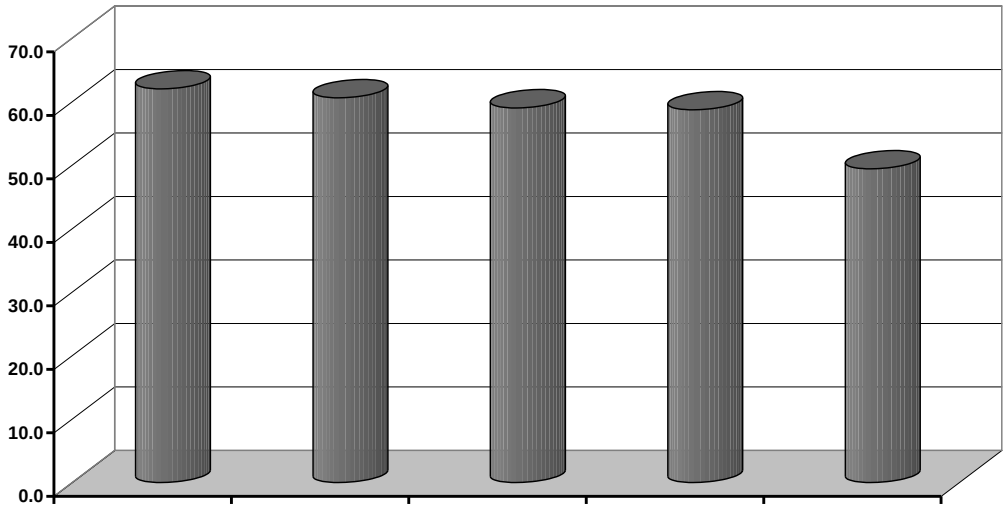
58.7, ranks 4th in the Reducing Environmental Stresses among the five countries around the Caspian Sea in 2005.

Figure 8. Ranking the Countries around the Caspian Sea by Reducing Environmental Stresses Index in 2005



Source: Table 5

Figure 9. Shows the ranking the five countries around the Caspian Sea by Reducing Environmental Stresses growth rate in 2003- 2005. Regarding to the figure, the top ranked country in the Reducing Environmental Stresses growth rate is Russia and the lowest ranked country is Turkmenistan. Iran ranks 2nd in the Reducing Environmental Stresses growth rate among the five countries around the Caspian Sea. Also according to figure 9, Russia and Iran have a positive Reducing Environmental Stresses growth rate. On the contrary, Azerbaijan, Kazakhstan and Turkmenistan have a negative Reducing Environmental Stresses growth rate during 2003-2005.

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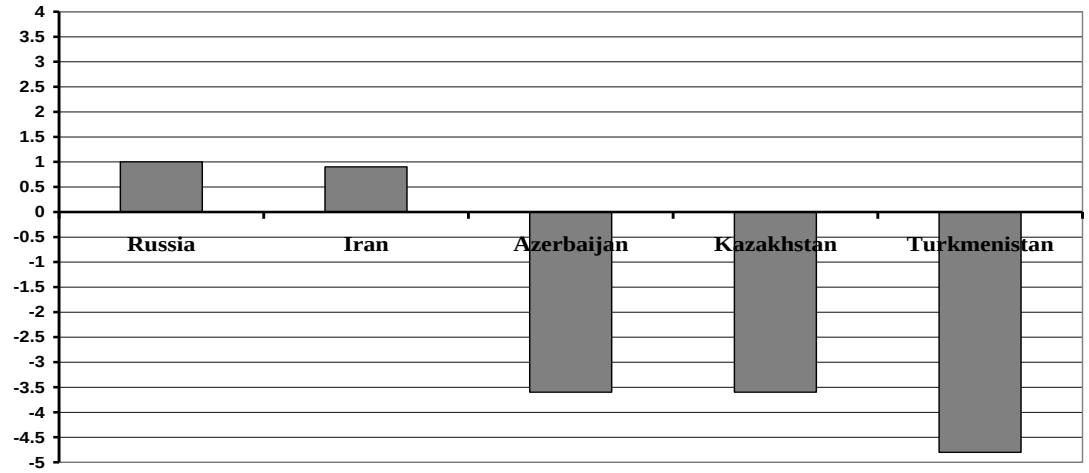
Figure 9. Ranking the Countries around the Caspian Sea by Reducing Environmental Stresses Index Growth Rate



