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Prioritization of the Economic Activities in Yazd Province with an Emphasis on the Importance of Water Resources: Integration of the Input-Output and TOPSIS Models

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Abstract:
The purpose of this study is to prioritize the economic activities in Yazd Province, Iran, with a sustainable development approach and an emphasis on the importance of water intensity in economic activities. Therefore, multiple criteria were used to prioritize the activities that cover the economic, social and environmental dimensions of sustainable development. In the first stage, the SFLQ method was used to prepare an input-output table for Yazd Province. Then, the economic activities in the province were prioritized in terms of six criteria including the intensity of interdepartmental communication and value-added (economic dimension), job creation (social dimension) as well as energy intensity, water intensity and pollution (environmental dimension). Moreover, a combination of an input-output model and the TOPSIS method was applied. According to the results of this study, among the activities in the province, "transportation" proved to have the highest priority. It was also found that the ignorance of water use as an important criterion can lead to significantly different prioritization results.

Introduction

Vasily Leontief won the Nobel Prize in economics in 1973 for his design of the input-output data table [I-O]. The main purpose of the I-O approach was to identify the flows or exchanges among the economic sectors of a region or a country. Over time, however, it has emerged that identifying the key sectors of

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economy is an attractive application of I-O tables. Among the studies in this area, one may refer to Rasmussen (1956), Laomas (1975), Schultz (1977), Hawings (1982), and Garc´ıa Mu˜niz et al. (2008). In fact, since government priorities and policies play important roles to determine economic growth, the basic idea is that any economic policy aimed at protecting or threatening specific sectors should begin by identifying and explaining their importance and priority.

From a purely economic point of view, one of the characteristics of these sectors is that they have the most backward and forward linkage relations with the other sectors of the economy. The key sectors are able to use these relations to make extensive changes in employment, production and, ultimately, economic growth. The identification of key economic sectors helps local and regional policymakers and planners allocate infrastructure budgets, grant tax exemptions, and implement other policies.

However, identifying key sectors is not easy. Is a key sector the one with the highest output or the one that creates the most exports or employment? It is quite clear that the choice of a measurement criterion greatly affects the results. Different sectors become 'key' ones under different assumptions and for different purposes.

In fact, what should be considered is that identifying key economic sectors is not a static process but a dynamic one. This is because, in addition to resource scarcity, which is always a challenge for societies, there is a change of priorities for various reasons. Changes in such factors as socio-economic conditions, technology and attitudes can influence resource allocation decisions. Therefore, there is a need to determine and evaluate the factors that affect the economic outlook. One of the changes that currently influence the landscape of economic decision-making is the replacement of the concept of development with that of sustainable development.

The over-exploitation of the environmental resources as a result of competition in production and consumption has caused a wide range of environmental problems, including anthropogenic climate change (global warming), the depletion of stratospheric ozone (the ozone hole), the acidification of surface waters (acid rains), the destruction of tropical forests, the depletion and extinction of species, and the precipitous decline of biodiversity.

The concept of sustainable development was introduced in response to these environmental crises with the aim of achieving balanced economic, environmental and social goals as well as a balanced welfare of present and future generations. It involves a long-term integrated approach to developing and achieving a healthy society by addressing economic, environmental and social issues together while preventing the overuse of key environmental resources.

What should be considered in determining the key sectors of the economy is the concept of sustainable development with its economic, social and environmental

dimensions. In other words, it is not only economic factors but also social and environmental factors to consider.
The present study uses an input-output data model as the main tool to calculate transactions and interactions among economic sectors, taking into account six criteria including the intensity of inter-sectoral communication and value added (economic dimension), employment (social dimension) as well as energy, pollution, water intensity (Environmental dimension). The study seeks to prioritize the economic activities in Yazd Province. In this regard, 89 economic activities defined in the input-output table of the Central Bank in 2016 are classified into 20 groups. The objectives of the study are achieved through a combination of an input-output model and the TOPSIS method.
The rest of this article is organized in several sections. The second section provides the research background. The third section presents the research method and the data. The findings of the study are put forth in the fourth section. The last section is dedicated to the conclusion of the study and suggestions for future research.

