Quarterly Journal of Quantitative Economics(JQE) **(2024) 21(1) 107-137**

Shahid Chamran University of Ahvaz

Quarterly Journal of Quantitative Economics

Journal Homepage:
www.jqe.scu.ac.ir
Print ISSN: 2008-5850
Online ISSN: 2717-4271

Prioritization of The Economic Sectors of Isfahan Province from The Perspective of The Importance of Water Resources and Considering The Three Goals of Social, Environmental and Economic Sustainable Development

Zahra Nasrollahi,* Elham Operajouneghani**

** Professor of economics, Faculty of Economics management and Accounting, Department of Economics, Yazd University, Yazd, Iran. (Corresponding Author)*
***Email**: nasr@yazd.ac.ir*

0000-0002-9537-136X
***Postal address**: Pajohesh st, Yazd Univesity, Faculty of Economics management and Accounting, Yazd, Yazd, Iran.*

*** PhD student in Economics, Economic Department, Faculty of Administrative Sciences & Economics, University of Isfahan, Isfahan, Iran.*
***Email**: elhamoperaj@gmail.com*

ARTICLE HISTORY	JEL CLASSIFICATION	KEYWORDS
Received: 2December2022 *Revision: 2June2023* *acceptance:26August 2023*	*R15 ،Q01 ،Q25 ،C67*	*Economic sector prioritization, Input-output model, Sustainable development, TOPSIS method, Water*

ACKNOWLEDGMENTS: Acknowledgments may be made to individuals or institutions that have made an important contribution.
CONFLICT OF INTEREST: The authors declare no conflict of interest.
FUNDING: The authors received no financial support for the research, authorship, and publication of this article.

How to Cite:
Nasrollahi, Zahra & Operajouneghani, Elham. (2024). Prioritization of The Economic Sectors of Isfahan Province from The Perspective of The Importance of Water Resources and Considering The Three Goals of Social, Environmental and Economic Sustainable Development. *Quarterly Journal of Quantitative Economics(JQE)*, 21(1), 107-137.
10.22055/JQE.2023.42445.2528

EXTENDED ABSTRACT

INTRODUCTION

Scarcity and justice have always been the concerns of human beings. To make a choice between these two concepts, capitalist systems have given priority to scarce resources and the optimization of their use in the hope that economic growth will also provide justice. In recent decades, environmental degradation, increasing pollution, extinction of various animal and plant species, climate change and global warming have cast doubt on the unbridled growth approach adopted by the capitalist system. This approach has proposed the idea of ‘sustainable development’ as a solution to those problems. The concept of sustainable development, which was proposed in 1980, was actually a response to the destructive environmental and social effects and to the concept of economic growth in general, in such a way that this opinion originated from environmental trends (Zakerian et al., 2014). Based on this idea, it is possible to take advantage of development opportunities through the interaction and adaptation of social, environmental and economic goals. The approach focuses on sustainable development, which gives importance to the equitable distribution of economic growth benefits (social and environmental goals) and pays attention to scarcity (economic goals). On this basis Sustainable development is development that can continue for a long period of time without causing damage to the environment (Shafiei, 2018). These points bring one to the conclusion that, to exploit resources, not only economic interests but also social, environmental and economic goals should be taken into consideration.

Since in recent years, the continuation of economic growth along with the development of urbanization and population growth has led to further destruction of the environment and the reduction of scarce natural resources, including water resources, this issue has led researchers to pay more attention

to the environmental aspect of sustainable development. From the perspective of sustainable development, priority is given to activities that, while providing the most economic benefits, put the least pressure on water resources and the environment of the region (Nasrollahi & Zarei, 2017). In Iran as a developing country, environmental issues took on a wider and more visible dimension. Although Iran has devised measures to overcome environmental challenges, the gap with global indicators is large, and according to many activists in this field, Iran is approaching a multi-faceted environmental crisis (*Rezayan ghayehbashi* and Marzban, 2020). The location of Iran in the arid and semi-arid climatic region and the uneven distribution of rainfall have led to the aggravation of the water shortage in Iran, so that the increase in demand has faced the country with the limited supply of water resources.