Source: Table 5

Table 6. Shows the Reducing Human Vulnerability Index score in the five countries around the Caspian Sea. According to the information of this table, average score of Reducing Human Vulnerability in the Caspian Sea region in 2003 is equal 62.1 that shows these countries have moderate score in the Reducing Human Vulnerability, whiles in 2005 the Reducing Human Vulnerability average score in this region is equal 49.2 that indicate the region has a worse and 21 percentages negative growth rate respect to last period. Therefore, Reducing Human Vulnerability Index average score in grouping around Caspian Sea countries in 2003 and 2005 demonstrate that this region has moderate operation.

Table 6. Reducing Human Vulnerability Index Score of the Countries around The Caspian Sea

Country	2003	2005	Growth Rate
Azerbaijan	47.6	38	-20
Iran	70.7	56	-21
Kazakhstan	70.6	55.8	-21
Russia	79.7	71.1	-11
Turkmenistan	42	24.9	-41
Average	62.1	49.2	-21

Source: Yale Center for Environmental Law & Policy (2006)

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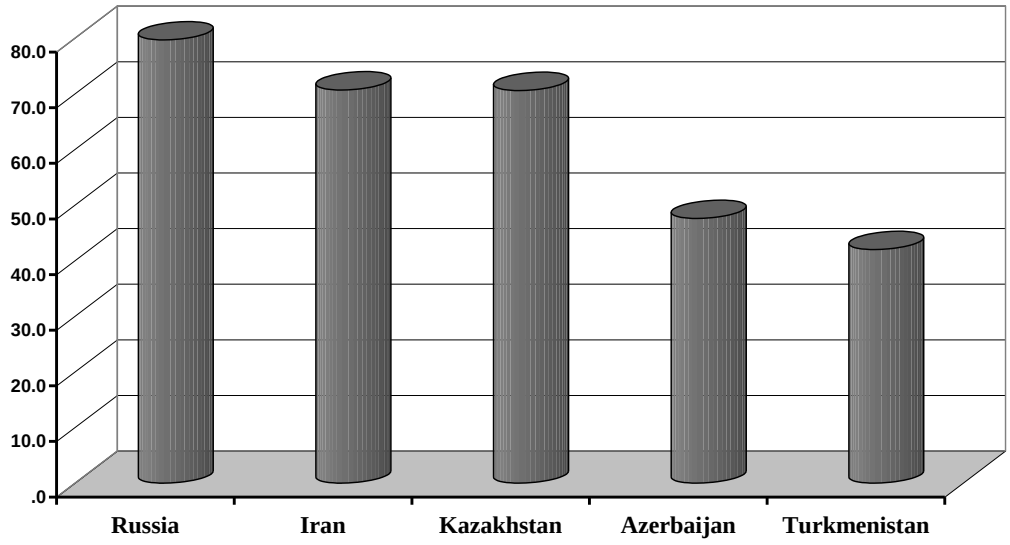
Also table 6. Represents that in 2003, Iran, Russia and Kazakhstan have high Reducing Human Vulnerability score, Azerbaijan and Turkmenistan has moderate Reducing Human Vulnerability Index. Figure 10. Shows the ranking the five countries around the Caspian Sea by Reducing Human Vulnerability score in 2003. Regarding to the figure, the top ranked country in the 2003 Reducing Human Vulnerability Index is Russia and the lowest ranked country is Turkmenistan. Iran scoring 70.7, has above performance and ranks 2nd in the Reducing Human Vulnerability among the five countries around the Caspian Sea in 2003.

Figure 10. Ranking the Countries around the Caspian Sea by Reducing Human Vulnerability Index in 2003



Source: Table 6

Table 6. As well as expresses that in 2005, Russia has high Reducing Human Vulnerability score, Iran and Kazakhstan have moderate Reducing Human Vulnerability score, and Azerbaijan and Turkmenistan have low Reducing Human Vulnerability score. Figure 11. Shows the ranking the five countries around the Caspian Sea by Reducing Human Vulnerability score in 2005. Regarding to the figure, the top ranked country in the 2005 Reducing Human Vulnerability is Russia and the lowest ranked country is Turkmenistan. Iran scoring 56, ranks 2nd in the Reducing Human Vulnerability among the five countries around the Caspian Sea in 2005.