Research background

A review of the literature shows that, in most studies, one or two criteria have been used to prioritize economic activities. Also, as far as the authors of this study know, the research ever done in Iran has ignored the environmental criteria that are important in discussions of sustainable development. The innovation of the present study is the use of environmental criteria to prioritize economic activities.
In their study, Zhao et al (2015) integrated the environmental input-output model with a modified hypothetical extraction method to investigate the carbon linkage among sectors. Based on the data of South Africa in 2005, they empirically estimated the CO_2 emissions in the industrial sectors and the carbon effects of inter-sector linkages. The results showed that the total carbon linkage of the industrial systems in South Africa in 2005 was 171.32 million tons (Mt), which accounted for 81.58 Mt of total backward carbon linkage and 89.71 Mt of total forward carbon linkage. The industrial block of electricity, gas and water had the largest total carbon linkage as well as internal and net forward effect. The block of basic metals, coke, and refined petroleum products, however, proved to have the largest net backward effect.
Guo et al. (2018) used the input-output model and the demand elasticity approach to define the key sectors driving the energy consumption and CO_2 emissions in China. The results indicated that the key economic sectors consuming substantial fossil energy and emitting tremendous amounts of CO_2 were the manufactures of basic chemicals, building constructors, wholesale and retail trades, road transportation and real estate.

Solangi et al. (2019) used the Analytic Hierarchy Process (AHP) and the fuzzy technique to evaluate the energy strategies for sustainable energy planning. It emerged that providing low-cost and sustainable electricity to residential, commercial and industrial sectors (WO5) was a highly prioritized energy strategy. In contrast, the use of coal resources to generate electricity (WO2) was prioritized as the least favored energy strategy.

Pavlović et al. (2021) used FAHP[1] to assess the potential of renewable energy sources in the Serbian electricity sector. The weights were estimated according to the values of energy indicators and expert judgments. It was shown that hydropower and biomass have the highest potentials among the available renewable energy sources.

Nasrollahi and Zarei (2017) integrated an input-output model and the analytic hierarchy process (AHP) to prioritize the industrial activities in Yazd Province with an approach to sustainable development and an emphasis on the importance of water resources. The prioritization was conducted with five criteria including water use, employment, inter-sectoral linkages, emission and value added. According to the results, the sector of electrical equipment and office machinery had a higher priority for investment than the other sectors.

Fatemi et al. (2018) prioritized power plants based on environmental, social and economic dimensions. They focused on Kahak and Pakdasht power plants as the biggest wind power plant and combined cycle power plant in Iran respectively. To this end, multi-criteria decision making methods such as AHP and Topsis were used to determine the priority of the power plants. The results showed that, among the five environmental criteria selected by experts, water (with the weight of 0.451) had the first rank. The other criteria including weather (with the weight of 0.223), social and economic effects (0.120), soil (0.114) and environmental effects (.081) were placed in the second to fifth ranks. According to the expert opinions Delphis' panel), wind cycle power plants were found more appropriate to construct than combined cycle ones due to less environmental pollution and degradation.

Alvandizadeh et al. (2019) identified investment bottlenecks and priorities in Sistan and Baluchestan Province. The numerical taxonomy and the Topsis model served to compare and rank those investment priorities. The numerical taxonomy was applied to 25 indicators of investment. Fishing, education and real estate sectors were found to be of the highest investment priorities, and hotels and restaurants had the next rank. The negative indices were eliminated, and the other 21 indicators had different weights according to their special status in the province and the theoretical foundations of investment. As the Topsis model suggested, fishing, real estate and agricultural sectors were of a higher investment priority than hotels and restaurants.

1 Fuzzy Analytical Hierarchy Process

shirzouraliabadi (2021) prioritized economic activities for sustainable rural development in the city of Quchan. For this purpose, the scope and networking of activities for social sustainability were assessed through fuzzy hierarchical analyses and with three criteria including income stability, economic sustainability and environmental sustainability. The highest weight was assigned to income stability followed by the indices of environmental stability and social stability. Finally, the activities in the industrial conversion of grapes were ranked as the first priority for stability in the region, while the dairy industry, production of medicinal plants, and ecotourism had the next priorities, respectively.

Research method

As stated in the section on theoretical foundations, most studies conducted in the field are on the prioritization of economic activities based on the theory of unbalanced growth and the criterion of cross-sectoral relationships through the input-output method. Some other studies have also prioritized activities using various multi-criteria decision making methods such as hierarchical analysis and TOPSIS.