Therefore to prioritize the economic activities, it is necessary to pay attention to the water shortage issue and the other environmental considerations .In this regard, the present study has identified and prioritized the economic activities of Isfahan Province by using the criteria for different dimensions of sustainable development and with an emphasis on the importance of water resources .To this end, input-output models and the TOPSIS method are innovatively combined to provide a proper picture of prioritizing the economic activities in the province. The rest of this article is organized in several sections. The second section provides the research background .The third section presents the Background studies, and the forth section research method and the data. The findings of the study are put forth in the five section. The last section is dedicated to the conclusion of the study and suggestions for future research.

METHODOLOGY

Therefore, the present study prioritizes the economic activities in the province of Isfahan by combining an input-output model and the TOPSIS method as well as considering the six criteria of water abstraction, energy consumption, pollution, intensity of inter-sectoral relations, job creation, and value added. To achieve the objectives of the research, first, the national input-output table of 2016, the Central Bank data and the SFLQ quota method were used to prepare a twenty-sector input-output table for Isfahan Province. Then, using the internal multipliers of the province, the forward and backward linkages, direct and indirect water intensity, direct and indirect energy intensity, and direct and indirect employment of the economic sectors of the province were calculated. Shannon weighting method was also used to weight the criteria. Finally, the prioritization of the sectors in Isfahan Province was done with the TOPSIS method and the desired criteria. In the following sections, more details are provided on the methods collection in this research.

Shannon Entropy Method

Shannon entropy method served to determine the weight of each criterion in the study. This method is an alternative to using the opinions of experts, and it is advantageous in that the opinions and personal judgments of individuals are not involved in it; the weight of each criterion is determined based on a decision matrix (Dorostkar Ahmadi and Dehghani, 2020). There were a number of steps to determine the weights by Shannon entropy. First, all the decision matrices were normalized through Equation (1) and the value of E (entropy) was estimated using Equation (2)

(1) $$r_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}} \; \forall \; i, j$$

(2) $$E_j = -h \sum_{i=1}^{m} r_{ij} \times log\, r_{ij}$$

In Equations(1) and (2), x_{ij}, the values studied in the research and m and n represent the number of the sectors and indicators studied in the research.
Next, the weight vector was calculated, and the weight of each criterion was determined using Equation(3).

(3) $$W_j = \frac{(1-E_j)}{\sum_{j=1}^{n}(1-E_j)}$$

Topsis Model

The TOPSIS model, as a multi-criteria decision-making method, is a simple but efficient method of prioritization. It is one of the best methods in which *m* options are evaluated by *n* methods.

This technique, which is a compensatory model based on MCDM methods, follows a mathematical logic. This logic first introduces a "positive ideal solution" and a "negative ideal solution". The positive one is a solution that increases the profit criterion and decreases the cost criterion. In other words, the negative ideal solution has the opposite value of the positive one. Then, all the examined options are compared with the best and the worst options, and the linear distance of each option from the best option and the worst option is measured. Finally, the option at the most distance from the worst option and the least distance from the best option is selected as the best or the optimal option (Khatami Firouzabadi et al., 2013).

The TOPSIS method can be described as a sequence of steps as follows:

1) Calculate the normalized decision matrix. This regards the formation of a decision matrix with a number of criteria and options. The criteria are placed in the columns and the options in the rows of the matrix.