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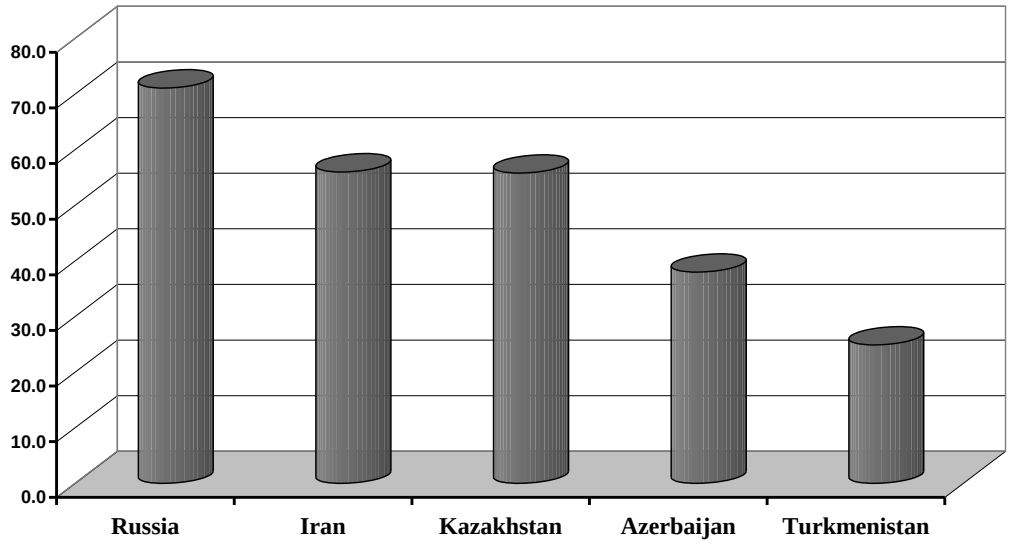
Figure 11. Ranking the Countries around the Caspian Sea by Reducing Human Vulnerability Index in 2005



Source: Table 6

Figure 12. Shows the ranking the five countries around the Caspian Sea by Reducing Human Vulnerability growth rate in 2003- 2005. Regarding to the figure, the top ranked country in the Reducing Human Vulnerability growth rate is Russia and the lowest ranked country is Turkmenistan. Iran ranks 3rd in the Reducing Human Vulnerability growth rate among the five countries around the Caspian Sea. Also according to figure 12, all of the countries around the Caspian Sea have a negative growth rate in Reducing Human Vulnerability during 2003-2005.

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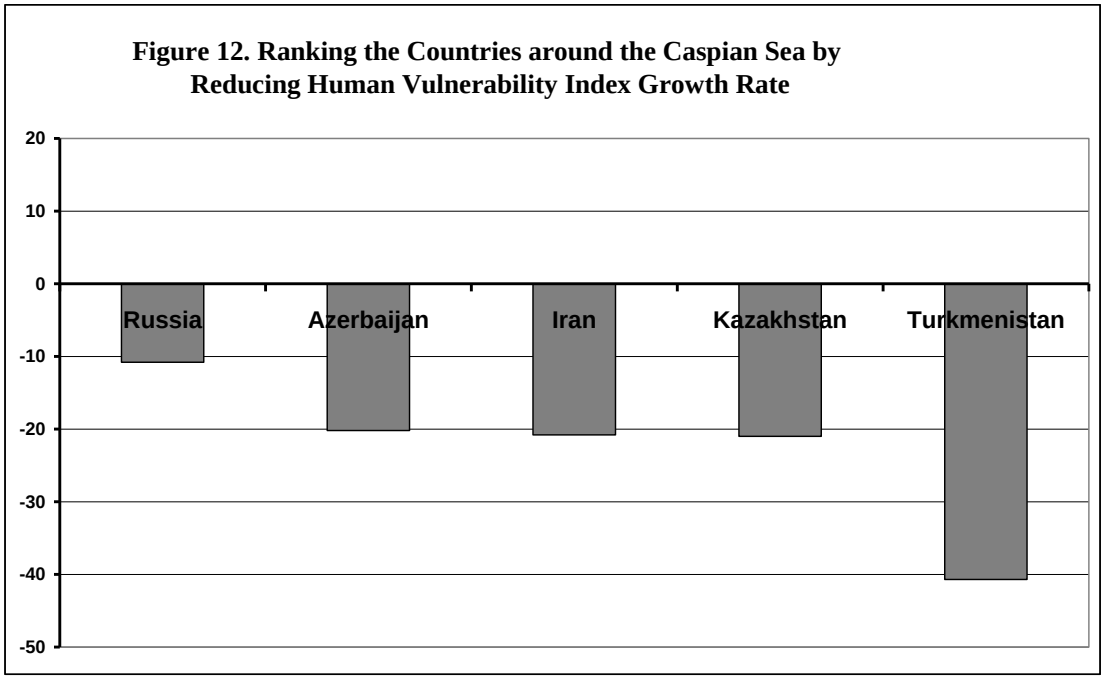