As already mentioned, the aim of this research is to prioritize the economic activities in Yazd Province with an approach to sustainable development and an emphasis on water intensity of those activities. As a result, an attempt was made to cover various aspects of sustainable development, and the prioritization was done with a combination an input-output table and the TOPSIS method. In accordance with this process and in order to achieve the objectives of the research, first, the input-output table of the Central Bank in 2016 and the Industry-Specific FLQ (SFLQ) method served to provide the input-output table of 20 internal sectors of Yazd Province. Then, using the internal multiplier coefficients of the province, the total link (backward and forward) was calculated. The industrial sectors of the province were prioritized in terms of several criteria including water use, employment, inter-sectoral linkages, energy use, emission and value added.

Input-output Table

The basic idea of the input-output model is that the output of each economic sector is distributed among the other sectors of the economy (intermediate demand) and the final consumers (final demand). This idea is illustrated in the following linear equation:

$$x_i = \sum_{j=1}^{n} x_{ij} + y_i \tag{1}$$

where n denotes the number of economic sectors, x_i represents the total gross output of the i[th] sector, x_{ij} is the inputs from sector i to sector j, and y_i stands for the final demand of sector *i*. The matrix of Equation (1) and its solved form are shown as Equations (2) and (3):

$$X = AX + Y \quad (2)$$

$$X = (I-A)^{-1}Y \qquad \mathbf{A} = [a_{ij}] \qquad a_{ij} = \frac{x_{ij}}{x_j} \quad (3)$$

where X denotes the gross output vector, $[A]_{a_{ij}}$ is the matrix of the technical coefficients, and Y is the final demand vector. The element a_{ij} of the matrix A represents the amount of the input from sector *i*, which is required to increase the output in sector *j* for one unit. Moreover, $[I]_{n\times n}$ is the identity matrix, and $(I-A)^{-1}$ is called the Leontief inverse matrix. The l_{ij} element of the inverse Leontief inverse matrix represents the total (direct and indirect) output of sector *i*, which is required to increase the monetary final demand in sector *j* for one unit. In other words, the elements of the Leontief inverse matrix represent the total production of every sector to satisfy the final demand of the economy (Zhao et.al, 2009).

Input-output table of Yazd Province

The Location Quotients (LQ) method is a non-statistical method widely used to prepare regional tables based on the intermediate exchange coefficients of the regions obtained the adjustment of the coefficients in the national table to the dimensions of space economics (Banoui et al., 2020). All LQ methods are based on the assumption that the production technology in all sectors is the same nationally and regionally. Therefore, the role of LQ coefficients is to adjust national input coefficients and calculate the percentage of the domestic purchases of regional coefficients. This is done through the following equation:

$$\widehat{r_{ij}} = q_{ij} \times a_{ij} \quad (6$$

where a_{ij} is the national input coefficient, q_{ij} is an LQ coefficient the size of which normally cannot be greater than one, and $\widehat{r_{ij}}$ is a regional input coefficient (Flegg and Tohmo, 2016). The difference between LQ methods lies in how the q_{ij} coefficient is calculated. The more spatial economic factors are included in the LQ coefficient, the more capable it is of properly adjusting the national coefficients. In the present study, the Industry-Specific FLQ (SFLQ) method was used to prepare the input-output table of Yazd Province, For this purpose, first, the national table was divided into 20 sections in accordance with the production structure of the province. These sections are presented in Table (1).

Table 1. Economic sectors in Yazd Province

Section name	Activity number	Section name	Activity number
Agriculture	1	Manufacture of basic metals	11
oil, natural gas and other mines	2	Manufacture of fabricated metal products except machinery and equipment	12
Manufacture of food, beverage and tobacco products	3	Manufacture of machinery and equipment not classified elsewhere	13
textiles	4	Manufacture, repair and installation of subsidized products as well as electronic, optical and electrical equipment	14
Manufacture of clothing, processing and dyeing of fur as well as tanning and polishing of leather and other leather products	5	Manufacture of motor vehicles and other means of transportation	15
Manufacture of wood and wood products	6	Manufacture of armchairs and equipment not classified elsewhere	16
Manufacture of paper, paper products and printing devices	7	Electricity, gas and water supply	17
Manufacture of coke, refined oil products, nuclear fuels, and chemical materials and products	8	Construction	18
Manufacture of rubber and plastic products	9	Transportation	19
Manufacture of non-metallic mineral products	10	Other services	20