(4) $$N_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}$$

2) Calculate the weighted normalized decision matrix. The weighted normalized value V_{ij} is calculated with Equation (4) where W_j is the weight of j criteria, $\sum_{j=1}^{n}$, and w_j.=1

(5) $$V_{ij} = W_j N_{ij} \ldots\ldots\ldots i=1,\ldots\ldots,m, j=1,\ldots\ldots,n$$

3) Determine the positive ideal and negative ideal responses:

(6) $$A^+ = \{(V_1{}^+, V_2{}^+, \ldots\ldots, V_n{}^+)\} = \left\{\left(max_{V_{ij}}\middle| i \in O\right), \left(min_{V_{ij}}\middle| i \in I\right)\right\}$$

$$A^- = \{(V_1{}^-, V_2{}^-, \ldots\ldots, V_n{}^-)\} = \left\{\left(min_{V_{ij}}\middle| i \in O\right), \left(max_{V_{ij}}\middle| i \in I\right)\right\}$$

Thus, the best response (A^+) is selected as the option that contains the highest values of the criteria, and the worst response (A^-) contains the smallest values. In Equation**Error! Reference source not found.**(6), O corresponds to the utility criteria, and I corresponds to the cost criteria.

4) Calculate the Separator Dimensions: Using the Euclidean criterion, the distance of each point from the ideal response (positive and negative) is estimated through Equation(7):

(7) $$d_i^+ = \left[\sum_{j=1}^{n}\left(V_{ij} - V_j^+\right)^2\right]^{1/2} i = 1, \ldots\ldots, m$$

(The distance of option i from the positive ideal)

(8) $$d_i^- = \left[\sum_{j=1}^{n}\left(V_{ij} - V_j^-\right)^2\right]^{1/2}, i = 1, \ldots\ldots, m$$

(The distance of option i from the negative ideal)

5) Calculate the relative proximity to the ideal response. The relative proximity of option A_i to A^+ is as Equation(8). There is also $R_i \in$ [0 to 1].

(9) $$R_i = \frac{d_i^-}{d_i^- + d_i^+}, i = 1, \ldots\ldots, m$$

6) Rank the priorities. Using R_i, the options can be ranked in a descending order. In other words, any option with a larger R_i has a higher priority (Moazzami Gudarzi et al., 2014).

FINDINGS

To show the importance of the simultaneous consideration of different criteria, the results of the study were prioritized once with the water intensity criterion and once without it. This was done with regard to the significance of water resources.

For example, in the prioritization of the sectors according to the water intensity criterion, the agriculture sector was in the twentieth place, while this rank was the second in the prioritization without considering that criterion. Also, in the sector of "manufacture of leather apparel", this criterion was downgraded from the ninth to the thirteenth rank considering the water intensity criterion. Similarly, the sectors of "manufacture of textiles" and "manufacture of rubber and plastic products" were ranked 7th and 9th, respectively, while the ranks of these sectors without considering the water intensity criterion were fifteen and twelve. In the meantime, the priorities for the sectors of "wood and products of wood", "manufacture of machinery and equipment not classified elsewhere" and "construction" remained constant.

CONCLUSION

The results of this prioritization showed the importance of ranking the sectors in terms of water intensify as a criterion. As it occurred, through the TOPSIS method, the priority of most sectors emerged to be different from the results of prioritization with no water intensity considered. The difference was very significant in some sectors. For example, in the prioritization of sectors according to the water supply criterion, the agriculture sector was in the twentieth place, while it shifted to the second rank when prioritized without that criterion considered. Similarly, for the sector of manufacture of leather apparel, the involvement of the water intensity criterion downgraded the sector from the ninth to the thirteenth rank. Thus, the change in the rank of a sector depends on the water level of that sector. As it was found, the agriculture sector was in the second place in the prioritization without considering the water supply criterion, while the rank of this sector moved to twenty with the inclusion of the water supply criterion. This role of water intensity suggests the importance of paying attention to the water level. Therefore, it is necessary to prioritize the economic sectors in a region in accordance with the climatic conditions there. It is also advisable not to establish water-demanding activities such as steel industries and cultivation of highly water-consuming products in low-water areas.