Source: Table 6

Table 7. Shows the Social and Institutional Capacity Index score in the five countries around the Caspian Sea. According to the information of this table, average score of Social and Institutional Capacity Index in the Caspian Sea region in 2003 is equal 27.5 that shows these countries have low score in the Social and Institutional Capacity Index, whiles in 2005 the Social and Institutional Capacity average score in this region is equal 26.9 that indicate the region has a worse performance and 2.1 percentage negative growth rate respect to last period. Therefore, Social and Institutional Capacity Index average score in grouping around Caspian Sea countries in 2003 and 2005 demonstrate that this region has a weak operation. This fact seems to indicate that Social and Institutional Capacity challenges come in multiple forms and combination.

Table 7. Social and Institutional Capacity Index Score of the Countries around The Caspian Sea

Country	2003	2005	Growth Rate
Azerbaijan	27.9	25.5	-8.6
Iran	26.9	29.1	8.2
Kazakhstan	27.8	27.6	-0.7

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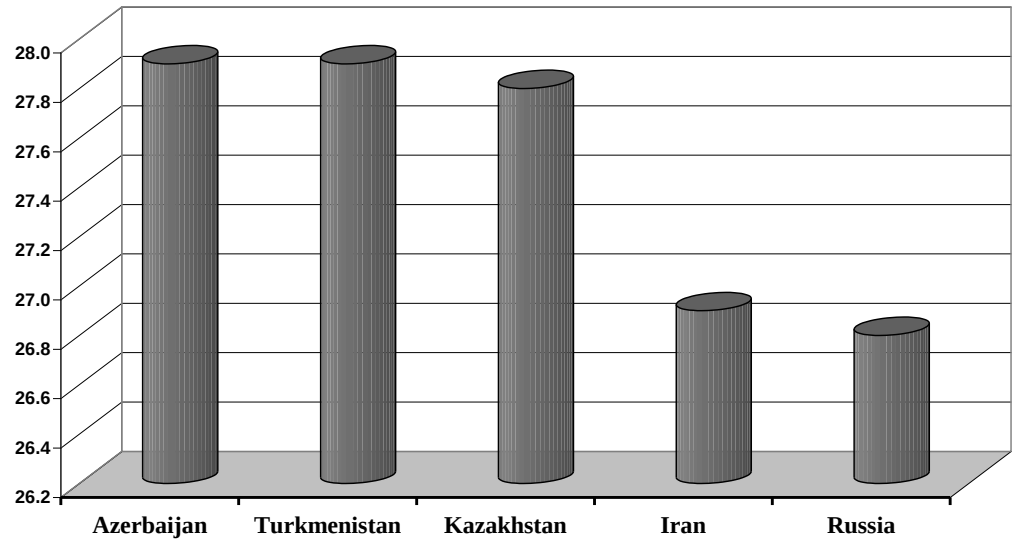
Russia	26.8	37.4	40
Turkmenistan	27.9	14.8	-47
Average	27.5	26.9	-2.1

Source: Yale Center for Environmental Law & Policy (2006)

Also table 7. Represents that in 2003, all of the five countries around the Caspian Sea have low and weak Social and Institutional Capacity score. Figure 13. Shows the ranking the five countries around the Caspian Sea by Social and Institutional Capacity score in 2003. Regarding to the figure, the top ranked country in the 2003 Social and Institutional Capacity Index is Azerbaijan and the lowest ranked country is Russia. Iran scoring 26.9, ranks 4th in the Social and Institutional Capacity Index among the five countries around the Caspian Sea in 2003.