The Industry-Specific FLQ (SFLQ) method has an obvious advantage over other spatial share methods in that it estimates regional coefficients and allows national coefficients to be adjusted to different ratios in different economic sectors. The method is also able to largely adjust the problem of overestimating regional coefficients and estimate the provincial output with less error based on all the evaluation criteria (Kowalewksi, 2015). The following can be assumed according to AFLQ:

$$SFLQ_{ij} = \begin{cases} CILQ_{ij} \times \lambda_j & \text{for } i \neq j \\ SLQ_{ij} \times \lambda_j & \text{for } i = j \end{cases} \tag{7}$$

$$\lambda = \left[\log_2(1 + X^r/X^n)\right]^{\delta} \qquad 0 \leq \delta < 1 \quad 0 \leq \lambda \leq 1 \tag{8}$$

$$r_{ij} = \begin{cases} (SFLQ_{ij}\, a_{ij}) & \text{if } SFLQ_{ij} \leq 1 \\ a_{ij} & \text{if } SFLQ_{ij} > 1 \end{cases} \tag{9}$$

where $CILQ_{ij}$ and SLQ_{ij} are the intersecting spatial share of industry and the simple spatial share of supply and demand, respectively. In addition, λ is the adjustment coefficient of the region, and δ is the adjustment coefficient of the economic structure of the region. The values of δ for different sectors are different in the method of Location quotient flag, and they are obtained in terms of minimizing the difference between the actual output of individual regions and the estimated output (Dehghan Benadokouki, 2020). The calculation of δ in this research is based on the specific industrial spatial share of the computational flag in Formula (10) as follows:

$$\mu_1 = \frac{1}{n^2}\sum_j |\dot{X}_j - X_j| \quad (10)$$

where μ_1 is a measure of the mean absolute value of the difference, δ is determined based on that measure, the variables $\dot{x}_j$ and x_j are the estimated and actual outputs of part j, and n is the number of parts.

Topsis Method

Topsis is a method of compensatory aggregation that compares a set of alternatives by identifying the weight of each criterion, normalizing the scores for each criterion and calculating the geometric distance between each alternative and the ideal alternative. TOPSIS makes it possible to fully implement the attribute data, provides the cardinal ranking of alternatives, but does not require attribute preferences to be independent. To apply this method, attribute values must be numeric, monotonically non-increasing or non-decreasing, and have commensurable units (Chen and Hwang, 1992; Yoon and Hwang, 1995).

The data of this article are of library type and include the statistics of the economic sectors in Yazd Province. They are also analyzed in terms of six criteria. In order to match the data with the input-output table of the Central Bank in 2016, the statistics related to 2016 are used. The method of collecting and calculating the data of each criterion is described below.

Water and energy intensity

The actual rate of water and energy consumption in different activities is not limited to direct usages; rather, each activity indirectly consumes these two sources by using inputs the production of which needs quantities of water and energy.

The direct water and energy intensity of each activity is calculated as the quantity of the consumed water and energy is divided by its output (Equation 11). Then the total water and energy1intensity (direct and indirect) for each activity is calculated with the input-output table of the province and through Equation 12 as follows (Zhao et al., 2009):

$$c_j^{d(w,e)} = \frac{C_j^{w,e}}{X_j} \quad (11)$$

$$c_j^{t(w,e)} = \sum_{i=1}^{n} c_i^{d(w,e)} l_{ij} \quad (12)$$

where C_j ^ (*w*, *e*), X_j, *c_j* ^ [*d* (*w*, *e*)] and c_j ^ [*t* (*w*, *e*)] are the amount of water and energy consumption, the output of each activity, the direct consumption of water and energy and the total amount of water and energy consumption in each activity respectively. Also, *n* indicates the number of activities in the input-output table of the province (20 activities)|

The data for the water consumption in non-industrial sectors including agriculture, services and mining are obtained from Jihad Agricultural Organization and the Water and Sewerage Company of the province as well as reports from the Statistics Center of Iran. The water consumption in the ‘construction’ and ‘water, electricity, gas’ sectors has been estimated by the adjustment of national data against the output, assuming that water productivity (i.e., the ratio of output to water consumption) is the same at the national and provincial levels. Moreover, the statistical data for the consumption of five energy carriers including diesel, natural gas, gasoline, kerosene and liquefied petroleum gas in various national economic activities are extracted as a part of the hydrocarbon balance in 2016.