References

Ait- Kadi, M. (2016). Water for development and development for water: realizing the Sustainable Development Goals (SDGs) vision. *Aquatic Procedia*, 6, 106-110. doi.org/10.1016/j.aqpro.2016.06.013

Alvandizadeh, A., Nonezad, M., & Jahangiri, M. (2019). The ranking of investment priority in economic sector of Sistan & Baluchestan province. *Regional Planning*, 9(35), 73-84. https://jzpm.marvdasht.iau.ir/article_3702.html?lang=en [In Persian]

Banouei, A. A., Jeloudari, M. M., & Mohagheghi, M. (2007). Identifying Key Sectors Based on Demand and Supply Approaches. *Journal of Sustainable Growth and Development*, 7(1), 1-26. httsp://sid.ir/paper/86481/fa. [In Persian]

Bazazan, F., & Pourbagher, Z. (2013). Impact of Omitting Energy Subsidies on Air Pollution. *Economic policy*, 5(9), 1-27. doi: 20.1001.1.26453967.1392.5.9.1.0 [In Persian]

Dorostkar, A. N., & Dehghani, A. (2020). Identifying and Ranking Environmental Destructive Economic Sectors Based on The Amount of Greenhouse Gas Emission by Shannon Entropy-Vikor Approach (Case Study: Iran: 1388-1392). *journal of environmental science and technology*, 22(4), 41-53. www. magiran.com/p2205759. [In Persian]

Fallahi, F., Beheshti, M. B., & Marashi, S.A. (2017). Ranking the environmental sustainability in selected Iranian provinces: A comparison of AHP and TOPSIS methods. *Quarterly Journal of Quantitative Economics (JQE)*, *14*(1), 97-118. https://doi.org/10.22055/jqe.2017.12948. [In Persian]

Faraji Dizaji, S., Arefian, M., & Assari Arani, A. (2023). The Impact of Carbon Taxes and Fossil Fuels Subsidies on the Development of Renewable Energy in Selected OECD Countries. *Quarterly Journal of Quantitative Economics (JQE)*, *19*(4), 79-109. https://doi.org/10.22055/jqe.2021.33321.2243. [In Persian]

Guo, J., Zhang, Y. J., & Zhang, K. B. (2018). The key sectors for energy conservation and carbon emissions reduction in China: evidence from the input output method. *Journal of Cleaner Production*, *179*, 180-190. https://doi.org/10.1016/j.jclepro.2018.01.080.

Jafari Samimi, A., Zaribaf, M., & Amirpoor Ashori, P. (2012). Relationship Between Relative Advantage of Tourism Added Value and Mazandaran Economic Growth Compared with Other Provinces in Iran. *journal of industrial strategic management (pajouheshgar)*, 9(25), 11-20. www. magiran.com/p1098268. [In Persian]

Jahangard, E. (2015). The Investment Preference in Iran'S Economic Activities with Regard to Environmental Pollutions. *majlis & rahbord*, 21(80), 137-168. httsp://sid.ir/paper/224931. [In Persian]

Javaheri, B., Masodi, R., & Fegheh Majidi, A. (2023). Measurement of Energy Consumption and GHG Emissions of Kurdistan's Economic Sectors.

Quarterly Journal of Quantitative Economics(JQE), 20(2), 100-128. https://doi.org/10.22055/jqe.2021.37619.2379. [In Persian]

Kiani Ghaleh no, R. (2021). Modification of TOPSIS method to improve the results of performance evaluation of financial and credit institutions. *Journal of decision and operation research, 6(1),* 97-114. https://doi.org/10.22105/dmor.2021.258329.1262 [In Persian]

khatami Firouzabadi, s. m. A., galali, s. h., & parvardeh, S. A. m. (2013). Prioritizing of Strategy Implementation Obstacles among Energy sector's Contractors using fuzzy TOPSIS method. *industrial management studies*, 11(29), 113-137. doi: 20.1001.1.22518029.1392.11.29.6.3. [In Persian]

Lenzen, M. (2003). Environmentally Important Paths, Linkages and Key Sectors in the Australian Economy. *Structural Change and Economic Dynamics*, 14(1), 1-34. https://doi.org/10.1016/S0954-349X(02)00025-5.