Figure 13. Ranking the Countries around the Caspian Sea by Social and Institutional Capacity Index in 2003



Source: Table 7

Table 7. As well as expresses that in 2005, all of the five countries around the Caspian Sea have low and weak Social and Institutional Capacity score too. Figure 14. Shows the ranking the five countries around the Caspian Sea by Social and Institutional Capacity score in 2005. Regarding to the figure, the top ranked country in the 2005 Social and Institutional Capacity is Russia and the lowest ranked country is Turkmenistan. Iran scoring 29.1, ranks 2nd in the Social and Institutional Capacity among the five countries around the Caspian Sea in 2005.

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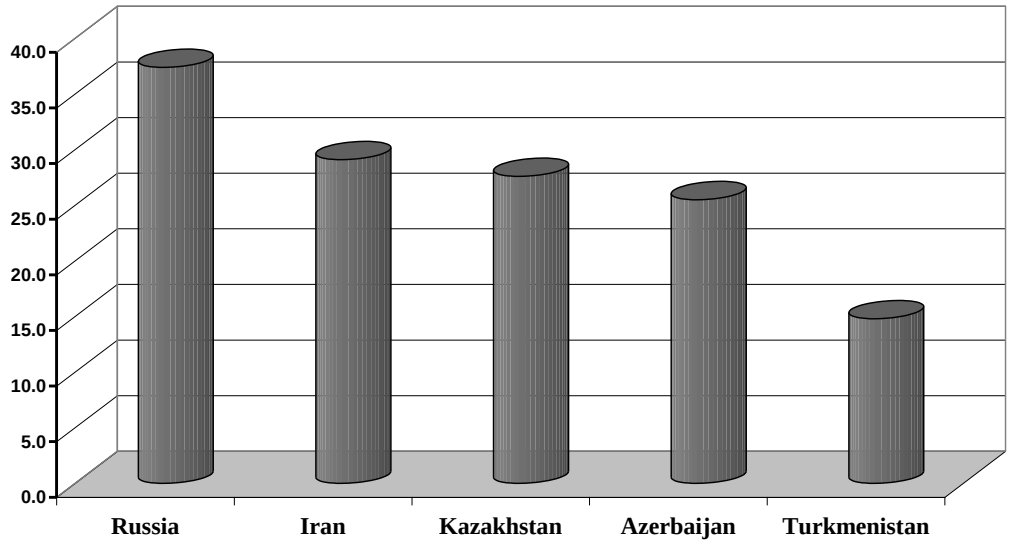
Figure 14. Ranking the Countries around the Caspian Sea by Social and Institutional Capacity Index in 2005



Source: Table 7.

Figure 15. Shows the ranking the five countries around the Caspian Sea by Social and Institutional Capacity growth rate in 2003- 2005. Regarding to the figure, the top ranked country in the Social and Institutional Capacity growth rate is Russia and the lowest ranked country is Turkmenistan. Iran ranks 2nd in the Social and Institutional Capacity growth rate among the five countries around the Caspian Sea. Also according to figure 15, Russia and Iran have a positive Social and Institutional Capacity growth rate. On the contrary, Kazakhstan, Azerbaijan and Turkmenistan have a negative Social and Institutional Capacity growth rate during 2003-2005.

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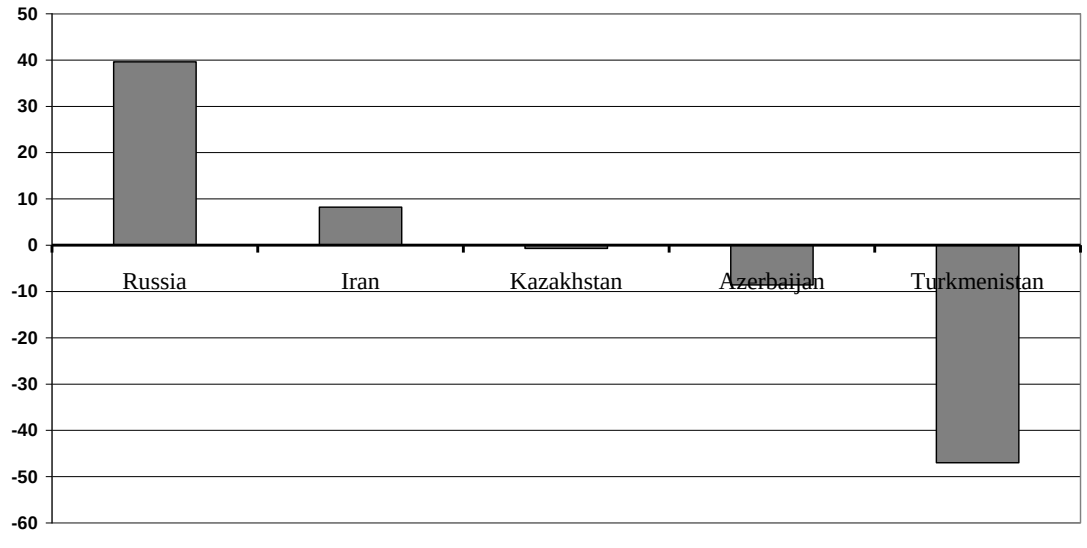
Figure 15. Ranking the Countries around the Caspian Sea by Social and Institutional Capacity Index Growth Rate