To calculate the amount of energy consumed by the economic activities in the province, the national data are adjusted to the output. In this regard, the standardization of units in the field of energy consumption is important. After the data collection, due to the unit heterogeneity of the energy carriers, all the units are reported in terms of millions of BTUs[1] Water and energy are consumed in two types of industries including workshops with 10 or more employees and those with less fewer 10 employees. Water consumption in the former is extracted directly from the corresponding census in 2016. Regarding the water and energy consumption of industrial workshops with less than 10 employees, since the last survey of them was made in 2001, first assuming water and energy productivity remain constant, water and energy consumption of these industries in 2016 in the country was estimated. Then, the data are adjusted in relation to the output, and water and energy consumption in the province are estimated.

The results of the calculations indicate that the activities of ‘agriculture’, ‘manufacturing of non-metallic mineral products’ and ‘manufacturing of coke, products of refining oil, and nuclear fuels as well as materials and chemical products’ in Yazd Province are the greatest consumers of water, and energy.

The degree of the interdependence of a sector with its economic environment can be explained by the relationship of individual intermediary factors and the total production. Depending on the perspective, This relationship has been defined as a backward or forward linkage (Asgharpour and Sharifi, 2020).

A method proposed by Rasmussen to calculate linkages is their normalization, which involves normal forward linkages to get the diffusion strength index (BL) and backward linkages to get the dispersion sensitivity index (FL). In fact, a

[1]At this stage, the energy consumption of each sector is multiplied by the values in the table below, and the energy consumption of each sector is obtained in terms of millions of BTUs.

normalized indicator shows the economic performance or the relative size of a sector in the average performance of the whole economy (Babaei and Jalalifar, 2018). The following equations are used to calculate normalized forward and backward linkages:

$$BL_j = \frac{\frac{1}{n}\sum_{i=1}^{n} l_{ij}}{\frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} l_{ij}} \quad (13)$$

$$FL_i = \frac{\frac{1}{n}\sum_{j=1}^{n} g_{ij}}{\frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} g_{ij}} \quad (14)$$

In the above relations, l_{ij} and g_{ij} represent the elements of Leontif inverse matrix and those of Gash inverse matrix in the input-output table of Yazd Province, respectively. Also, n is the number of the sections (20 sections are included in the present study)

The results of the calculations show that the sectors of 'manufacturing motor vehicles and other transport equipment', 'manufacturing machinery and equipment not classified elsewhere', 'manufacturing basic metals' and 'transportation' have the most backward and forward normalized linkages.

Employment

Like the water and energy intensity criteria, the total employment (direct and indirect) criterion of each activity is calculated through the internal input-output table of the province and equation 15 as follows:

$$L_j = \sum_{i=1}^{n} e_i l_{ij} \quad (15)$$

where e_i and l_i represent the direct and the total rates of employment in each activity, respectively. The collection of data on the employment in each activity, like data collection for water and energy consumption, is conducted with the census of industrial workshops and labor force reported by the Statistics Center of Iran. Then, the national data are adjusted to the province. As the calculations indicate, among the activities in Yazd Province, agriculture, transportation and construction have the highest total employment.

Emission

Carbon dioxide is an air pollutant that leads to climate change and global warming. The total pollution (direct and indirect) criterion of each activity is calculated by means of the internal input-output table of the province.

The data on carbon dioxide emission have been prepared in three steps. First, the consumption rates of five energy carriers, including diesel, natural gas, gasoline, kerosene and liquefied petroleum gas, are obtained in each activity. Then, in order to add up these indices, the same unit conversion is used, and the consumption units are all converted to BTU. At the third step, using the emission coefficients provided by the Intergovernmental Panel on Climate Change (IPCC), the carbon dioxide emissions in different activities of the province are calculated. Through these calculations, it has been shown that the sector of 'other non-metallic mineral products' is the most polluting economic activity in Yazd Province; it emits more than 74 kg per million BTU of carbon dioxide per unit of output. The activities of 'manufacturing coke, products obtained from refining oil and nuclear fuels, and chemical materials and products' and 'manufacturing basic metals') are also among the most polluting activities in the province.