Maddah, M., & mohamadnia sarvi, Z. (2017). Empirical analysis the relationship among corruption, shadow economy and environmental pollution (LISREL Approach). *Quarterly Journal of Quantitative Economics (JQE)*, *13*(4), 1-18. https://doi.org/10.22055/jqe.2017.12692 [In Persian]

Moazzami Gudarzi, M., Jaberansari, M., Moallem, A., & Shakiba M. (2014). Appling Data Envelopment Analysis (DEA) for Measuring Relative Efficiency and Ranking Branches of Refah Kargaran Bank in Lorestan Province. *Economic Research*, 14(1), 115-126. Doi: 20.1001.1.17356768.1393.14.1.5.4.

Nasrollahi, z., & zarei, M. (2017). Prioritization of industrial activities in Yazd province with an emphasis on the importance of water resources: integration the input-output models AHP. *Iranian journal of economic research*, 22(71), 27-64. https://doi.org/10.22054/ijer.2017.8278.

Okadera, T., Geng, Y., Fujita, T., Dong, H., Liu, Z., Yoshida, N., & Kanazawa, T. (2015). Evaluating the Water Footprint of the Energy Supply of Liaoning Province, China: A Regional Input Output Analysis Approach. *Energy Policy*, 78, 148-157. https://doi.org/10.1016/j.enpol.2014.12.029.

Operajouneghani, E., & Nasrollahi, Z. (2021). comparative study of traditional methods, final output demand elasticity and data envelopment analysis in identifying key economic sectors of isfahan province. *economics and modeling*, 12(3), 141-164. doi: 10.29252/JEM.2022.224470.1683

Pavlović, B., Ivezić, D., & Živković. M. (2021). a multi-criteria approach for assessing the potential of renewable energy sources for electricity generation: Case Serbia. *Energy Reports*, 7, 8624-8632. https://doi.org/10.1016/j.egyr.2021.02.072.

Rahimdel, M. j., & Noferesti, H. (2020). Investment preferences of Iran's mineral extraction sector with a focus on the productivity of the energy consumption, water and labor force. *Resources Policy*, 67, 101695. https://doi.org/10.1016/j.resourpol.2020.101695.

Rezayan ghayehbashi, A., & Marzban, E. (2020). identification of driving forces, uncertainties and future scenarios of iran' s environment. *iranian journal of health and environment, 12(4), 531-554.* http://ijhe.tums.ac.ir/article-1-6278-en.htm

Shafiei, M. (2018). The answer lies in nature: a reflection on the theme of World Water Day 2018 in the context of sustainable development. *Water and sustainable development*, 4(2), 166-168. doi: 10.22067/JWSD.V4I2.72220 [In Persian]

Solangi, Y. A., Tan, Q., Mirjat, N. H., & Ali, S. (2019). Evaluating the strategies for sustainable energy planning in Pakistan: An integrated SWOT-AHP and Fuzzy-TOPSIS approach. *Journal of Cleaner Production*, 236, 117655. doi.org/10.1016/j.jclepro.2019.117655

Teymouri, M., & Bazazan, F., & Andish,Y. (2018). Identifying the key sector Of Iran's economy in terms of lowest carbon dioxide emissions: Using the social accounting matrix approach. *Fiscal and economic policies*, 6(23), 97-117. http://qjfep.ir/article-1-826-fa.html [In Persian]

United Nations. (2006). Water Demand Management Strategy and Implementation Plan for Jabalpur. *Human Settlements Programme, Nairobi, Kenya*.

Zakerian, M., Moosavi, M. N., & Bagheri kashkooli, A. (2014). Environmental issues and sustainable development of cities in Yazd province. *Geograghy*, 11(39), 293-316. httsp://sid.ir/paper/495459/fa [In Persian]

Zhao, X., Chen, B., & Yang, Z. F. (2009). National Water Footprint in an Input-Output Framework - a Case Study of China 2002. *Ecological Modelling*, 220(2). https://doi.org/10.1016/j.ecolmodel.2008.09.016.