Source: Table 7

Table 8. Shows the Global Stewardship Index score in the five countries around the Caspian Sea. According to the information of this table, average score of Global Stewardship Index in the Caspian Sea region in 2003 is equal 27.6 that shows these countries have a weak score in the Global Stewardship Index, whiles in 2005 the Global Stewardship average score in this region is equal 26 that indicate the region has a worse and 5.8 percentage negative growth rate respect to last period. Therefore, Global Stewardship average score in grouping around Caspian Sea countries in 2003 and 2005 demonstrate that this region has a weak operation. This fact seems to indicate that Global Stewardship challenges come in multiple forms and combination.

Table 8. Global Stewardship Index Score of the Countries around The Caspian Sea

Country	2003	2005	Growth Rate
Azerbaijan	27.8	45.2	63
Iran	41.4	19	-54
Kazakhstan	27.6	24.5	-11
Russia	14.3	25.9	81
Turkmenistan	26.7	15.2	-43

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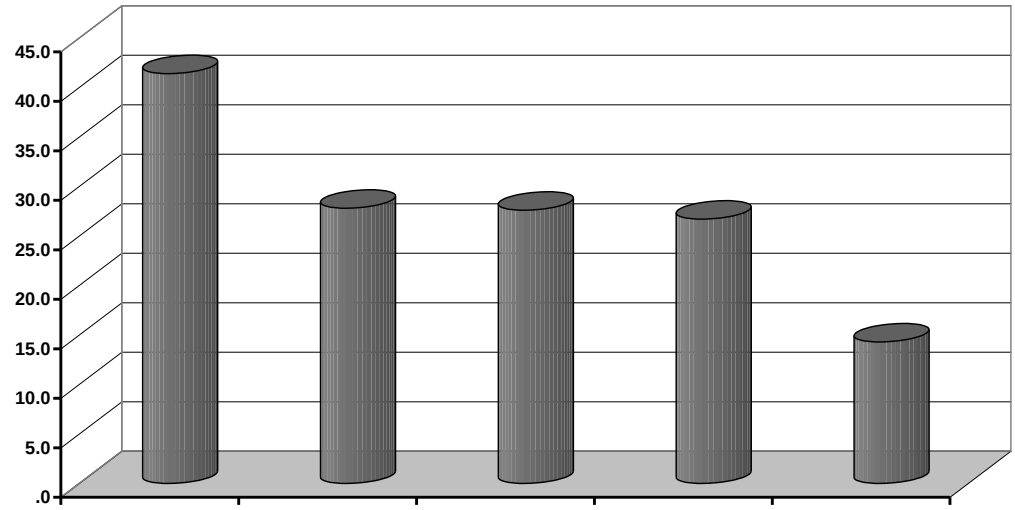
Average	27.6	26	-5.8

Source: Yale Center for Environmental Law & Policy (2006)

Also table 8. Represents that in 2003, Iran has moderate, Azerbaijan, Kazakhstan and Turkmenistan have low and Russia has very low Global Stewardship score. Figure 16. Shows the ranking the five countries around the Caspian Sea by Global Stewardship score in 2003. Regarding to the figure, the top ranked country in the 2003 Global Stewardship Index is Iran and the lowest ranked country is Russia.