Value added

The value added of each activity is obtained from the difference between its output and input. In the present study, the value-added comparative advantage indices have been used to calculate the rates of value-added. According to Equation (16), this is done by comparing the ratio of the value-added of each activity to the total value-added of the province with the corresponding ratio in the country (Nasrollahi and Zarei, 2017).

$$VARCA_i = \frac{\frac{RVA_i}{TRVA}}{\frac{NVA_i}{TNVA}} \qquad (16)$$

In the equation above, $VARCA_i$ is the obvious comparative advantage of the value added in activity i, RVA_i is the value added of sector i in the province, $TRVA$ is the total value added (GDP) of the province, NVA_i is the value added of sector i in the country and $TNVA$ is the total value added of the country. Thus, activities with comparative advantages in the province have a higher priority for investment. The results of calculating this criterion show that Yazd Province has a significant comparative advantage for the manufacturing of basic metals, textiles and non-metallic mineral products.

Results

As mentioned earlier, this study has used the TOPSIS method to prioritize the economic activities in Yazd Province based on six criteria. To fulfill the prioritization, the weight of each criterion has been determined with Shannon entropy method.

Shannon entropy represents the amount of uncertainty in a continuous probability distribution. The method is based on the fact that the higher the variance in the values of a criterion, the more important that criterion is. It is of benefit for weight calculation when the data of a decision matrix are completely clear (Masoudi et al., 2019).

The weights of the criteria obtained through Shannon entropy method are presented in Table (2). As it can be seen, each weight is calculated from a total of one. In addition, the water level criterion has the highest weight per a thousand cubic meters (This shows the importance of water in the province). This is while the lowest weight belongs to the criterion of total transplantation.

Table 2. Weight of the criteria by Shannon entropy method

Criteria	Water intensity	Energy Intensity	Linkage	Job creation	Pollution	Value-added
Weight	0.3604	0.1729	0.000031	0.2104	0.1759	0.0804

Source: Research findings

The results of calculating the priority indices and ranks of activities in the province are presented in Table (3). The transportation activity is found to rank first, followed by construction and other services down to agricultural activity at the bottom of the list.

Table 3. Ranking of activities in Yazd Province using water intensity, energy intensity, linkages, employment, pollution and value added as indicators in 2016

Activities[1]	Distance from the positive ideal	Distance from the negative ideal	Priority index	Rank
1	0.361	0.265	0.423	20
2	0.144	0.421	0.745	5
3	0.150	0.408	0.731	14
4	0.146	0.409	0.736	9
5	0.151	0.418	0.735	11
6	0.150	0.404	0.730	15
7	0.151	0.404	0.728	16
8	0.166	0.388	0.700	17
9	0.144	0.416	0.743	6
10	0.265	0.393	0.597	18
11	0.265	0.393	0.597	19
12	0.149	0.415	0.736	10
13	0.149	0.418	0.737	8
14	0.148	0.417	0.738	7
15	0.152	0.420	0.734	12
16	0.151	0.412	0.732	13
17	0.137	0.420	0.753	4
18	0.068	0.428	0.863	2
19	0.057	0.432	0.883	1
20	0.086	0.424	0.831	3

Source: Research findings

In addition, to investigate the role of water intensity in the task of prioritization, the activities in the province are prioritized in the absence of that criterion. According to Table (4), there is a significant change in the priorities without

[1] Each number refers to the corresponding activity in Table (1) in Section 2.4.

considering water intensity. In its absence, the pollution criterion (kg per million BTU) is given the first priority due to higher dispersion as compared to the other criteria.

Table 4. Weight of the criteria by Shannon entropy method without considering the water intensity criterion

Criteria	Energy intensity	Linkages	Employment	Pollution	Value added
Weight	0.2703	0.000048	0.3290	0.2749	0.1257

Source: Research findings

As it can be seen in Table 5, the removal of the water intensity criterion leads to the increased priority of activities with higher water intensity, such as agriculture. This means the negligence of the water intensity criterion in prioritizing the economic activities of the province. This may provide economic benefits in the short term, but, in the long run, the pressure on the limited water resources can jeopardize the future development of this province

Table 5. Ranking of the activities in Yazd Province without considering the water intensity criterion in 2016

Activities[1]	Distance from the positive ideal	Distance from the negative ideal	Priority index	Rank
1	0.057	0.415	0.878	1
2	0.225	0.346	0.605	6
3	0.234	0.321	0.578	14
4	0.228	0.313	0.577	15
5	0.235	0.344	0.594	8
6	0.233	0.300	0.562	16
7	0.236	0.300	0.560	17
8	0.259	0.239	0.479	18
9	0.225	0.334	0.597	7
10	0.414	0.257	0.383	19
11	0.414	0.257	0.383	20
12	0.232	0.332	0.588	12
13	0.233	0.336	0.590	10
14	0.231	0.335	0.591	9
15	0.237	0.340	0.589	11
16	0.235	0.330	0.584	13
17	0.214	0.348	0.619	5
18	0.106	0.366	0.775	3
19	0.089	0.380	0.810	2
20	0.134	0.362	0.729	4

Source: Research findings

[1] Each number refers to the corresponding activity in Table (1) in Section 2.4.

Conclusion

Sustainable development is a package with economic, social and environmental dimensions, and any effort to achieve it needs to consider all these dimensions. Emphasis on a dimension can challenge long-term and sustainable development. For example, activities that bring about high economic growth may also increase the pressure on scarce natural resources such as water. Therefore, it is necessary to choose a systematic method based on which an optimal combination of different criteria is provided. With such a method and by emphasizing the importance of water resources, the present study seeks to prioritize twenty economic activities in Yazd Province. For this purpose, input-output models and the TOPSIS method were combined. The criteria considered in this study were water intensity, the intensity of cross-sectoral relationships, job creation, energy intensity, pollution and value added. Among them, the water intensity of economic activities is of special importance, which is due to the role of water resources in sustainable development and the severe shortage of these resources in Yazd Province.

The results of the research show that the activity of transportation has the first priority based on the six criteria. It is also understood that water intensity is an important criterion. If activities are prioritized regardless of this criterion, the sequence of priorities changes significantly. For the achievement of sustainable development in Yazd Province, activities such as agriculture and manufacture of basic metals with and without regard to water intensity turned out as the least important activities. Based on the results of the research, the following recommendations are made for future studies:

1. To prioritize economic sectors at national and regional levels, economic factors and the inter-sectoral relations should also be considered along with social and environmental aspects.
2. Due to the conditions of Yazd Province, the expansion of activities such as steel and non-metallic goods industries has put a lot of pressure on the environment and water resources. So, it is advisable to review and redefine the production policies in the province.
3. Based on the results of this study, water intensity was the most important criterion in prioritizing the economic activities of the province in 2016. So, it is recommended to consider the limitation of water resources in planning and upstream documents and to allocate those resources to the economic activities that are in line with the goals of sustainable developmento

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اولویت‌بندی فعالیت‌های اقتصادی استان یزد با تأکید بر اهمیت منابع آب: تلفیق مدل‌های داده – ستانده و TOPSIS

چکیده: هدف پژوهش حاضر اولویت‌بندی فعالیت‌های اقتصادی با رویکرد توسعه پایدار و با تأکید بر اهمیت منابع آب است. در این راستا از شاخص‌هایی استفاده شده که ابعاد مختلف توسعه پایدار را پوشش می‌دهند. بدین منظور ابتدا با استفاده از روش سهم مکانی SFLQ، جدول داده–ستانده استان یزد تهیه شد. پس از آن با تلفیق مدل‌های داده– ستانده و روش تاپسیس و با استفاده از شش معیار شدت ارتباطات بین‌بخشی، اشتغال‌زایی، انرژی‌بری، آلایندگی، آب‌بری و ارزش‌افزوده، فعالیت‌های اقتصادی استان یزد اولویت‌بندی شدند. براساس نتایج این پژوهش، فعالیت «حمل و نقل» در مقایسه با سایر فعالیت‌های استان دارای بالاترین اولویت به‌منظور سرمایه‌گذاری‌های بیشتر است همچنین این نتایج اهمیت منظور داشتن معیار آب‌بری را نشان می‌دهند به‌طوری‌که نتایج اولویت‌بندی فعالیت‌ها بدون در نظر گرفتن این معیار با اولویت‌های حاصل از این تحقیق متفاوت است.

واژگان کلیدی: اولویت‌بندی، فعالیت‌های اقتصادی، مدل داده– ستانده، مدل تاپسیس، توسعه پایدار.
طبقه‌بندی JEL: R15, Q01, C67