Figure 16. Ranking the Countries around the Caspian Sea by Global Stewardship Index in 2003



Source: Table 8

Table 8. As well as expresses that in 2005, Azerbaijan has moderate, Russia and Kazakhstan have low and Iran and Turkmenistan have very low Global Stewardship score. Figure 17. Shows the ranking the five countries around the Caspian Sea by Global Stewardship score in 2005. Regarding to the figure, the top ranked country in the 2005 Global Stewardship is Azerbaijan and the lowest ranked country is Turkmenistan. Iran scoring 19, ranks 4th in the Global Stewardship Index among the five countries around the Caspian Sea in 2005.

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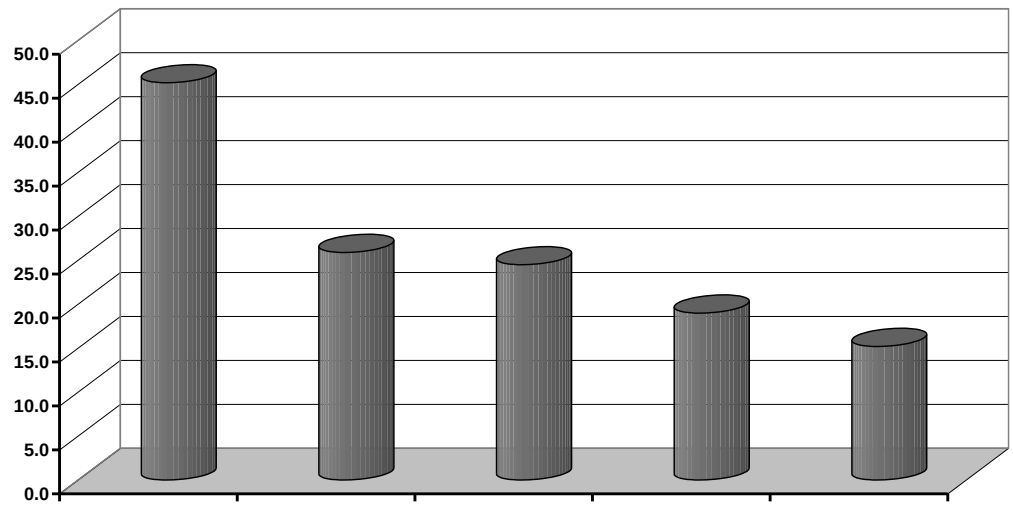
Figure 17. Ranking the Countries around the Caspian Sea by Global Stewardship Index in 2005



Source: Table 8

Figure 18. Shows the ranking the five countries around the Caspian Sea by Global Stewardship growth rate in 2003- 2005. Regarding to the figure, the top ranked country in the Global Stewardship growth rate is Russia and the lowest ranked country is Iran. Also according to figure 18, Russia and Azerbaijan have a positive Global Stewardship Index growth rate. On the contrary, Iran, Kazakhstan and Turkmenistan have a negative Global Stewardship Index growth rate during 2003-2005.

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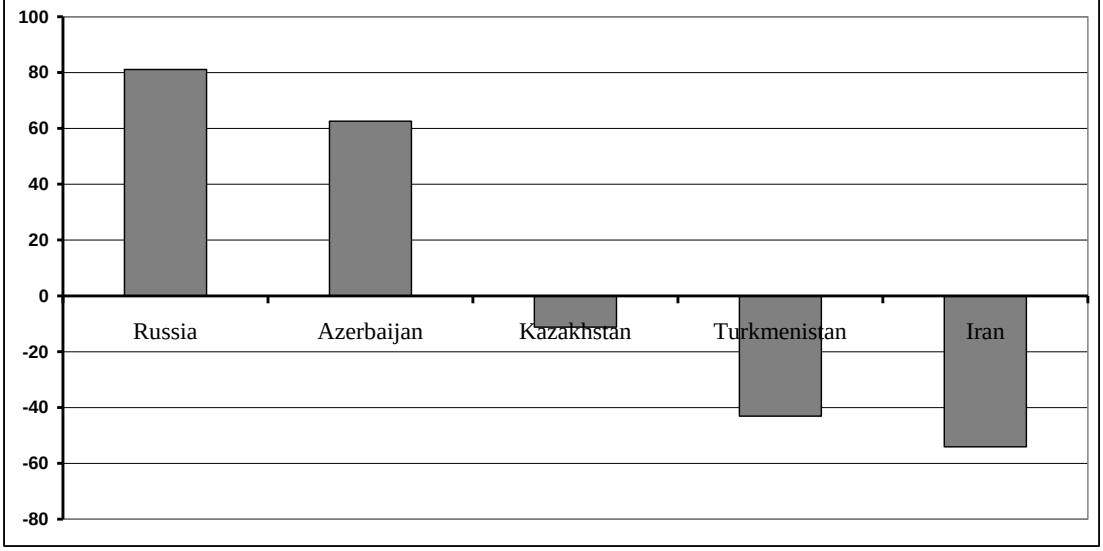
Figure 18. Ranking the Countries around the Caspian Sea by Global Stewardship Index Growth Rate



Source: Table 8

4. SUMMARY AND CONCLUSIONS

The purpose of the present paper was to study the Environmental Sustainability Index (ESI) of the countries around the Caspian Sea. ESI is an important composite index (i.e. consists of Environmental Systems, Reducing Environmental Stresses, Reducing Human Vulnerability, Social and Institutional Capacity and Global Stewardship) that tracks a diverse set of socio-economic, environmental, and institutional indicators that characterize and influence environmental sustainability at the national scale. ESI provides a gauge of a society's natural resource endowments and environmental history, pollution stocks and flows, and resource extraction rates as well as institutional mechanisms and abilities to change future pollution and resource use trajectories. In this paper ESI and its components were used in order to evaluate the performance all of the five countries located around The Caspian Sea in each individual Component as well as the overall performance during 2003 - 2005. To do so, we used overall ESI and its elements data from the Yale Center for Environmental Law & Policy that was reported in 2006.

Our findings indicate that the Caspian Sea region had moderate ESI Score that represented the countries around the Caspian Sea faces many challenges, both natural and manmade, and have poorly managed its policy choices. Also, Russia enjoys high

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performance comparing to other countries in the region. On the contrary, Turkmenistan has the lowest ESI score during 2003-2005.

Average score of Environmental Systems Index in the Caspian Sea region in 2003 was equal 49.2 that shows these countries have moderate score in the Environmental Systems Index, whiles in 2005 the Environmental Systems average score in this region was equal 53.6 that indicate the region has a better and 9 percentage growth rate respect to last period. Also the top ranked country was Russia (in 2003 and 2005) and the lowest ranked countries were Turkmenistan (in 2003) and Iran (in 2005).

Average score of Reducing Environmental Stresses in the Caspian Sea region in 2003 was equal 59.1 that shows these countries have rather high score in the Reducing Environmental Stresses Index, whiles in 2005 the Reducing Environmental Stresses Index average score in this region was equal 57.9 that indicate the region has a worse and 2 percentages negative growth rate respect to last period. Also the top ranked country was Kazakhstan and the lowest ranked country was Turkmenistan in 2003 and 2005 Reducing Environmental Stresses score.

Average score of Reducing Human Vulnerability in the Caspian Sea region in 2003 was equal 62.1 that shows these countries have moderate score in the Reducing Human Vulnerability, whiles in 2005 the Reducing Human Vulnerability average score in this region was equal 49.2 that indicate the region has a worse and 21 percentages negative growth rate respect to last period. Also the top ranked country in the 2003-2005 Reducing Human Vulnerability Index was Russia and the lowest ranked country was Turkmenistan.

Average score of Social and Institutional Capacity Index in the Caspian Sea region in 2003 was equal 27.5 that shows these countries have low score in the Social and Institutional Capacity Index, whiles in 2005 the Social and Institutional Capacity average score in this region was equal 26.9 that indicate the region has a worse performance and 2.1 percentage negative growth rate respect to last period. Also the top ranked countries were Azerbaijan (in 2003) and Russia (in 2005) and the lowest ranked countries were Russia (in 2003) and Turkmenistan (in 2005).

Average score of Global Stewardship Index in the Caspian Sea region in 2003 was equal 27.6 that shows these countries have a weak score in the Global Stewardship

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Index, whiles in 2005 the Global Stewardship average score in this region was equal 26 that indicate the region has a worse and 5.8 percentage negative growth rate respect to last period. Also the top ranked countries were Iran (in 2003) and Azerbaijan (in 2005) and the lowest ranked countries were Russia (in 2003) and Turkmenistan (in 2005) in the Global Stewardship Index.

Based on above findings Policies to improve each component of ESI in order to reach the desirable overall level of ESI are suggested in each individual country in the region. Undoubtedly better performances in environmental indicators help to achieve sustainable development.

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